

Northern States Power Company- Minnesota

2024 NSPM RFP

Request for Proposals



RFP Issue Date: June 28, 2024

Proposals Due: September 18, 2024

RFP Website: xcelenergy.com/NSP2024RFP

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2024 RFP

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Notice of Disclaimer

The information contained in this Request for Proposals ("RFP") has been prepared solely to assist bidders in deciding whether or not to submit a proposal. Northern States Power Company, a Minnesota corporation, ("NSPM") the "Company" – do not represent this information to be comprehensive or to contain all of the information that a respondent may need to consider in order to submit a proposal. The Company, its affiliates, or their respective employees, directors, officers, customers, agents and consultants makes, now or in the future, any representation, promise or warranty, express or implied, as to the accuracy, reliability or completeness of the information contained herein, or in any document or information made available to a respondent, whether or not the aforementioned parties knew or should have known of any errors or omissions, or were responsible for their inclusion in, or omission from, this RFP.

The Company reserves the right to modify, supplement or withdraw this RFP at any time, whether due to changes in law or otherwise, and issue one or more addenda to this RFP during this solicitation. No part of this RFP and no part of any subsequent correspondence by the Company, its affiliates, or their respective employees, directors, officers, customers, agents or consultants shall be taken as providing legal, financial or other advice or as establishing a contract or contractual obligation. Contractual obligations on the part of the Company will arise only if and when definitive agreements have been approved by Company management, executed by the appropriate Company representatives having the authority to approve and enter into such agreements, and all required regulatory and/or governmental approvals are obtained. The Company reserves the right to request from a bidder information that is not explicitly detailed in this document, obtain clarification from bidders concerning proposals, conduct contract development discussions with selected bidders, conduct discussions with members of the evaluation team and other support resources as described in this RFP and in compliance with all FERC Code of Conduct rules.

The Company will, in its sole discretion and without limitation, evaluate proposals and proceed in the manner the Company deems appropriate, which may include deviation from the Company's expected evaluation process, the waiver of any requirements and the request for additional information. The Company in its sole discretion may accept any proposal or reject any, all or portions of any proposal. The Company also may decline to enter into any agreement with any bidder, terminate negotiations with any bidder or abandon the RFP process in its entirety at any time, for any reason and without notice thereof. Respondents who submit proposals agree to do so without legal recourse against the Company, its affiliates, or their respective employees, directors, officers, customers, agents or consultants for failure to select or rejection of their proposals or for failure to execute an agreement for any reason. The Company and its affiliates shall not be liable to any respondent or other party in law or equity for any reason whatsoever for any acts or omissions arising out of or in connection with this RFP. Except as otherwise provided in the rules and orders of the Public Utilities Commission of the state of Minnesota ("Commission"), by submitting its proposal, each respondent waives any right to challenge any aspect of the Company's evaluation of its proposal. By submitting its proposal, each respondent waives any right to challenge any determination of the Company to select or reject its proposal. Each respondent, in submitting its proposal, irrevocably agrees and acknowledges that it is making its proposal subject to and in agreement with the terms of this RFP.

Each respondent shall be liable for all of its costs incurred to prepare, submit, respond or negotiate its proposal and any resulting agreement and for any other activity related thereto, and the Company shall not be responsible for any of the respondent's costs.

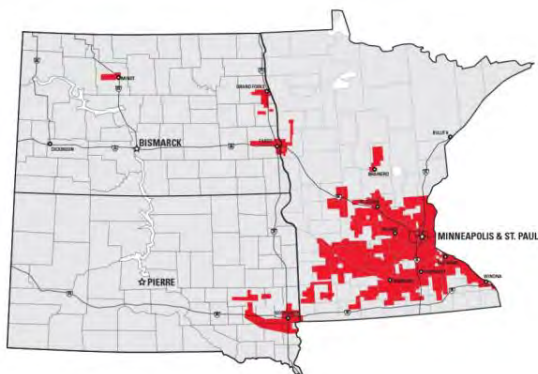
Northern States Power Company - Minnesota 2024 NSPM RFP

Section 1. Introduction

Xcel Energy Inc., headquartered in Minneapolis, Minnesota, is a U.S. investor-owned holding company parent of four major electric and natural gas utilities. The four Xcel Energy operating companies have regulated utility operations in the eight western and midwestern states of: Minnesota, Wisconsin, North Dakota, South Dakota, Michigan, Colorado, Texas, and New Mexico. The operating companies of Xcel Energy provide, collectively, energy-related products and services to approximately 4.6 million customers. More information about Xcel Energy is available at www.xcelenergy.com.

Northern States Power Company, a Minnesota corporation (“NSPM”), is the Xcel Energy operating company in North Dakota, South Dakota and Minnesota— is issuing this Request for Proposals (“RFP”) to seek firm proposals for at least 1,600 MW of wind, solar, standalone storage, wind + storage hybrid, or solar + storage hybrid generation assets (“RFP Projects”) coming online by December 31, 2029.

Figure 1. NSPM Retail Electric Service Territory



1.1 Primary RFP Objective

The main purpose of the Company’s RFP is to fill a need for capacity and energy. An additional benefit includes securing projects that can allow the Company to reutilize certain existing points of interconnection with the Midcontinent Independent Transmission System Operator (“MISO”) due to the planned retirement of the Company’s Sherburne County Generating Station (“Sherco”) generation assets and the Blue Lake Generating Station (“Blue Lake”).

The Company looks to fulfill these objectives by seeking at least 1,600 MW of solar, wind, storage, or hybrid capacity in this RFP that will achieve commercial operation by December 31, 2029. Proposals from a wide geographic range and both transmission and distribution-interconnections are allowed, as are proposals for the Company to own, enter into power purchase agreements, or self-build.

In order to help meet this target, the Company has broadened the scope of eligible projects beyond newly constructed solar, wind, storage and hybrid generation projects. These include, with certain conditions mentioned later in this document: 1) extensions of solar, wind, storage or hybrid generation purchased power

agreements, 2) proposed repowers of existing projects in commercial operation with new solar, wind, storage or hybrid generation; and 3) proposals to add storage at existing solar or wind facilities.

While open to exceeding the 1,600 MW target, the amount of generation the Company may acquire from this RFP depends on, among other things, the quality of the bids received in response to this solicitation, the economic value to NSPM customers, and regulatory approval.

1.2 Regulatory Context

The Company is initiating this request for proposals consistent with the Minnesota Public Utilities Commission (“MPUC”) Order in the matter of the Company’s 2020-2034 Upper Midwest Integrated Resource Plan¹ and per the near-term capacity needs shown in its recently filed 2024-2040 Upper Midwest Integrated Resource Plan². Collectively, these two Integrated Resource Plans will be referred to as “IRP” or “IRP Needs”.

This RFP follows a Modified Track 2 procurement process, as approved by the MPUC in cases when the Company may choose to submit a self-build bid. In a Modified Track 2 process, the MPUC requires that an Independent Auditor (“IA”) conduct an independent review of the Company’s evaluation and selection process in response to this solicitation. The Company will work cooperatively with the IA and shall provide the IA immediate and continuing access to all documents and data reviewed, used, or produced by the utility in this solicitation and evaluation. The IA will provide a written report regarding their assessment of the Company’s evaluation and selection process, which will be filed with the MPUC.

The Company is not seeking to meet Distributed Solar Energy Standard (DSES) requirements³ with this solicitation or with any of the projects selected in this solicitation; the Company will have future solicitations aimed at specifically meeting DSES requirements. Developers of projects that may possibly qualify for the DSES requirements are welcome to apply, at their own option and risk, to this RFP, provided they meet the requirements of this RFP and understand that should they be shortlisted in this RFP process, their project will not be used by the Company to meet DSES requirements and will not be expected to comply with any additional DSES requirements.

1.3 Contacts and Communications

The primary point of contact for all communications between the Company and potential bidders is the RFP Project Manager who may be contacted at:

NSP24RFP@xcelenergy.com

Any questions with respect to this RFP should be submitted to the RFP Project Manager at the above email address before the deadline indicated in section 4.1.

The NSP 2024 RFP webpage can be found at: <https://www.xcelenergy.com/NSP24RFP>.

In addition to this primary point of communication, the Company will also hold a bidder conference in which the Company will provide an overview of the solicitation and answer questions posed by potential bidders. See Section 4 which indicates the planned schedule.

¹ ORDER APPROVING PLAN WITH MODIFICATIONS AND ESTABLISHING REQUIREMENTS FOR FUTURE FILINGS, Docket No. E002/RP-19-368, April 15, 2022 (IRP Order).

² Docket No. E002/RP-24-67. Filed February 1, 2024

³ Minnesota Statutes 216B.1691 Subdivision h. and as seen in MPUC Docket No. 23-403 IMPLEMENTATION OF THE NEW DISTRIBUTED SOLAR ENERGY STANDARD PURSUANT TO 2023 AMENDMENTS TO MINNESOTA STATUTES, SECTION 216B.1691

Section 2. Eligible Project Information

A summary of the eligible RFP Project types and parameters can be seen in Table 1; each major parameter is described in further detail below. Note that, as explained further below, there are two bid types: 1) Traditional Option bids, and 2) MN Energy Connection Contingent bids.

Table 1. Summary of project types eligible for the 2024 NSPM RFP.

	Traditional Option	MN Energy Connection Contingent Option
Resource Types	Wind, Solar, Storage, Hybrid	Wind, Solar, Storage, Hybrid
Location	Physically located in MN, SD, or ND, plus ⁴ : <u>Transmission-Interconnected Proposals</u> : located in MISO Zone 1 ⁵ OR <u>Distribution-Interconnected Proposals</u> : Located in NSPM service territory ⁶	Physically located in MN with proximity to proposed MN Energy Connection
MW Target	1600 MWac total (inclusive of MN Energy Connection Contingent Option Bids) ⁷	Up to 800 MWac of 1600 MWac total target
Minimum Size per Project Site	Newly Built: > 5 MWac Existing Resources: > 1 MWac	> 5 MWac
Project Structure	Power Purchase Agreement (“PPA”), Build Transfer (“BT”), Company self-build	BT, Company self-build
COD	Expected COD by December 31, 2029	Expected COD by December 31, 2029
COD Bonus Points	By June 1, 2027: 20 points By June 1, 2028: 10 points	N/A
PPA Term Lengths	PPA Extensions: (5 – 15 years); Newly Constructed Projects: (10 - 30 years)	N/A
New Or Existing	Newly constructed and <u>some</u> existing projects ⁸	Newly constructed only
Co-Location	Bidder must own or have an agreement in place with the owner of any existing co-located generating facility. The existing facility must have its output fully committed to the Company.	

⁴ NSPM’s affiliate Northern States Power, a Wisconsin corporation (NSPW) plans to issue an RFP to acquire resources in Wisconsin.

⁵ <https://www.misoenergy.org/>. Projects physically located in other zones, including MISO Zone 2 and 3, are not eligible. Projects interconnecting to the MN Energy Connection but choosing the Traditional option are already located in MISO Zone 1; no additional information is necessary.

⁶ PPA proposals selecting this option must be interconnected to the NSPM distribution system – which includes portions of Minnesota, North Dakota and South Dakota – in a location where the Point of Common Coupling is in the NSPM service territory and the remainder of the location of the DER system allows the interconnection without NSPM being required to provide any compensation or service territory swap with any neighboring utility in order to allow the interconnection. The interconnection must not be on any feeder, or not be on any feeder connected to a substation, that is owned in whole or in part by any utility other than NSPM.

⁷ An RFP in Wisconsin will also seek similar capacity. The amount of capacity taken in Minnesota, North Dakota, and South Dakota will be dependent on the relative economics of the bids across both RFPs. Capacity solicited for the King gen-tie in the RFP in Wisconsin will be incremental to the NSP System target.

⁸ Please see Section 2.2 for additional details on which types of existing projects are eligible.

Planned Interconnection Strategy	• Projects proposing new POIs in MISO: must have generator interconnection application in MISO 2021 DPP Cycle or earlier cycle. • Utilization of Surplus or Generator Interconnection Applications at existing MISO POIs, including MN Energy Connection & Blue Lake • Distribution-interconnected projects: must have signed interconnection agreement with NSPM as of June 28, 2024	No MISO interconnection applications are required at time of bid submittal ⁹

2.1 Eligible Project Structures

a. Build-Transfer (BTs)

Under this project structure, the Company will assume 100% ownership of the RFP Project as outlined in the Purchase and Sale Term Sheets (“TS”) which are attached to this RFP in Appendix A.

Depending upon the interconnection type, all BT proposals shall include a bid price (Standard Bid) that is fully compliant with NSP’s TS (Appendix A) and the conditions and requirements stated in NSP Technical Specification for Transmission Interconnected Renewable Generation (Specifications attached to this RFP in Appendix C). If a Standard Bid is submitted, BT proposals may also include any written exceptions from those stated in the Technical Specifications in Appendix C and to the TS in Appendix A. All proposed exceptions must be in written form and propose specific alternative terms. In the case that exceptions are submitted, an additional bid price must be submitted that is fully compliant with the written exceptions submitted.

Respondents should note per Section 5.3 below that any proposed material exceptions likely will result in a deduction applied to the project score, and that in the event an additional bid price is submitted that is compliant with the proposed exceptions, both the Standard Bid and the alternative bid price will be considered in the RFP evaluation.

b. Power Purchase Agreements (PPAs)

The Company will consider new PPAs, existing PPA extensions, and repower of existing PPAs as an eligible project structure for all eligible resource types, for Traditional Option bids not reusing Sherco or Blue Lake transmission interconnection rights. All PPA proposals must include a bid price that is fully compliant with NSPM’s model purchase power agreements, NSPM’s Model [Wind] [Solar] Power Purchase Agreement, NSPM’s Model Standalone Storage Power Purchase Agreement, and NSPM’s Model [Wind, Solar + Storage] Power Purchase Agreement, provided in Appendix B of this RFP. No exceptions to the model PPAs are permitted either in written form or by inference in the bid proposal as further described below. Bidders who intend to submit technologies or a combination of technologies that do not have a Model PPA listed in the Appendix should submit a question to the RFP Manager email inbox for additional information.

The Company requires every Bidder to provide a proposal and associated firm non-conditional bid price that is fully compliant with NSPM’s model agreement without markup or exceptions and not subject to adjustment in the future. The definition of exceptions includes redline edits as well as any indication, inference, notes, remarks, statements, assumptions or expectation that such may/will be negotiated following a selection of the bid submitted. The Company expects that each Bidder considers and commits to all development and

⁹ The Company will ultimately handle interconnection requests for any selected projects that propose to interconnect with the MN Energy Connection. A project that already has a generator interconnection request in any MISO DPP cycle, even cycles after DPP-2021, is still eligible to choose this option; the presence of a MISO interconnection application does not preclude a bid from choosing to submit a contingent MN Energy Connection bid in this RFP.

performance risks, costs, and obligations, as represented in the model agreement before bidding and does not condition the proposal with such being shifted to NSP or its customers. For avoidance of doubt, these include but are not limited to, costs or delays related to supply chain disruption, construction, interconnection, permitting, market changes, or changes in law. Should a proposal be selected, the Bidder, must in good faith have certified that: (i) their bid price reflects the terms of the model agreement in its entirety (aside from bracketed and/or facility specific details), (ii) Bidder can meet all obligations under the model agreement, and (iii) Bidder understands and accepts all associated risk therein.

The Company will not enter into an agreement that is conditioned on Seller's ability to source and deliver equipment, qualify for tax benefits, or secure permits. Furthermore, the Company expects, development milestones, environmental matters, Security requirements, damages, credit and transfer requirements, defaults, remedies, performance metrics and Force Majeure as outlined in the model agreement as minimum provisions that will be maintained in a final agreement.

In respect to proposals for existing PPA extensions, similarly bidders must submit a bid that is fully compliant with NSPM's model agreement inclusive of any remaining years of the existing PPA term. For clarity, bidder should assume that the remaining term of the existing PPA included in bidder's proposal, beginning upon commencement of seller's bid will be amended and restated under the terms of the model agreements provided in this RFP. Bids proposing to retain the terms of existing PPAs will not be eligible for consideration or evaluation in the RFP.

In respect to proposals for projects in which a storage asset is proposed to be added or co-located with existing generation already contracted under an existing PPA with NSPM, bidder's proposal will be evaluated based on the application type submitted. For example, if a bidder submits details and pricing only for the storage asset, the bidder's proposal will be evaluated as a standalone storage asset, with no references or changes to the current PPA for the existing facility. Likewise, if bidder proposes to add or co-locate storage with existing generation for the purpose of the asset becoming a hybrid asset under a new hybrid PPA which will replace the existing PPA, bidder must submit full details and new pricing for both the existing facility and the new storage asset under the terms of the model agreement provided in this RFP."

c. Company Self-Build (SB)

The Company will consider self-built projects in this RFP. Any such proposals will pay a bid fee and provide all relevant bid information that the RFP team requires to evaluate the proposed project on a fair, impartial and consistent basis with any third-party proposals.

2.2 Product Description

RFP Project: Proposals must be for qualified resource types that provide *new* accredited capacity for the Company. The qualified resource types are solar, wind, standalone storage, solar plus storage hybrids, wind plus storage hybrids, or any other combination of these non-emitting technologies that consume no physical fuel, excluding hydroelectric.

The following types of projects are considered eligible candidates capable of providing *new* accredited capacity for the Company. For each case, proposals must result in facilities that are complete and commercially operable, including all facilities necessary to generate and deliver energy at the point of interconnection by the commercial operation date specified in the proposal.

Project Types Considered by the Company to offer Net New Accredited Capacity:

- New, to-be-built resources at greenfield locations.

- New, to-be-built resources at brownfield sites or at the site of other qualified generation that continues to operate commercially (i.e., surplus interconnection):
 - **Eligible example:** Battery Energy Storage System (BESS) added to independent power producer (IPP) owned existing wind or solar project that the Company already has a PPA with, *with* documented permission from IPP.
 - **Ineligible example:** Third party proposals to add Battery Energy Storage Systems (BESS) at existing Company-owned wind or solar projects.
- Existing resources that offer net *new* capacity to NSPM:
 - **Eligible example:** Existing solar or wind project with current NSPM PPA expiring on 12/31/2026. Bid is submitted to this RFP for a new PPA of the same MW size starting on 1/1/2027, with capability to provide accredited capacity starting in Spring 2027 (MISO Planning Year 2026-2027). *Because the Company's existing contract expires on 12/31/2026, the new 2027 contract is offering new qualified capacity starting in 2027.*
 - **Eligible example:** Existing project with current NSPM PPA that expires in 2032. Bid is submitted to this RFP to enter into new PPA for a repowered higher capacity wind or solar facility at this location from January 1, 2027 – December 31, 2042. *The repowered facility is larger than the facility operating under the original PPA, ultimately resulting in an increase in accredited capacity for the Company beyond what it would have had under the original PPA, and the repowered capacity is solar, wind, storage, or hybrid.*
 - **Eligible example:** Existing wind, solar, storage or hybrid IPP owned project that is physically located in MISO Zone 1 and not currently contracted with or owned by NSPM. Bid is submitted to this RFP for new PPA effective June 15, 2028 through June 14, 2038. *Since NSP has not received capacity from this asset before, due to the asset's earlier contract with another offtaker, this proposal provides incremental new qualified capacity for NSP.*
 - **Ineligible example:** Existing project with a NSPM PPA that expires in 2032. Bid is submitted to this RFP to enter into new PPA for a repowered facility at this location from January 1, 2027 through December 31, 2042, but with no increase in facility capacity. *Because the Company already will receive accredited capacity from this project until 2032, this capacity is already encompassed in the Company's planning and modeling prior to 2032, due to its existing PPA.*

Project types not listed above are not likely to be eligible. For projects that are somehow not included in the categories above, bidders are encouraged to submit questions to the RFP inbox or during the bidder conference as to whether their specific project type provides net new accredited capacity to the Company.

Bidders should be advised that these are only project categories, not a guarantee that specific project in one of these categories will provide new accredited capacity in accordance with the rest of the RFP requirements.

Product: The Company is seeking RFP Projects that are already in commercial operation or that have an established development plan and that convey all energy, capacity, ancillary services including reactive supply and voltage control, and environmental benefits (RECs) generated from the proposed project. Note that all RFP Projects are expected to ultimately supply accredited capacity to the Company as a Planning Resource so that the Company can use this capacity to meet its MISO resource adequacy requirements.

Project Size: Each RFP Project must provide to the Company new incremental nominal AC electrical output exceeding 5 MW at each location and point of interconnection (i.e., not the result of aggregated smaller projects at different sites/locations). The only exception to this RFP requirement is for existing resources that already have a solar or wind PPA with the Company; proposals related to these existing resources must provide to the Company new incremental nominal AC electrical output exceeding 1 MW at each location and point of interconnection. For BT proposals, Company ownership of 100% of the project and all associated facilities is required. For PPA proposals, RFP Projects that consist of partial offtake from a solar or wind generation asset are allowed, as long as the proposed new offtake amount provided to the Company is larger than 5 MWac.

Location:

All RFP projects must be physically located within Minnesota, North Dakota or South Dakota. Additionally, depending upon the RFP Project's intended interconnection strategy option, the RFP Project must be located within one or more of the following areas ("RFP Project Location"):

- Transmission-Interconnection Projects, including those planning to utilize surplus interconnection requests, generator replacement requests, interconnection with the MN Energy Connection or new interconnection application requests in a MISO DPP cycle: The new or existing MISO POI must be located within MISO Zone 1. *Projects physically located in other MISO Zones, such as MISO Zone 2 or 3, are not eligible for consideration in this RFP.*
- Distribution-Interconnection projects: Can be interconnected to the NSPM distribution system in a location where the Point of Common Coupling is in the NSPM service territory and the remainder of the location of the DER system allows the interconnection without NSPM being required to provide any compensation or service territory swap with any neighboring utility in order to allow the interconnection. Further, the interconnection must not be on any feeder, or not be on any feeder connected to a substation, that is owned in whole or in part by any utility other than NSPM. Additionally, the interconnection application must have a signed Interconnection Agreement with NSPM by June 28, 2024. Joint proposals – such as multiple locations with joint pricing bundled into a single bid – are allowed as long as each separate location independently meets the Project Size, Product, and RFP Project requirements in this section (i.e., minimum interconnection of 5 MWac at each location that has a signed Interconnection Agreement by June 28, 2024). *Each separate location will be subject to a separate bid fee as articulated in section 4.5.*

Expected Online Date: The RFP Proposal(s) should have an expected commercial operation date for incremental qualified capacity by December 31, 2029.

2.3 Special Conditions

The first four conditions below – Union Labor, Certified Diverse Suppliers, Workforce Diversification Information, and for projects with a solar component, Pollinator Habitat Scorecard Assessment – apply to all RFP Projects.

Union Labor

The Company seeks RFP Projects that utilize labor covered by a collective bargaining agreement for its construction, and thus requires bidders to provide pricing in the Standard Bidder Form 6 that assumes the use of such labor, and agree to language for this requirement in the applicable Model Power Purchase Agreement (for PPA bids) or Bid Certification form (Standard Bidder Form 2) for BT and Self-Build bids.

Certified Diverse Suppliers

The Company furthermore has a strong preference for projects that utilize contractors and/or suppliers that are classified as certified Diverse Suppliers. Projects will be scored in the RFP in accordance with this preference. The Company requests all proposals to include a completed Subcontracting Plan for this project and an overview of your subcontracting program that reflects the percentage of business done with diverse suppliers in 2023. A Subcontracting Plan template is provided in Appendix D for completion as part of the RFP proposal.

A certified Diverse Supplier means any contractor or supplier that falls into at least one of the following business groups: Small Disadvantaged Business, Woman-Owned Business, HUBZone Business, Veteran-Owned Business, Service-Disabled Veteran-Owned Business, Minority-Owned Business, LGBT-Owned Business and Disability-Owned Business.

To be eligible for classification as a certified Diverse Supplier, bidders must supply documentation confirming the status of contractors and/or suppliers as certified by a third party, including: the Small Business Administration, regional affiliates of Disability:IN, National LGBT Chamber of Commerce (NGLCC), National Minority Supplier Development Council (NMSDC), National Veteran Business Development Council (NVBDC), the Women Business Enterprise National Council (WBENC), or other national, state and local agencies as deemed acceptable by Company.

Workforce Diversification Information

Annual reporting of workforce diversification information including for subcontractors and suppliers will be requested of successful bidders.

Pollinator Habitat Scorecard Assessment

The Company is committed to supporting pollinator friendly habitat at our solar facilities. We require all bidders to provide a pollinator habitat scorecard assessment form¹⁰ with their proposed bid package.

Ownership Requirements for Utilization of Sherco or Blue Lake Interconnection Rights

A potential benefit of this RFP is to allow the Company to continue its progress towards reusing nearly 2,000 MW of transmission interconnection rights from retiring Sherco generation and 135 MW of interconnection rights from retiring generation at the Blue Lake site. In order to accomplish this and comply with MISO and FERC requirements, the Company must own the initial generation assets proposed to utilize this interconnection re-use approach. For the purposes of this RFP, this means that only BT and self-build bids will be considered for Blue Lake interconnection re-use and Sherco interconnection reuse, including resources proposed for interconnection to the MN Energy Connection.

Blue Lake Timing and Resource Requirements

In alignment with the Generator Replacement application submitted by the Company for reusing Blue Lake interconnection rights¹¹, any resources attempting to reuse this capacity would need to provide their own site, be a standalone storage resource, and attain a COD by June 2028.

¹⁰ All RFP projects, regardless of location, will complete the Minnesota scorecard, available in Appendix G.

¹¹ Queue number R1050.

Sherco Interconnection Rights Reuse: MN Energy Connection Contingent Bid Option vs Traditional Bid Option

The Company has applied to the MPUC for a route permit to construct the Minnesota Energy Connection (MNEC) Project, a new approximately 171- to 174-mile 345-kilovolt (kV) double-circuit transmission line between Sherburne and Lyon counties (MPUC Docket CN-22-131 and TL-22-132). The MNEC Project includes the following components:

- A new 345-kV double-circuit transmission line between the existing Sherco Substation in the city of Becker in Sherburne County and a new substation (Garvin Substation) proposed near the city of Garvin in Lyon County. The Company has proposed two route alternatives: the Purple Route, which is 171 miles in length, and the Blue Route, which is 174 miles in length. The Company has also proposed four connector segments that would provide options to utilize different portions of each alternative route, as appropriate.
- A new 3.1-mile single-circuit 345-kV transmission line between the existing Sherco and Sherco Solar West substations in the city of Becker. This new transmission line segment would be co-located with the Company's existing Line 5651, occupying the open position of the double-circuit-capable structures.
- Modifications to the existing Sherco and Sherco Solar West substations.
- A voltage-support substation to be located 80 miles south of the existing Sherco Substation in either Meeker, Kandiyohi, or Renville counties.
- An intermediate substation to be located 20 miles north of the proposed Garvin Substation in Lyon County

A final decision by the MPUC on the specific route and substation locations for the MNEC Project is not expected prior to spring 2025.

Given the uncertainty with respect to the MNEC Project routing, the Company will allow proposals for new solar, wind, storage or hybrid capacity to interconnect with the MNEC Project (MNEC Project Proposals) two options for participation, as seen in Table 2.

Table 2: Options for Participation by Projects Interconnecting with MN Energy Connection

	MN Energy Connection Traditional Option Bid	MN Energy Connection Contingent Option Bid
Timing of Final Shortlisting	December 18, 2024	June 30, 2025, contingent upon MPUC order for MN Energy Connection route
Bid Pricing Updates	No updates	Updates in 2025 during additional evaluation period
Eligible Interconnection Locations	MN Energy Connection Known Substations (Sherco, Sherco West, or Garvin substations)	All Locations along proposed MN Energy Connection Routes (including Known Substations and Midpoints)
Eligible bid types	Build-Transfer, Self-Build	Build-Transfer, Self-Build

Any bids submitted under the MN Energy Connection Traditional Option will be evaluated under the same schedule as all other Traditional Bids in this RFP. As noted above, proposed projects under the MN Energy Connection Traditional Option must interconnect at the MNEC project Known Substations identified in Table 2.

Regarding the MN Energy Connection Contingent Bids, the Company plans to use a modified evaluation and selection process. The bidder must identify the anticipated location of the new project's interconnection with the MNEC Project, consistent with the MNEC Project routes selected for continued evaluation by the MPUC on May 9, 2024. MNEC Contingent Option Proposals will be evaluated and scored on the presumption that the MNEC Project final routing will include the proposed interconnection point, and the proposal scoring will be compared to the scoring of all other proposals in this RFP. As part of this evaluation, the MNEC Contingent Option Proposals will be reviewed by MNEC Project transmission specialists to ascertain likely interconnection costs and any stability concerns.

In the event that the combination of MN Energy Connection Traditional Option and MN Energy Connection Contingent Bids across the entire MNEC project or in any single MNEC project location requires additional analysis to access the impacts of interconnection to the MNEC project, the Company reserves the right to evaluate all affected bids together as MNEC Contingent Option Proposals. Such evaluation will be subject to review and approval by the IA and will be undertaken to ensure that the interconnection impacts are considered collectively when evaluating proposed projects.

MNEC Contingent Option Proposals that score favorably with other proposals in this RFP will be selected to a MNEC Project Contingent Short List. The total capacity of MNEC Contingent Option Proposals chosen for the MNEC Project Contingent Short List is not to exceed 800 MW, but will also depend on the scoring of MNEC Contingent Option Proposals relative to other RFP proposals and potential groupings of the MNEC Contingent Option Proposals by proposed interconnection on the routes shown in Appendix E - Purple route, Blue route, or either route (e.g., interconnection at the Garvin substation).

Once final MNEC routing is approved by the MPUC, the MNEC Project Contingent Short List will be re-evaluated by the Company to ascertain whether the final routing allows each proposal to be selected from a technical standpoint and remain cost competitive. Given the expected 2025 timing for the final routing to be approved by the MPUC those proposals that remain viable as determined by the Company will be given an opportunity to update their pricing (no other changes permitted, *absent documentation*). The proposals would be re-evaluated by the Company, and those that remain competitive with the Traditional Bid proposals selected in this RFP will be selected to the MNEC Project Final Short List, conditioned on the need by the Company for additional renewable capacity as of that time. For these selected proposals, if any, the second bid fee will be payable at that time, and contracting discussions with the Company would commence.

2.4 Pricing

Regardless of whether the proposal is a PPA, self-build, or BT, proposal pricing must be for a complete RFP Project that meets the definitions in Section 2.2, including but not limited to solar modules, wind turbines, inverters, tracking system, balance of plant equipment, operations and maintenance, and required transmission or interconnection costs. If the RFP Project includes a Battery Energy Storage System ("BESS"), the proposal price must also include all equipment associated with the energy storage system.

Bidders must offer firm pricing valid through the duration of this RFP, and, if the proposal is selected for negotiations, the completion of negotiations resulting in an executed PPA or Purchase and Sale Agreement ("PSA"). Indicative pricing in a proposal will not be acceptable. All pricing must be in terms of current year United States dollars, also referred to as escalated or nominal dollars.

BT bids will also be expected to provide two sets of ongoing, post-closing expenses with their Purchase Price: one set of ongoing costs that includes a Long-Term Services Agreement (LTSA) and one set that does not include an LTSA. If the bidder's original equipment manufacturer (OEM) for major equipment requires an LTSA, the bidder may forgo submitting an ongoing set of expenses without an LTSA. Instructions in the Bidder Forms will identify where these separate sets of ongoing expenses are to be submitted.

Bids choosing the Minnesota Energy Connection Contingent bid option should see Section 2.3 for additional information regarding pricing and evaluation. Depending upon the proposed location, bidders proposing interconnection to the MN Energy Connection have the option of choosing whether they want to submit a bid under the Traditional Option or the Contingent Option (or both).

a. BT and Self-Build Pricing

Within the Standard Bidder Forms (attached in Appendix F), Form 6 provides the pricing template for BT and SB proposals.

The bid price shall include:

- the cost to fully comply with conditions and requirements stated in the applicable NSP Technical Specification (both in Appendix C) and the applicable NSP's TS in Appendix A;
- all costs associated with the development, permitting, procurement, construction, commissioning, and applicable testing of the RFP Project (including any costs required for gen-tie from the RFP Project to the POI and associated land rights). The proposal shall not be contingent upon awarding an operations and maintenance contract unless it is required by the OEM;
- transfer of all property rights and/or any land lease(s)/easements (including those necessary for any gen-tie from the RFP Project to the POI);
- all costs necessary to provide a tax opinion as required in the term sheet; and
- all costs necessary to secure title insurance for the project (including the title insurance premium)

On Standard Bidder Form 6 the Company requests bidders to list the schedule and amounts of ongoing payments to be assumed by NSPM post-closing¹² that separately identifies payments for land and easement costs, optional items available for selection at NSP's discretion, and all other payments to be made by NSP post-closing.

Depending upon whether a PTC or ITC applies, the Company prefers to make one lump-sum payment at closing (in the PTC context) or to make a one installment payment at closing and one installment on the substantial completion date (in the ITC context). The Company may consider making installment/progress payments, subject to achievement (to the Company's satisfaction) of certain milestones and subject to certain limitations and/or conditions.

Any installment/progress payments require security in favor of the Company in such form acceptable to the Company in its sole discretion. See applicable BT term sheet template to RFP in Appendix A for additional details. If bidder is interested in receiving installment/progress payments, bidder's bid forms must include a proposed schedule of installment/progress payments for the Company to consider.

The Company will add its projected costs associated with the Allowance for Funds Used during Construction ("AFUDC") to all payments made prior to the in-service date. The Company will also add its projected Construction Oversight Costs (Company costs to manage and verify the construction is completed in accordance with the Technical Requirements) to the SB or BT bid price for evaluation. Therefore, SB and BT bidders shall not include these Company costs in their pricing.

Related to the BT and SB bid pricing, bidders will be responsible for identifying the level of federal tax credit qualification they expect the project to attain and for providing supporting documentation or a detailed plan for providing such documentation. The tax credit in place on the day of bid submittal should be the tax credit discussed in the proposal. The Company reserves the right to request bidders provide updated tax credit

¹² Post-closing is the period of time that starts after the Company has closed on the acquisition of a Build-Transfer bid and taken ownership. This period occurs after Commission or regulatory approval; however costs occurring from this point on for a BT bid represent ongoing costs to the Company that will be included in the modeling of the BT bid.

information and expected qualification in the event that tax policy changes during the RFP or in subsequent contract negotiation processes.

b. PPA Pricing

Form 4 for PPA proposals contains the pricing template. Bidders may propose PPA term lengths between 5 and 15 years for existing facilities and between 10 and 30 years for new facilities; each separate PPA term length proposed constitutes a separate bid. The maximum length for storage only PPAs is 15 years, as discussed further below.

All pricing must be in terms of current year United States dollars, also referred to as escalated or nominal dollars. For example, a \$50 per megawatt-hour (“MWh”) energy price proposal for 2024 means that in 2024 energy from the facility will be purchased at an all-inclusive Energy Payment Rate¹³ of \$50/MWh. All PPA proposals shall include a bid price that is fully compliant with the applicable Model Power Purchase Agreement in Appendix B). Assuming the federal tax policy in place at the time of RFP bid submittal, RFP Project Bids should identify the level of tax credits which Bidder anticipates the Project will secure and the year in which construction of the project is expected to be treated as beginning for tax credit purposes. The Company reserves the right to request bidders provide updated pricing in the event that tax policy changes during the RFP or in subsequent contract negotiation processes.

The Company requires fixed price proposals that contain a fixed base price, with or without a fixed annual escalator. Respondents may not submit proposals with variable base year pricing or variable annual escalators.

2.5 Regulatory Approvals

At the completion of the bid evaluation and contract negotiation process, the Company will file the signed transactional agreements and any necessary acquisition petitions to regulatory commissions in the states in which the Company operates for all necessary review and approvals. Bids choosing the MN Energy Connection Contingent option bids may have additional petition filings required as indicated in the schedule in Table 2.

2.6 Contract Accounting

All contracts proposed to be entered into as a result of this RFP will be assessed by the Company for appropriate accounting and/or tax treatment. Respondents shall be required to supply promptly to the Company any and all information that the Company requires in order to make such assessments.

By submitting a proposal, each respondent agrees to make available to the Company at any point in the bid evaluation process any financial data associated with the respondent and its proposed RFP Project so the Company may independently verify the respondent’s information in the above matters. Financial data may include, but shall not be limited to, data supporting the economic life (both initial and remaining) of the facility, the fair market value of the facility, and any and all other costs and financing arrangements (including debt specific to the asset being proposed) associated with the respondent’s proposal. The Company may also use financial data contained in the respondent’s financial statements (e.g., income statements, balance sheets, etc.) as may be necessary.

a. Additional PPA Requirement

The Company is aware that certain contract approaches – especially with respect to battery energy storage – could result in either (i) a contract that must be accounted for by the Company as a finance lease or an operating lease pursuant to Financial Accounting Standards Board (“FASB”) Accounting Standards Codification (“ASC”)

¹³ Rate covers energy, capacity, renewable energy credits (“RECs”), and ancillary benefits of the RFP Project.

842, or (ii) consolidation of the seller or assets owned by the seller onto the Company's balance sheet pursuant to the variable interest entity requirements of FASB ASC 810.

The Company is unwilling to be subject to accounting or tax treatment that results from a PPA's finance lease or consolidated variable interest entity classification.

For example, the Company will not execute a PPA, that includes either a capacity or capacity plus energy payment structure whereby, the contract term is longer than 75% of the expected remaining economic life of the facility.

As such, any proposal for a battery energy storage contract must be limited to 15 years, or less.

Similarly, for all other resource types the Company will not execute a PPA without confirmation from the Company's external auditors that the PPA will not be classified as a finance lease or a consolidated variable interest entity.

As a result, in their proposal(s), respondents shall (i) state that the respondent has considered applicable accounting standards in regard to finance leases and consolidated variable interest entities, and (ii) state that, to the respondent's knowledge and belief, the respondent's proposal will not result in such treatment as of the date of the proposal.

Section 3. Interconnection Requirements

3.1 General Information

The Company will only consider RFP Projects located within one of the eligible RFP Project Locations. While the associated interconnection costs will differ for Traditional and MN Energy Connection Contingent Bids, and for different interconnection approaches, each proposal is required to include all applicable interconnection costs within its pricing proposal. More details about each interconnection option are provided below.

3.2 Transmission-Interconnection Approach: New MISO Points of Interconnection

Bids pursuing this strategy for interconnection must have submitted a generator interconnection request in either the MISO 2021 DPP Cycle or a cycle from a year earlier than 2021. Interconnection requests must seek Network Resource Interconnection Service (NRIS); requests only seeking Energy Resource Interconnection Service (ERIS) are not eligible.

Proposals choosing this interconnection approach must include information that allows the Company to confirm the proposed Project's interconnection status and its ability to demonstrate deliverability of accredited capacity as a Planning Resource within the MISO Resource Adequacy construct. As indicated in the Standard Bidder Forms, this includes: all pertinent MISO or bidder prepared studies including generator interconnection request information, generation interconnection study information, or generation interconnection agreement ("GIA") information, MISO document links and information, general project transmission information, congestion and curtailment analyses, and a point of contact for all transmission related information.

3.3 Transmission-Interconnection Approach: Utilization of an Existing MISO Point of Interconnection Other Than Sherco Units (includes Blue Lake)

Depending upon the COD proposed, some RFP Projects bidding under this category would not need to have already submitted a surplus or generator replacement interconnection request at the time of bid submittal. Bids that have not yet submitted an interconnection request must identify a timeline and the size of the planned surplus or generator replacement interconnection and should expect that the project must meet the

requirements of an “interconnection request ready”¹⁴ project per MISO Attachment X *Generator Interconnection Procedures* and meet all technical requirements per MISO Attachment X: Appendix 6 *Generator Interconnection Agreement*.

Bids that have already submitted a generator replacement interconnection request or a surplus interconnection request must include information that allows the Company to confirm the proposed Project’s interconnection status and that it has the potential for deliverability of the accredited capacity as a Planning Resource within the MISO Resource Adequacy construct. As indicated in the Standard Bidder Forms, this includes: all pertinent MISO or bidder prepared studies including generator interconnection request information and/or generation interconnection study information.

In addition to information about the newly proposed interconnection, bidders selecting this option must also provide current information about POI to which the interconnection is proposed, including the existing generation interconnection agreement (GIA), MISO document links and information, general project transmission information, congestion and curtailment analyses, and a point of contact for all transmission related information.

Bidders must also provide a summary of all anticipated interconnection and/or system upgrade costs included in their proposal pricing including financial analyses related to any costs expected to be incurred with regard to interconnection, including the cost of installing the interconnection facilities, the network upgrades, distribution upgrades, affected system upgrades, and system protection facilities that have been identified, and a discussion of any unknown or contingent network upgrades for which the RFP Project may be responsible. As indicated in the Standard Bidder Forms in Appendix F, bidders are requested to attach third party studies on projected interconnection/system upgrade costs related to the RFP Project(s).

3.4 Transmission-Interconnection Approach: Utilization of Sherco interconnection rights (including use of MN Energy Connection)

This option includes projects proposing interconnection at the Sherco substation and to the Minnesota Energy Connection. Bidders selecting this strategy do not need to have submitted a generator interconnection request with MISO or submit plans on when an application would be submitted. However, bidders should expect that their project must meet the requirements of an “interconnection request ready”¹⁵ project per MISO Attachment X *Generator Interconnection Procedures* and meet all technical requirements per MISO Attachment X: Appendix 6 *Generator Interconnection Agreement*.

Additionally, the bidder must identify the anticipated location of the new project’s interconnection with the MNEC Project, consistent with the MNEC Project routes selected for continued evaluation by the MPUC on May 9, 2024. MNEC Project Proposals will be evaluated and scored on the presumption that the MNEC Project final routing will include the proposed interconnection point, and the proposal scoring will be compared to the scoring of all other proposals in this RFP.

Regarding costs under this approach, bidders must choose whether to submit a MN Energy Connection Traditional Bid Option or a MN Energy Connection Contingent Bid option, or whether they wish to submit their proposal separately under each participation option¹⁶:

¹⁴Bidders are required to provide all data needed to complete Appendix 1 of the GIP, which can be found at: https://docs.misoenergy.org/legalcontent/Attachment_X-Appendix_1_-_Interconnection_Request_for_a_Generating_Facility.pdf.

¹⁵Bidders are required to provide all data needed to complete Appendix 1 of the GIP, which can be found at: https://docs.misoenergy.org/legalcontent/Attachment_X-Appendix_1_-_Interconnection_Request_for_a_Generating_Facility.pdf.

¹⁶ Those submitting bids under each MN Energy Connection Option presented in Table 2 will be responsible for paying two bid fees.

- Those bidders choosing to submit a Minnesota Energy Connection Traditional Bid Option must also provide a summary of all anticipated interconnection costs included in their proposal pricing including financial analyses related to any costs expected to be incurred with regard to interconnection, including the cost of installing the interconnection facilities, the network upgrades, distribution upgrades, affected system upgrades, and system protection facilities that have been identified, and a discussion of any unknown or contingent network upgrades for which the RFP Project may be responsible.
- Those bidders choosing to submit a MN Energy Connection Contingent Bid option will not be responsible for submitting interconnection costs for their proposals; rather these proposals will be reviewed by MN Energy Connection project transmission specialists to ascertain likely interconnection costs for use during the bid evaluations in fall 2024. As outlined in section 2.3 projects remaining viable after additional studies in 2025 will be permitted to update their costs.

Finally, both those projects submitting a MN Energy Traditional Bid Option and those submitted as a MN Energy Connection Contingent Bid Option will be reviewed by MN Energy Connection project transmission specialists for any stability concerns.

3.5 Distribution-Interconnected Projects

PPA proposals selecting this option must be interconnected to the NSPM distribution system – which includes portions of Minnesota, North Dakota and South Dakota – in a location where the Point of Common Coupling is in the NSPM service territory and the remainder of the location of the DER system allows the interconnection without NSPM being required to provide any compensation or service territory swap with any neighboring utility in order to allow the interconnection. The interconnection must not be on any feeder, or not be on any feeder connected to a substation, that is owned in whole or in part by any utility other than NSPM. Further, the bid must be interconnected by the COD indicated in the proposal. Only projects that have a signed interconnection application as of June 28, 2024 are eligible to submit bids into this RFP.

Bidders choosing this interconnection option will be responsible to include all anticipated interconnection and/or system upgrade costs in their proposal pricing, including the estimated cost of installing any necessary interconnection facilities, network or affected system upgrades. As indicated in the Standard Bidder Forms in Appendix F, bidders are encouraged to attach the Interconnection Agreement which supports the projected interconnection/system upgrade costs related to the RFP Project(s).

Projects submitted without signed interconnection agreements as of June 28, 2024 are not eligible and will be removed from further consideration in this RFP process.

Section 4. RFP Schedule and Proposal Content Requirements

4.1 Schedule

NSP's objective is to complete proposal evaluations, selections, and contract negotiations as set forth below in Table 3. For consideration in this RFP, proposals from third parties must be submitted by 5:00 p.m. (CDT) on September 18, 2024. As per the Modified Track 2 process required by the MPUC, any self-build bids in this RFP must be submitted by 5:00 p.m. (CDT) on September 17, 2024 and will remain unopened until the proposal acceptance period has ended.

The Company reserves the right to adjust the schedule; this information would be communicated to all bidders in writing should it occur.

Table 3: NSPM 2024 RFP SCHEDULE

RFP Issued	June 28, 2024
Standard Bidder Forms provided on RFP webpage	July 3, 2024
Bidder Conference	July 24, 2024
Company-preferred deadline to submit the Notice of Intent to Respond	August 15, 2024
Last date for bidders to submit questions (answers posted online weekly)	September 8, 2024
Responses to last bidder questions posted	September 11, 2024
Self-Build Bids due, 5 p.m. CDT	September 17, 2024
Third Party Bids due, 5 p.m. CDT	September 18, 2024
Traditional Option bids shortlisted for contract negotiations are notified	December 18, 2024
MN Energy Connection Contingent Option proposals shortlisted for additional study are notified	December 18, 2024
Schedule for MN Energy Connection Contingent Option proposals to submit any cost updates is released to bidders	First Quarter 2025
Contract negotiation complete for Traditional Option Bids	April 1, 2025
Petition filed for Traditional Option Bids, including Independent Auditor report	Second Quarter 2025
Shortlist of MN Energy Connection Contingent Bids Released*	June 30, 2025
If necessary, Petition & Independent Auditor Addendum for MN Energy Connection Contingent bids is filed	September 30, 2025

*Timing dependent on timing of MPUC permit order for MN Energy Connection route.

By submitting proposals, bidders acknowledge there will be a short period of time to complete negotiation of a contract following selection and understand failure to timely complete those negotiations is likely to result in the proposed project not moving forward in the subsequent regulatory approval process.

4.2 Minimum Requirements for Proposals

This section describes the minimum requirements that all proposals must satisfy to be eligible for consideration in this solicitation. Additional requirements and process details for bids choosing the MN Energy Connection Contingent Option can be seen in Section 2.3. Unless the Company in its sole discretion elects otherwise, proposals that do not comply with these requirements will be deemed ineligible and will not be considered further. The Company reserves the right to reject any bid and all bids.

- Proposals must include all applicable content requirements described in Section 4.6, including clear and complete written descriptions of all information requested and completed forms.
- Proposals must clearly specify all pricing terms in accordance with Section 4.6.
- Proposals must demonstrate an acceptable level of development and technology risk, as determined by the Company's due diligence and evaluation team.

- Proposals must clearly demonstrate any financing requirements and an indicative financing structure (construction and permanent) for any proposed resources that will be delivered under the proposals. Respondents should include a description of how current financial markets are likely to impact the respondent's ability to access the debt and tax equity markets.
- Each respondent must present clear and sufficient proof that it has or can secure an adequate and confirmed supply of all equipment and materials necessary to construct and commission a complete, commercially operable, solar, wind, storage, or hybrid electric generating plant sufficient (at a minimum) to meet the RFP requirements.
- Respondents must provide the required bid fee (described in Section 4.5) for each proposal submitted and agree to pay another fee upon bid shortlisting.
- All respondents are expected to provide truthful and accurate statements as part of their bids. Any false statements will result in project disqualification.
- No respondent may act through partnership, joint venture, consortium, or other association or otherwise act in concert with any other person unless it provides written notification of such to the Company as part of its proposal.
- Proposals must clearly confirm that the respondent is assuming the use of labor covered by a collective bargaining agreement for the construction of the RFP Project and that the pricing provided in the applicable Standard Bidder Form 6 is based on this assumption.
- All bidders with PV solar generation components must provide the applicable pollinator habitat scorecard assessment form(s) with their proposal.

4.3 Proposal Submission Deadline

All proposals will be accepted until 5:00 p.m. Central Daylight Time on the date indicated in Section 4.1.

All proposals must be transmitted electronically via upload to the Company's XpressDRIVE File Exchange. Bidders can request upload links to submit their proposals by emailing the RFP Project Manager at:

NSP2024RFP@xcelenergy.com

Proposals received via email or uploaded to XpressDRIVE later than the due date and time indicated will be rejected and remain unopened in XpressDRIVE unless the Company determines, at its sole discretion, to consider such proposals.

Each proposal submitted must be a complete and electronically signed original proposal. If a bidder submits multiple RFP Project proposals, they must all be clearly marked and differentiated. Proposals in which multiple project sites are bundled into a single proposal – are allowed as long as each separate location independently meets all RFP Product requirements in Section [2.2] (e.g., minimum size of 5 MWac at each site for newly constructed facilities).

4.4 Information Policy and Internal Communications Protocol

To obtain additional information about this RFP, potential respondents as well as all other parties may only submit inquiries via email at:

NSP2024RFP@xcelenergy.com

Potential respondents as well as all other parties should not attempt to acquire information through any other means including telephone calls to the Company. The Company will maintain a log of all inquiries and coordinate the preparation of written responses. The Company will periodically post responses to questions on the RFP website and these responses will be filed as addendums to the RFP. The deadline for submitting

questions is indicated in Section 4.1. Questions may no longer be accepted after this deadline. All filed addendums will be posted by Company on the RFP website. Bidders are responsible for monitoring the RFP website for updated addenda. The Company has established this information policy to ensure that all respondents have the same timely access and knowledge about the bidding and evaluation process.

a. Internal Communications Protocol

As indicated in this RFP, the Company is using the Modified Track 2 process for this RFP. This process was developed, in part, to speed the renewable resource acquisition process while ensuring an objective and transparent process when the Company may potentially submit its own self-build proposal into the RFP. As required by the Modified Track 2 process and as a general best practice, we have established an internal communications protocol that creates a “firewall” with respect to communications related to this RFP between Company staff who may work on potential Company self-build proposals and Company staff on the RFP evaluation team.

This firewall is designed to safeguard against the self-build team obtaining information that is not available to other potential bidders. The separation protocol also governs the communication process the RFP evaluation team will use to communicate with all bidders, both internal and external to the Company. An Independent Auditor hired by the Company monitors our firewall and communications between the RFP team and bidders pertaining to the RFP and includes a review of the firewall and team structures in its report filed with the resource acquisition petition resulting from the RFP process.

For the current RFP, the internal firewall has been in place since February 12, 2024 and will remain in place at least until bids are received. If the Company submits self-build proposal(s), the firewall will remain in place until the final shortlisted bids are announced, currently planned for December 18, 2024. If there are self-build bids among the bids chosen for the MN Energy Connection Contingent Bid Short List, a modified firewall will be put in place at that time regarding the communication process with respect to the bids on the MN Energy Connection Contingent Bid Short List.

4.5 Bid Evaluation Fees

a. First Bid Fee

Each bidder submitting a transmission-interconnected project shall pay by wire transfer on or before the Proposal Due Date a fee of \$10,000 for each proposal submitted. Each bidder submitting a distribution-interconnected project shall pay by wire transfer on or before the Proposal Due Date a fee of \$5,000 for each proposal submitted.

A separate bid evaluation fee is required for project proposals with different COD, interconnection choice, pricing, PPA term length, equipment type, or MW size. RFP Projects on *different* sites, regardless of similarities in size or COD, also require a separate bid fee for proposal evaluation and due diligence through RFP completion. BT bids are required to provide two sets of cost options – one with a LTSA and one without, unless the OEM requires an LTSA. These BT proposals are exempt from the separate bid fee requirement and will only need to pay one fee per single paired set of ongoing expenses. Bid fees shall be paid by wire transfer to NSP. In response to a bidder sending an email to the RFP email address, **NSP2024RFP@xcelenergy.com**, no earlier than 10 business days prior to the Proposal Due Date, the Company will email a response with wire transfer instructions. No cashier's checks will be accepted.

The Company will not refund any bid fees associated with any bid, regardless of the success or failure of that bid.

b. Second Bid Fee

Any bidder(s) selected to begin negotiation of a Power Purchase Agreement or Purchase and Sale Agreement shall be required to submit a Second Bid Fee of \$1/kW (e.g., 100 MW Project * \$1/kW = \$100,000) to the Company prior to commencement of negotiations. Upon execution of an Agreement the Second Bid Fee shall, at the option of the bidder, be either refunded to the bidder or, for Power Purchase Agreements only, be applied to fulfill the bidder's obligations under Article 11 of the Power Purchase Agreement. However, if the bidder and the Company fail to execute an Agreement due to, in whole or in part, bidder's actions or inactions that do not reflect or conform to bidder's representations or commitments made during the RFP bidding process, the Bidder shall surrender the Second Bid Fee. For bids selecting the MN Energy Connection Contingent Option process, please see Section [2.3] for details.

4.6 Proposal Content Requirements

This section outlines the content and format requirements for all proposals submitted in response to this RFP. Unless the Company in its sole discretion elects otherwise, proposals that do not include the information requested in this section will be deemed incomplete and ineligible for further consideration, unless the information requested is not applicable or relevant to a given proposal.¹⁷ The Company reserves the right to conduct any further due diligence it considers necessary to fully understand and evaluate proposals.

Bidders are encouraged to provide as much information as possible to assist in the evaluation of their proposals. A complete proposal will include a complete, electronically signed original proposal, assembled in the following format:

Section 1 – Executive Summary

All bidders shall provide an RFP Project summary and overview including narrative that addresses why their proposal provides value to NSP and its customers, especially with regard to the Company's two primary objectives outlined in Section 1.1 of this document. Bidder shall also provide detail on background and experience in developing similar projects as well as any applicable references (including contact name, contact number and project name) from projects where the bidder has completed development and construction of a similar facility.

Relevant Bidder Experience

All proposals must describe the respondent's qualifications and experience in developing, constructing, commissioning and operating generation facilities similar to the proposed RFP Project, including the experience, qualifications and safety record of key personnel who will manage development and an overview of utility scale project(s) the respondent has developed during the last 5 years. If a project team is in place, the proposal should identify the members of the team who will be responsible for design, siting, permitting, financing, construction, and operation of the facility; if such a group is not in place, the proposal must set forth the respondent's plan for assembling such team (including process and timing). If an Engineering, Procurement, and Construction ("EPC") contractor or any other contractors will be utilized, the same level of information must also be provided for each separate entity, along with a clear description of their role in the RFP Project's development. This part of Section 1 is also required in addition to Standard Bidder Forms 3 and/or 15.

Section 2 – Standard Bidder Forms (Appendix F)

Please note: Standard Bidder Forms will be provided on the NSP 2024 RFP web page on July 3, 2024, as indicated in Table 3.

¹⁷ Applicants will be given the opportunity to remedy deficiencies.

All bidders shall complete forms in Appendix F (Standard Bidder Forms 1-18) and provide all information that is applicable to bidders' respective RFP Project(s). Standard Bidder Forms will be made available on the Company's website at the following link:

xcelenergy.com/NSP2024RFP

Below is a list and brief description of each form:

Form 0: Notice of Intent to Respond (optional): As a potentially large number of RFP Projects may be submitted, bidders are encouraged, but not required, to submit the Notice of Intent to Respond by August 15. This form is optional, but highly encouraged, for all bid types. Note that, as discussed further below, given the time required to perform related transmission studies, timely submission of completed NOIR forms for BT and/or self-build projects proposing to reuse Sherco interconnection rights will avoid a 10 point deduction to their proposal's score.

Form 1: Confidentiality: Form 1 is required for all bid types. Any person that receives confidential or Highly Confidential information belonging to the Company shall be required to execute the confidentiality agreement set forth in Form 1 and indicate where prompted that they have read the Company's data attachment.

Form 2: Bid Certification: There are two versions of Form 2 that correspond to whether the proposal is a BT or self-built option versus a PPA. Please use the form that corresponds to the proposed contract structure. Bidders must make several certifications, including:

- a. All statements and representations made in bidder's proposal are true, and bidder agrees to abide by the posted Conduct Code;
- b. The bidder accepts, as applicable:
 - i. BT bids: the applicable TS (Appendix A) and NSP Technical Specification (Appendix C) except as specifically noted in writing, or
 - ii. PPA bids: the applicable NSP Model Power Purchase Agreements (Appendix B),
- c. For PPA bids only: the applicable accounting standards in regard to finance lease and variable interest entities have been considered and that, to the bidder's knowledge, the bidder's proposal will not result in finance lease or consolidated variable interest entity treatment to the Company;
- d. The proposal pricing submitted in Standard Bidder Form 6 includes the full cost for the use of labor covered by collective bargaining agreements for construction as well as all transmission/distribution interconnection costs, except as specifically noted in the same Form¹⁸; and that
- e. The bidder identifies and accepts any RFP addenda issued by NSP.

Form 3: Applicant Info and References: Form 3 is required for all bid types. Bidders will provide basic contact information for project representatives, details about previous project development experience, an overview of the project, confirm whether or not their proposal may be affected by the AD/CVD circumstances mentioned in Section 4.9, and provide additional environmental justice data where prompted.

Form 4: GenTech&BOP: Form 4 is required for all bid types. Information is separated by type of technology. For example, if a proposal contains both solar and storage components, information about solar and storage should be provided in separate technology columns. For each generation tech type details including, but not limited to, the primary fuel type, nameplate capacity, and for storage resources, storage duration, must be provided. Bidders will also provide information in section 2 about the collection substation, Main Power

¹⁸ The Certification statement itself will be provided as an RFP Addenda by the time of the July 24 Bidder's Conference shown in Table 3.

Transformer, and generator tie-line. Bidders will also provide the estimated completion date, number of years of useful life and where prompted, other relevant attributes regarding the technology type proposed.

Form 5: GenAnnual: Form 5 is required for all bid types. In this section bidders must provide expected generation levels for each year of the RFP Project's expected life, net of expected degradation impacts, if any, parasitic loads, and losses. Expected generation shall be estimated at the Point of Interconnection ("POI"). Additionally, bids proposing to include storage must provide details on storage capacity at POI based on their proposal type; *please read the form instructions carefully*. PPA bids may choose whether to provide storage capacity with or without augmentation to align with the pricing on Form 6-Renew Storage PPA Pricing; BT and SB Bids will provide estimates of storage capacity both with and without augmentation. All bids proposing storage will also provide round-trip efficiency information.

Form 6: Pricing: There are two types of Standard Bidder Form 6 that correspond to whether the proposal is a BT or self-built option versus a PPA. For all proposals, bidders must complete the set of Standard Bidder Form 6's that applies to their bid type (BT or PPA).

Bidders must offer firm pricing valid through the duration of this RFP, and, if proposal is selected for negotiations, the completion of negotiations resulting in an executed PPA or Purchase and Sale Agreement ("PSA"). Indicative pricing in a proposal will not be acceptable.

- A. **PPA bids:** Use the Form called 6-Renew Storage PPA Pricing and follow the instructions to complete the proposal pricing and Finance Lease consideration and tax credit sections. *Please read the instructions on the Form carefully to ensure that your pricing is provided in the correct format.*
- B. **BT bids:** Complete both D1 and D2 Tabs in accordance with the number of separate technologies contained in your proposal. For example, if a BT bid with both solar and storage technologies is being submitted, each technology should be broken out on different D1 tabs. For example, the solar technology could be provided the D1_T1 tab and the storage technology on the D1_T2 tab. In the D1 tab(s), bidders shall provide a proposed lump-sum payment or schedule of payments from NSP to the bidder that identifies the purchase price for that technology into generation equipment, electrical equipment, transmission equipment, land purchase payments, and all other project related payment categories. Please see Form instructions for more details about each cost category definition and section 2.4 for more information about payment schedules acceptable to the Company. If the bidder proposes more than one pricing option (i.e., more than one set of D1 tabs), a separate bid and attendant bid fee must be submitted. All pricing is expected to be fully compliant with the applicable NSP Technical Requirements (Appendix C) and model TS (Appendix A) unless otherwise noted.

In addition to the pricing data on each D1 tab bidder must provide tax credit information as requested in the Form.

The D2 tab is structured to allow bidders to identify ongoing expenses anticipated for their proposal after the asset has begun commercial operation. In accordance with the requirements for sets of ongoing expenses with and without an LTSA, the D2 tab is where the LTSA pricing information will be included, in addition to other ongoing, post-COD estimated O&M and land and easement costs separately for each technology type.

Form 7: Construction: Form 7 is required for all bid types proposing the construction of any new equipment. Bidders are to provide proposed dates for each significant construction milestone, as shown on a detailed development schedule provided with the proposal. Milestones should be based on the requirements to achieve the proposed commercial operation date. The dates for the major milestones should also be indicated on Standard Bidder Form 7. Bidder shall also provide onsite construction execution details, including anticipated

personnel sizes for construction labor and management, expected on site manpower labor curves, construction union labor trade compositions, and required equipment laydown or other warehousing sizes and locations.

Form 8: Technical Descriptions & Designation of Technology for Evaluation: This form applies to all bids, including for bids proposing the repowering of existing generation sites and for existing projects seeking PPA extensions. There are three sections of this form that correspond to different technology types– wind, solar, storage (BESS) – which are eligible for inclusion in a proposal. Each technology type included in a proposal must have this Form included; for example a solar + storage proposal must include both of the corresponding sections (Battery Energy Storage and Solar Photovoltaic) of the TechDesc Standard Bidder Form in the proposal.

Provide all pertinent technical information for the RFP Project including detailed equipment and facility information in Form 8. If Bidder has not finalized the module manufacturer, they must identify the module options and provide the applicable production data and module warranty information for each module considered, as well as contingency plans in the event the preferred module in the RFP is unavailable at the time of procurement. For RFP Projects containing a BESS component, if Bidder has not finalized the battery cell manufacturer, they must identify the battery cell options and provide warranty information for each option.

Equipment Description

At a minimum, proposals should indicate for all major equipment planned, 1) the name of the manufacturer, 2) model, 3) key metrics and characteristics of the equipment, 4) contracting status, 5) site plan of solar array or wind farm, any BESS and collector substation, and 6) availability of equipment and planned or estimated delivery dates.

Designation of Equipment for Evaluation: in addition to providing the possible manufacturer names and models of a given technology that the bidder may use if shortlisted, the bidder must identify, where prompted in this Form, a single make and model for which the Company can evaluate the proposal. *Failure to identify a single set of equipment for evaluation can result in elimination from this RFP, as indicated in Section 5.2 of this RFP.*

Instead of construction or sourcing data for equipment, those proposals including existing facilities will complete additional information to confirm their resource is operable, if the proposal extends the life of the asset beyond expected asset design life.

Form 9: Capacity Accreditation: This Form is required for all bids, but different parts for the form are required for different resource types. For proposals that contain either a solar or wind component, new projects will be expected to provide the average expected hourly generation from the RFP Project for an entire year; existing projects will need to provide the most recent 3 years of historical hourly production data. Proposals for standalone storage should complete the certification at the bottom indicating they understand the use case assessed for their proposal will be for resource adequacy (i.e., capacity accreditation).

Finally, proposals for large BT distributed generation will need to indicate they understand that in order to serve as a Planning Resource for the Company, as per the requirements of this RFP, they understand 1) their facility will need to be designed to allow for the Company to have both remote active and reactive power control of the facility, and 2) they understand the Company may ask additional questions during the RFP Period to verify this capability.

Form 10: Energy Production Estimates: This Form is required for all proposals including a wind or solar component, *including* existing resources proposing a PPA extension or repowers of existing MISO POIs. There are different energy production estimate forms depending upon the resource type; proposals must include the following:

- Annual solar/wind energy output using a P50 study.

- For proposals with a solar component: Complete the PVSyst Inputs tab in the standard bidder form. Additionally, a PVSyst report for an entire year of estimated energy production and a summary file, in MS Excel format, that provides the assumptions being used by PVSyst to estimate energy production must be provided.
- For wind proposals: Complete the WResource and WPower Curve tabs in the Standard Bidder Form, including attachments as required.

Independent Consultant: Depending upon the technologies, the applicable solar or wind information listed above shall be included with the response. The annual P50 study shall be from a qualified external consultant unaffiliated with the Respondent.

Estimated Annual Energy Production should be as delivered to the POD and net of any expected plant degradation over time. Time is hour ending, Central Standard Time; do not adjust for daylight savings time. Explain fully the meteorological data, and sources, used for the annual estimates and provide all losses assumed. A copy of the third-party report and the contact information, resume, and experience of the external, unaffiliated consultant shall also be provided.

Form 11: Interconnection Details: There are four versions of this form that correspond to different transmission interconnection approaches: distribution interconnected projects, new MISO POIs, existing MISO POIs, and MN Energy Connection. Please use the version of the Form that corresponds to the interconnection strategy you are choosing for your proposal. Each version of the form requests applicable data that is needed.

Unless the proposal is a MN Energy Connection Contingent Option proposal, all other proposals must include a summary of all anticipated costs related to the delivery of energy from the RFP Project to the POI/POD included in their proposal pricing. Inclusion of additional materials, such as financial analyses related to any costs expected to be incurred with regard to interconnection, is also permitted and encouraged. Projects choosing the MN Energy Connection Contingent Option can see additional details regarding the process for cost estimates in Section 2.3.

Form 12: Creditworthiness: Form 12 is required for all bid types. Proposals must include detail and address all questions regarding financial aspects of all projects including financing information, credit history, and legal claims. The most recent three fiscal year-end financial statements need to be provided; preference will be given to audited statements but unaudited will be accepted.

Form 13: Siting and Environmental: There are two versions of this form that correspond to whether the RFP Project will have a PPA or BT/SB contract type. Please use the version of the Form that corresponds to the applicable contract type. Proposals must provide all requested details regarding site control, permitting, environmental studies, and legal claims. The Company will evaluate whether each bidder's proposal includes the required environmental approvals and permits for construction of the RFP Project and whether the appropriate timelines have been included in the project schedule.

Proposals must describe the impact of the project on wildlife including any direct or indirect impacts to state and federal-listed species. Report on any reviews, assessments or studies performed by the DNR, USFWS, or other relevant agencies or consultants on wildlife or cultural resources impacted by the project. Proposals shall provide a characterization of the site and surrounding areas including proximity to nearby wetlands, prime farmland (as referenced in Federal Regulations 1980, title 7, section 657.5, paragraph (a)) and endangered, threatened, or critical species and critical habitat for threatened and endangered species. If a site permit request has been filed with a state regulator, please provide the docket number where filings can be viewed.

The Company is committed to supporting pollinator friendly habitat at our solar facilities. We require bidders proposing a solar project to provide a pollinator habitat scorecard assessment form¹⁹ with their proposed bid package. Since eligible RFP Projects can be located in three different states, all bidders will complete a common scorecard assessment form in addition to any required in their specific jurisdiction.

Form 14: Warranties, 1Line, Safety: Form 14 applies to SB, BT and PPA bids. Proposals will need to include a satisfactory electrical one-line diagram²⁰ as outlined in the Standard Bidder Form. Additionally, depending upon proposal type, additional data must be provided:

For BT bids containing a BESS component: provide an independent, third-party estimate or copy of a warranty regarding the capacity degradation of the BESS indicated on the TechDesc tab (Form 8). The independent third party must be unaffiliated with the bidder and the contact information, resume, and experience of the external, unaffiliated consultant shall also be provided.

For PPA bids that contain a BESS component: provide additional data regarding BESS fire safety considerations. Additionally, these proposals will need to confirm the bidder plans to augment the battery or if not augmented, the bidder will need to provide an independent estimate or copy of a warranty documenting the appropriateness of the capacity degradation rate provided on the TechDesc tab (Form 8). The independent third party must be unaffiliated with the bidder and the contact information, resume, and experience of the external, unaffiliated consultant shall also be provided.

PPA and BT bids containing a solar component will need to provide warranties and data sheets for the designated module and inverter the Company will evaluate (the equipment designated on Form 8).

Form 15: Solar/Wind/Storage Projects Not Placed into Service: Form 15 is required for all bid types. Bidders should provide a list of similar projects and identify any solar, BESS, or wind projects contracted within the last five years that have not been placed into service, or are expected to not be placed into service, consistent with the originally executed contract terms.

Form 16: BT, SB Tech Specs Excepts: Form 16 applies to BT and Self-Build projects only and is an optional form. Bidders should include any proposed exceptions to the applicable Technical Specifications provided in Appendix C of the RFP.

Form 17: Repower: This form is only required for applications that contain an existing generation asset or propose being co-located with an existing generation asset.

Form 18: Bidder Checklists: Form 18 applies to all proposals and provides a checklist of all attachments for each proposal type.

Section 3 – Term Sheet (Appendix A) Exceptions

This Section only applies to BT proposals. In this section, respondents with BT contract structures are required to clearly document any exceptions to the applicable TS template by providing a redline version of the document with their Proposal and reason for taking each exception(s). Bidders should also provide the

¹⁹ All RFP projects containing a solar component, regardless of location, will complete the Minnesota scorecard, available here and in Appendix G: <https://bwsr.state.mn.us/sites/default/files/2020-05/Habitat%20Friendly%20Solar%20Site%20Assessment%20Form%20for%20Project%20Planning%205-26-2020.pdf>.

²⁰ Distribution-interconnected assets must be "in-front-of-the-meter." Projects "behind the meter" are not accepted for meeting the Company's accredited capacity/resource adequacy requirements.

information highlighted in yellow on the TS for their project. *Please note that any alternative price submitted for the Project will be assumed to take into account compliance with the redlined version of the TS submitted by the bidder.*

4.7 Clarification of Proposals

While evaluating proposals, the Company may request clarification or additional information about any item in the proposal. Such requests will be sent via email to respondents identified on Standard Bidder Form 3 by the RFP Project Manager, typically, and respondents are required to provide a written or electronic response back to the RFP Project Manager within five (5) business days, or the Company may deem the respondent to be non-responsive and either suspend or terminate evaluation of the associated proposal. Respondents are encouraged to provide an alternate point of contact to ensure a timely response to clarification questions.

Any amendment, modification, addenda, or clarification to a bid are binding and will be treated the same as any original RFP proposal. The Company will only accept amendments, modifications, or addenda to a bid in response to a request for clarification from the Company. Amendments, modifications, or addenda volunteered after bid submittal will be disregarded unless directly solicited by the Company.

Bidders are responsible for carefully examining and understanding all RFP documents and requirements, nature of the work to be performed, and any other requirements listed in this RFP document. A lack of understanding or ignorance of these requirements will in no way relieve the bidder of obligations of their bid or of any resulting contract.

4.8 Confidentiality

Respondents are allowed to identify any information in their proposals that respondents claim should be considered to be confidential or proprietary. Nonetheless, the Company reserves the right to release all proposals to its affiliates and such affiliates' agents, advisors, and consultants for purposes of proposal evaluation. The Company will, to the extent required by law, advise each agent, advisor or consultant that receives such claimed confidential information of its obligations to protect such information. In addition, all information, regardless of its confidential or proprietary nature, will be subject to review by the MPUC and other governmental authorities and courts with jurisdiction, and may be subject to legal discovery. It is not the Company's intent to enter into any separate confidentiality, non-disclosure, or similar agreements as a condition to receiving a respondent's proposal.

Bidders should clearly identify each page and piece of information claimed by bidder to be confidential, trade secret or non-public information. Bidders must provide written justification for any such claim(s). Bidders acknowledge and agree that notwithstanding its designation of certain materials as confidential, trade secret or non-public, NSP will have the right in its sole discretion to disclose such materials provided to it by a bidder in any regulatory proceeding or as required by law.

4.9 AD/CVD Petition

On April 24, 2024, the American Alliance for Solar Manufacturing Trade Committee filed antidumping and countervailing duty (AD/CVD) petitions on U.S. imports of crystalline silicon photovoltaic cells, whether or not assembled into modules (solar cells and modules), from Cambodia, Malaysia, Thailand, and Vietnam. The Company expects that all bidders consider and evaluate the possibility that certain solar cells, modules or other equipment from these and other countries outside the United States may be affected by this and other such petitions. As such each bidder should treat AD/CVD petitions whether imposed before or after the conclusion of this RFP as possible or foreseeable and develop bids accordingly.

4.10 Addenda to RFP

Any additional responses required from respondents as a result of an Addendum to this RFP shall become part of each proposal. Respondents must list all Addenda issued by NSP at the bottom of the Bid Certification Form (Standard Bidder Form 2).

Section 5. RFP Proposal Evaluation

The objective of the Company's evaluation is to identify proposals that meet the resource objectives identified in the solicitation in a reliable and cost-effective manner and which is likely to be successfully developed and ultimately placed into commercial operation under ownership of the Company.

An evaluation team, made up of various groups within the Company will evaluate proposals; however, the Company reserves the right to retain the services of outside experts to assist in the evaluation of proposals. The RFP Project Manager may contact respondents directly, via email, at any point during the evaluation process for the purposes of clarifying proposals.

The Company will use a three phased approach to evaluating bid proposals offered in the RFP. The three phases include:

- a. Completeness review
- b. Threshold review
- c. Key parameters review and scoring

Based upon the results of the complete evaluation, the Company will determine which proposals will be included in the final selection. Although it is not anticipated, the Company may conclude that no offered resource meets the Company's objectives of the solicitation and no proposal will be selected.

5.1 Completeness Review

The completeness review ensures compliance with all bid submittal requirements (fees, complete information provided in bid responses, submission of all required information and forms, etc.). The Company reserves the right to reject any, all or portions of any proposal received for failure to meet any criteria set forth in this RFP.

5.2 Threshold Review

The threshold review ensures the bidder and RFP Project parameters comply with all RFP requirements and seeks to identify any fatal flaws or critical risks in the proposal's ability to reach COD prior to December 31, 2029 at the proposed price and capacity level. Factors analyzed include, but are not limited to:

- a. Whether the proposed RFP Project type meets size, location, and technical requirements stated in this RFP document.
- b. Whether the project proposes a COD for new accredited capacity prior to December 31, 2029
- c. Proposed project timeline
- d. Site control and permitting
- e. PPA bids: Failure to submit a bid price in full compliance with the applicable Model PPA in Appendix B.
- f. BT bids: Failure to submit a Standard Bid in full compliance with the applicable Purchase and Sale Agreement (PSA) term sheet
- g. BT bids: Failure to submit an alternate price related to any proposed exceptions to the Term Sheets or Technical Specifications, or submission of exceptions that transfer an unacceptable level of risk to the Company.
- h. Failure to identify a single manufacturer, make, and model the Company can use for the purposes of evaluation:
 - a. Bidders may indicate an intent to choose from several similar generation or BESS models but must identify a single make and model to be used for the purposes of evaluation in the RFP.
- i. Interconnection approach and associated risk
 - a. Distribution Interconnected projects that do not have signed interconnection agreements as of June 28, 2024.

- b. Projects pursuing interconnection at new MISO POIs who have not submitted a generator interconnection request or whose generator interconnection request is in a Cycle later than MISO's 2021 DPP Cycle.
- c. Projects pursuing reuse of existing MISO POIs (other than MN Energy Connection POIs) that fail to provide a copy of the current GIA for the existing POI or who are proposing interconnection at a site for which there is no potential to increase the amount of deliverable accredited capacity in the proposed timeline.
- d. Projects proposing interconnection with the MN Energy Connection that are not in close proximity to the proposed routes.
- j. Potential for MISO Capacity accreditation
 - a. Projects pursuing new MISO POIs that do not have NRIS as part of their interconnection request.
 - b. Projects seeking to utilize existing MISO POIs that are not able to demonstrate the deliverability of their capacity.
- k. Projects proposing co-location with existing generator that do not have an agreement in place with the owner of the existing generator or who proposed existing facility must have its output fully committed to the Company.
- l. Accounting assessment
- m. Financial viability of the project and bidder
- n. Socioeconomic factors, including use of labor covered by a collective bargaining agreement and local community considerations
- o. Sourcing practices
- p. For proposals including BESS technologies: documentation of adequate fire safety measures
- q. For SB and BT bids: compliance with the applicable Technical Specifications

5.3 Key Parameters Review and Scoring

Proposals remaining after the Completeness and Threshold Reviews will be scored in a third stage of the evaluation process. The Company has identified the following key parameters to evaluate the RFP Projects during this stage:

Base Score Components

- a. Pricing
- b. Capacity Deliverability and Risk
- c. Bidder Strength and Execution

Both a Score Component and Deductor

- a. Environmental Justice Area Impacts (positive/negative)

Score Deductors

- a. Lack of Certified Diverse Suppliers
- b. BT Bids Only: Exceptions to the applicable Model PSA template
- c. Congestion
- d. MN Energy Connection Traditional and Contingent Bids Only: Lack of NOIR response
- e. Failure to respond to Company questions in a timely manner

Bonus Points

- a. Early COD

Base Score Components

Each proposal evaluated during this stage will receive a score between 0 and 100 points, with weighting as stated below:

- a. **Pricing:** The Company will evaluate proposals' pricing using levelized cost methodologies based on the technology type (wind, solar, storage, wind + storage hybrids or solar + storage hybrids), RFP project pricing, its energy production, and the amount of accredited capacity it can deliver. The proposal pricing score will have a maximum point value of 55 points out of the 100 total possible base points.
- b. **Capacity Deliverability and Risk:** The Company will provide a score for each proposal based upon how sufficiently it has demonstrated the deliverability of its proposed level of accredited capacity on the timeline in this proposal, including how well the bidder has identified potential risks and mitigated those risks through the proposal design. Examples include risks for the intended interconnection approach and supply chain risks for the type of generation selected, with more points being awarded for projects that have firmer plans addressing these risks. For example, projects proposing to submit a surplus interconnection application after shortlisting will receive fewer points than projects that have a generator interconnection request submitted into MISO's 2020 DPP Cycle. The proposal pricing score will have a maximum point value of 30 points out of the 100 total possible base points.
- c. **Bidder Strength and Execution:** The Company will evaluate each proposal based on the strength of the bidder, including the level of financial strength of the bidder relative to the size of the proposed project, whether the project is likely to achieve the estimated level of ITC or PTC estimated in the proposal, and the number of similar projects of the bidder that have reached commercial operation failed or had to reopen executed contracts with offtakers in recent years. The maximum points for this category will constitute 15 points out of the 100 total possible base points.

Both a Score Component and a Deductor

- a. **Environmental Justice Impacts (Positive/Negative):** The Company will evaluate proposals based upon the benefits provided and/or impacts of the project to Environmental Justice Areas as defined in *Minn. Stat. 216B.1691* and as articulated in the bid proposal. Projects with positive impacts, including but not limited to jobs and tax payments, on an Environmental Justice Area can receive up to 10 additional points added to their total bid score. Projects with negative impacts, including but not limited to a lack of demonstrated strategy for community engagement, can have up to 10 points deducted from the total bid score.

“Environmental Justice Area” is defined in *Minn. Stat. 216B.1691, Subd. 1(e)* as:

an area in Minnesota that, based on the most recent data published by the United States Census Bureau, meets one or more of the following criteria:

- (1) 40 percent or more of the area's total population is nonwhite;*
- (2) 35 percent or more of households in the area have an income that is at or below 200 percent of the federal poverty level;*
- (3) 40 percent or more of the area's residents over the age of five have limited English proficiency; or*
- (4) the area is located within Indian country, as defined in United State Code, title 18, section 1151.*

Proposers of projects located in Minnesota may use the Minnesota Pollution Control Agency's map at Understanding environmental justice in Minnesota (arcgis.com) to determine whether their project is located in an Environmental Justice Area. Proposers of projects outside Minnesota should use U.S. Census or other public data sources to determine whether their project is located in an area meeting one of the four criteria above.

Score Deductors

- a. **Lack of Certified Diverse Suppliers:** The Company will assess each proposal based on the proposal's intended use of certified Diverse Suppliers during construction and/or operations of the Solicitation Project, noting the Company's preference for the use of certified Diverse Suppliers. This category will only act as a deductor to the total bid score. A maximum of 5 points may be deducted from the total bid score for proposals that fail to use certified Diverse Suppliers during construction and/or operations of the Solicitation Project.
- b. **BT Bids Only: Exceptions to the applicable Model PSA template:** The number and type of exceptions made to the Company's applicable model term sheet for BT non-Standard bids only. If material exceptions are made to the Model BT term sheet that transfer risks or costs to the Company, the total bid score will be decreased by up to 10 points. Those non-Standard BT bids that are scored with the maximum potential deduction in this category will be considered ineligible for further evaluation in this RFP.
- c. **Congestion:** Future and historic MISO Day Ahead LMP congestion levels for all hours relative to NSP will be assessed using the nearest CPNode in existence as of January 1, 2024. A maximum of 15 points may be deducted from the total bid score for proposals that have a high level of congestion relative to other proposals. Bids can reduce the number of points deducted by being in the quartile of bids with the smallest congestion level relative to NSP.
- d. **Bids Seeking Interconnection to MN Energy Connection/Reuse of Sherco Interconnection Rights:** Given the ongoing complexity of the MN Energy Connection process, providing basic bid information in the NOIR – proposed size, location, type, and timing of the project – aids the Company in more complete evaluation of the impacts of these bids on the developing MN Energy Connection. Bids seeking this type of interconnection are still able to compete in this RFP without submitting a NOIR but 10 points will be deducted from the total bid score. Proposals selecting other interconnection options will have no adjustment to their bid score for this factor.
- e. **Inability to Respond to Company Questions in a Timely Manner:** Unless otherwise specified by the Company, bidders have 5 business days to respond to a request from the Company. Failure to respond by the requested dates interferes with the ability of the Company to complete the bid evaluation process for all proposals in a timely and effective matter. A maximum of 5 points may be deducted from the total bid score for failure to respond to requests on a timely basis.

Bonus Points

- a. **Early COD:** While the RFP allows projects to achieve COD between January 1, 2027 and December 31, 2029, projects with a COD prior to December 31, 2027 will receive a bonus of 20 points. Projects with a COD between January 1, 2028 and December 31, 2028 will receive a bonus of 10 points. Projects with a COD between January 1, 2029 and December 31, 2029 will not receive bonus points.

5.4 Final Project Selection and Bidder Notification

NSPM plans to complete the evaluation of bids and provide notification to bidders of the status of their proposal by December 18, 2024. On this date, bidders that have chosen to submit Traditional Option Bids will either be notified they are proceeding to contract negotiations or are eliminated from further consideration.

Bidders that have chosen to submit MN Energy Connection Contingent Option Bids will be notified by December 18, 2024 whether the Company wishes to conduct an additional stage of evaluation, including

modeling and cost updates, with their project in 2025, or whether the Company has eliminated the project from further consideration.

Attachments

Appendix A

NSP's Build-Transfer Term Sheets

See files titled:

NSP RFP: BOT Solar + Storage Term Sheet.docx

NSP RFP: BOT Wind + Storage Term Sheet.docx

NSP RFP: BOT Storage Term Sheet.docx

NSP RFP: BOT Wind Term Sheet.docx

NSP RFP: BOT Solar Term Sheet.docx

Appendix B

NSP's Model PPA Templates

See files titled:

Model Renewable [Wind] [Solar] Power Purchase Agreement.docx

Model Hybrid [Wind] [Solar] + Storage Power Purchase Agreement.docx

Model Standalone Storage Power Purchase Agreement.docx

Appendix C

NSP Resource Technical Requirements for BT bids. Note: Does not apply to distribution-interconnected projects, as PPAs are the only eligible contract structure for this project type.

See file titled.:

NSP Technical Specification for Transmission Interconnected Renewable & Storage Generation.pdf

Appendix D

NSP Template Subcontractor Plan

See file titled ***NSP Template Subcontractor Plan.pdf***

NOTE: A separate subcontractor plan must be submitted for each bid

Appendix E

Utilization of Sherco Interconnection Rights via Minnesota Energy Connection

See file titled:

MN Energy Connection Routes

Appendix F

Proposal Forms and Instructions

See file titled ***2024 NSPM RFP_Bidder Forms.xlsx***

As discussed in Section 4, the completed forms, attachments and narrative topic discussions, will comprise a complete proposal. The contents of each form and any special instructions for completing the forms are described in section 4.6 of this document. After July 3, these forms can be downloaded from the RFP web site and are expected to be completed and submitted in Microsoft Excel format.

If additional space is needed to elaborate on information requested on any form, please attach additional sheets with the heading "Form [] – Additional Information."

If certain information is requested that does not apply to the proposal, the respondent must indicate that the information is not applicable. If appropriate, the respondent should explain why the information is not applicable.

Please note: Standard Bidder Forms will be provided on the NSP 2024 RFP web page as of July 3, 2024, as indicated in Table 3.

Appendix G

Minnesota Pollinator Scorecard

See files titled:

2024 NSP RFP – Minnesota Pollinator Scorecard.pdf

Appendix H

NERC BESS Safety

See files titled:

NERC Lesson Learned: BESS Cascading Thermal Runaway.pdf

NSPM 2024 RFP

List of Potential Projects with Proximity to MN Energy Connection

Below shows capacity ranges of potential projects announced or otherwise indicated in Minnesota counties with proximity to the Minnesota Energy Connection proposed in Docket Nos. E002/CN-22-131 and E002/TL-22-132 – Route Permit. If projects have multiple touchpoints (i.e., site permit applications, regulatory filings, public announcements or MISO generator interconnection applications), they may potentially be counted twice in the totals below.

County	Resource Type	Potential Project(s) Total (MW)
Chippewa	None found	0
Cottonwood	Solar	60
Cottonwood	Solar + Storage Hybrid	400
Cottonwood	Wind	288
Cottonwood, Murray, Redwood	Wind + Storage	380
Kandiyohi	None found	0
Lincoln	Wind	450
Lyon	Wind	1050
McLeod	Solar	150
Meeker	None found	0
Murray	Solar	250
Murray	Solar + Storage Hybrid	245
Murray	Storage	20
Murray	Wind	588
Murray	Wind	550 - 1138
Pipestone	Solar	250
Pipestone	Wind	250
Redwood	Battery	300
Redwood	Solar	216
Redwood	Solar + Storage Hybrid	600
Redwood	Wind	138-538
Renville	Solar	125-450
Renville	Solar + Storage Hybrid	600
Renville	Storage	250
Renville	Wind	200-400
Sherburne	Solar	300
Sherburne	Storage	551
Stearns	None found	0
Watonwan	Hybrid	289
Watonwan	Solar	600
Watonwan	Wind	150
Wright	None found	0
Wright/Sherburne	Solar	600
Yellow Medicine	Battery	75
Yellow Medicine	Solar	193
Yellow Medicine	Wind	200

Draft for Discussion Purposes Only – Not an Offer
NON-BINDING TERM SHEET for the Purchase and Sale of a
Wind Electric Generation Project

*Seller to provide the information
Highlighted in yellow.*

Buyer

Northern States Power Company, a [Minnesota / Wisconsin] corporation (“Buyer”).

Seller

[Developer/Seller Name], a [Seller entity type and state of formation] (“Seller”), acting on its own behalf and on behalf of [Project Company Name], a [Project Company entity type and state of formation] (the “Project Company”), its wholly owned subsidiary. Buyer will also require Seller Credit Support (as defined below).

Project

The Project Company is developing the [Project Name] energy project, an approximately [·] MW nameplate capacity (the “Expected Nameplate Capacity”) integrated wind-powered electric generating plant located in [County Name] County, [State], and all other assets and rights relating to the project (the “Project”). For all purposes herein “Project” includes the gen-tie transmission line (the “T-Line”) that will connect the Project to the [relevant point of interconnection], and all electrical transmission line easements, rights-of-way or other real property interests necessary for the T-Line.

Type of Transaction

The transaction will be structured as an entity acquisition. Subject to the terms and conditions of a definitive purchase and sale agreement pertaining to the transaction (the “Agreement”), including that the Project is Production Tax Credit (“PTC”) qualified, has achieved an agreed set of “Substantial Completion CPs” (which Substantial Completion CPs shall include, without limitation, that the Project has been placed in service for U.S. federal income tax purposes and achieved substantial completion in accordance with the terms of the Agreement), free and clear of all encumbrances and liabilities, except for permitted encumbrances and assumed liabilities as defined in the Agreement (the consummation of such purchase and sale transaction, the “Closing”), on the transaction closing date (the “Closing Date”), Buyer shall purchase and Seller shall sell 100% of the ownership interests of the Project Company (the “Interests”). Seller would remain obligated after the Closing to perform the *Seller’s Work and Other Responsibilities* (described below) and all its other obligations described in the Agreement.

Purchase Price and Payment Terms

The “Purchase Price,” which is not to exceed [·] per MW, will be paid by Buyer at Closing; provided, that Buyer will consider making Purchase Price installment payments (“Progress Payments”)¹ to Seller from and after the Firm Date (defined below) and prior to Closing upon Seller’s achievement (to Buyer’s satisfaction) of certain milestones specified in the Agreement (or, if later, a “*payment not earlier than*” date to be specified for each milestone). In no case would a Progress Payment be made until (i) the Firm Date has occurred, including that Buyer has obtained State Regulatory Approvals (defined below) and (ii) the Seller Credit Support Amount (as defined below) is first increased by an amount equal to the

¹ If Seller is interested in receiving Progress Payments, Seller’s bid forms must include a proposed schedule of Progress Payments for Buyer to consider.

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subject Progress Payment. In no case would a Progress Payment be made if (a) Seller is in breach or default of its obligations under the Agreement, (b) the provider of the Seller Credit Support (as defined below) is in breach or default of its obligations under the relevant guaranty or letter of credit or (c) either Seller or the provider of the Seller Credit Support is suffering an insolvency or bankruptcy event. In no case will the amount of the Progress Payments made prior to substantial completion exceed 80% of the total Purchase Price.

Buyer will be entitled to set off against a Purchase Price payment (including a Progress Payment) any amount then owed by Seller to Buyer under the Agreement, including, without limitation, any accrued and unpaid Liquidated Damages (as defined below).

Buyer will be entitled to withhold from the Purchase Price payment made on the Closing Date an amount equal to 150% of the amount sufficient to complete any Punch List Items (defined below) (collectively, the “Punch List Holdback Amount”). If Seller has not completed all Punch List Items within the period of time agreed to by the parties, Buyer will be entitled to permanently retain a portion of the Punch List Holdback Amount equal to the greater of (i) the portion of the Punch List Holdback Amount attributable to the uncompleted Punch List Items and (ii) fifty percent (50%) of the Punch List Holdback Amount.

Credit Support

On the date the Agreement is signed (“Signing Date”), Seller will be required to deliver to Buyer “Seller Credit Support” in the form of either (i) cash held by Buyer for Seller’s account (or pursuant to a third-party escrow arrangement acceptable to Buyer in its sole discretion and at Seller’s sole expense), (ii) a guaranty from a guarantor acceptable to Buyer in its sole discretion and in a pre-agreed form or a form otherwise acceptable to Buyer in its sole discretion, or (iii) a letter of credit from an issuer acceptable to Buyer in its sole discretion and in a pre-agreed form or a form otherwise acceptable to Buyer in its sole discretion. Seller will be required to maintain Seller Credit Support in the Seller Credit Support Amount from the Signing Date until the first to occur of (a) the pre-Closing termination of the Agreement (including the period following such termination until all resulting claims are satisfied in full) and (b) the date that is twenty-four (24) months after the Closing Date (plus an additional period of time until all remaining indemnity claims are satisfied in full).

At any point in time prior to the Closing Date, the “Seller Credit Support Amount” shall be equal to the aggregate Seller payment obligations Seller could have if the Agreement is terminated at that point in time, including without limitation the Termination Payment (as defined below), accrued and unpaid Liquidated Damages and the aggregate Progress Payments, if any, then paid by Buyer. For twenty-four (24) months from and after the Closing Date (plus an additional period of time until all remaining indemnity claims are satisfied in full), the Seller Credit Support Amount shall be equal to the Indemnity Cap (as defined below).

Conditions Precedent to the Firm Date

The Agreement shall provide for the satisfaction, on or prior to the Outside Firm Date (defined below) and in each case in form and substance acceptable to Buyer and at Seller’s sole cost (except for costs of obtaining the State Regulatory Approvals, which shall be at Buyer’s sole cost) certain conditions precedent (“Firm Date CPs,” and the date all such Firm Date CPs have been satisfied or waived in writing by Buyer, the “Firm Date”). The Firm Date CPs will include, without limitation, that: (i) the State Regulatory Approvals have been obtained and are final, written, and non-appealable and in form

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and substance acceptable to Buyer in its sole discretion; (ii) all other required governmental approvals and permits (including without limitation the siting permit, environmental permits, and, if applicable, FERC approvals, approvals under the Hart-Scott-Rodino Antitrust Improvements Act of 1976, and any other permits necessary for the parties to consummate the transaction or for the Project Company to own, operate and maintain the Project) have been obtained and are final, written, non-appealable and in form and substance acceptable to Buyer in its sole discretion; (iii) Seller has obtained all land contracts (including that Seller shall obtain (x) amendments to the existing leases as needed to ensure that the lease payment provisions and other applicable terms provide for utility ownership, that the term of the leases is no shorter than the 25 years following construction of the Project and/or to address other matters reasonably required by Buyer, and (y) new lease agreements required for site setbacks or other requirements or otherwise reasonably required by Buyer) and otherwise secured full site control, including real estate rights required to interconnect the Project; (iv) Seller has obtained and delivered to Buyer title reports and title insurance commitments, and completed any curative work required by Buyer; (v) Seller has obtained and delivered to Buyer fully executed and enforceable agreements securing (A) the engineering, procurement and construction of the Project, including wind turbine generators (“WTGs”) and other equipment necessary for the Project to generate electricity and to transmit such electricity upon command, (B) O&M services (if applicable), (C) letters of credit and guarantees, (D) all third-party reports and studies (including without limitation those relating to wildlife, environmental, tribal resource, cultural and historic preservation, geotechnical, archaeological, noise impact, wind energy resources, engineering and cost segregation) and related reliance letters, and (E) all required third-party estoppels (including with respect to each lease and other land contracts), required subordination, non-disturbance and attornment agreements and third-party consents; (vi) the design documents have been finalized; (vii) Buyer has received a bring down of the Signing Opinion (defined below) confirming the Signing Opinion as of the Firm Date and otherwise in form and substance acceptable to Buyer; and (viii) Seller has secured interconnection rights for the Project and obtained an effective interconnection agreement for the Project acceptable to Buyer. Seller will provide Buyer with evidence that the Firm Date CPs have been satisfied in accordance with the terms of the Agreement, and Buyer will have a stated period to object to whether the Firm Date CPs have in fact been so satisfied. The “Outside Firm Date” will be [date TBD].

Seller’s Work and Other Responsibilities

Seller will be responsible, at its sole cost and expense, under the Agreement for all work required to achieve Project final completion, including with respect to the Project substation, O&M building, and all other integrated and operational infrastructure facilities, all radial transmission lines and other interconnection facilities required to deliver power from the electric grid to the Project and from the Project to [insert] substation/point of interconnection, and including without limitation the fully assembled, installed, tested and commercially operational WTGs, all in accordance with the turbine supply agreement, the turbine warranty and O&M agreement (if applicable), Seller’s EPC subcontract, the interconnection agreement and the Agreement. All work shall be performed in accordance with prudent utility practices, prudent engineering practices, applicable law, applicable permits, an agreed site plan, Seller’s quality management plan, manufacturers’ specifications and recommendations, and Buyer’s Technical Specifications (to be provided by Buyer as part of the Agreement) as to standards and requirements for the design, construction, materials, equipment and supplies for certain aspects of the Project. Buyer and Buyer’s authorized representatives shall have the right to inspect the work and to maintain personnel at the Project site, including the entire Project footprint and point of interconnection, for such purpose. All such work shall be performed by Seller in consultation with and cooperation with

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Buyer and in a manner reasonably acceptable to Buyer, including that all resulting deliverables are in form and substance reasonably acceptable to Buyer (in each case, unless a higher Buyer approval standard is expressly otherwise provided for in the Agreement, in which case, such higher approval standard shall apply, or the deliverable is in substantially the form previously agreed to in writing by Buyer, including pre-agreed forms attached as exhibits to the Agreement, in which case such deliverables shall be deemed acceptable to Buyer).

Buyer may elect in its sole discretion to permit items of Seller's work required for final completion to be completed after Closing (such items, "Punch List Items"). For the avoidance of doubt, the foregoing obligations of Seller will continue after the Closing and Seller will remain responsible for all costs and expenses of completing the work, including those arising under any applicable supply and construction agreements.

Required Approvals

The transactions contemplated hereby are subject to the execution and delivery of the Agreement and any ancillary agreements by the parties thereto and the obtaining of specified approvals, authorizations, or orders, including but not limited to the following (to the extent necessary):

- Approval of the board of directors of Buyer and the board of directors (or similar governing body) of Seller shall be obtained prior to execution of the Agreement.
- Third party consents.
- Governmental and regulatory approvals or consents necessary (as determined by Buyer in its sole discretion) from any state agencies or commissions regulating utility activities, each of which approval or consent shall have been obtained by Buyer and final, written, non-appealable and in form and substance acceptable to Buyer in its sole discretion (collectively, the "State Regulatory Approvals").
- Applicable governmental and regulatory approvals, permits, licenses, etc. from any other government agencies having approval, consent or authority over Buyer or Seller or the transactions contemplated by the Agreement (e.g., the FAA, DOD, US Fish and Wildlife Service). Each of which approval or consent shall have been obtained and be final, written, non-appealable and in form and substance acceptable to Buyer in its sole discretion.

Seller's Closing Deliverables

Upon the terms and conditions to be defined within the Agreement, the obligations of Buyer to consummate the transactions contemplated are subject to the satisfaction by Seller of certain conditions as of the Closing Date, in each case in a manner reasonably acceptable to Buyer, including that all resulting deliverables are in form and substance reasonably acceptable to Buyer (unless a higher Buyer approval standard is expressly otherwise provided for in the Agreement, in which case, such higher approval standard shall apply, or the deliverable is in substantially the form previously agreed to in writing by Buyer, including pre-agreed forms attached as exhibits to the Agreement, in which case such deliverables shall be deemed acceptable to Buyer), including, but not limited to:

- Achievement of the Firm Date.
- The transfer of all the ownership interests in the assets relating to the Project, including without limitation those necessary for the commercial operation of the Project, to the Project Company.

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- Certification that the Substantial Completion CPs have been satisfied in accordance with the terms of the Agreement.
- Buyer's receipt, at Seller's sole cost, of a bring down of the Signing Opinion confirming the Signing Opinion as of the Closing Date and otherwise in form and substance acceptable to Buyer in its sole discretion.
- The delivery to Buyer of evidence that any liens on the Project Company, Interests, Project real property or any other assets or interests of the Project Company have been removed as of the Closing other than permitted liens which have been scheduled or liens which have been scheduled and bonded to Buyer's satisfaction.
- Seller has obtained all certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Seller pertaining to the Closing.
- Seller has delivered the title insurance commitment and title policy (premium to be paid by Seller on or before the Closing Date).

Buyer's Closing Deliverables

Upon the terms and conditions to be defined within the Agreement, the obligations of Seller to consummate the transactions contemplated are subject to the satisfaction by Buyer of certain conditions as of the Closing Date, in each case, to Seller's reasonable satisfaction, including:

- Delivery of the Purchase Price or any remaining portion thereof, subject to certain adjustments contemplated in the Agreement.
- Buyer has obtained all certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Buyer pertaining to the Closing.

Representations and Warranties

The transaction is subject to customary representations and warranties to be made by Buyer and Seller as of the Signing Date, the Firm Date, and the Closing Date, including, without limitation:

- Corporate existence and powers – Seller is a [corporation] validly existing and in good standing and has the power and authority to conduct its business as now conducted.
- Company existence and powers – the Project Company is a limited liability company validly existing and in good standing and has the power and authority to develop, construct, operate and own the Project and has been engaged in no other business since its formation.
- Authority (execution and delivery and performance of obligations).
- No conflicts – the transaction does not create any conflicts.
- Consents and approvals – no consent, approval or authorization is required in connection with the execution and performance of the Agreement.
- Legal proceedings of Buyer – there are no legal proceedings pending, or to Buyer's knowledge, threatened, against Buyer, that affect the consummation of the transaction contemplated by the Agreement.
- Legal proceedings of Seller and the Project Company – there are no legal proceedings pending, or to Seller's knowledge, threatened, against (i) Seller relating to the Project or affecting Seller's ability to sell the Project Company or (ii) the Project Company or the Project.

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- Compliance with Laws – Seller and the Project Company are in compliance with all laws applicable to Seller, the Project Company, the Project and the transactions contemplated by the Agreement.
- Environmental – Seller and its affiliates have no environmental liabilities relating to the Project. The Project Company has no environmental liabilities. Seller and its affiliates have been, and are in, compliance with environmental requirements relating to the Project. The Project Company has been, and is in, compliance with environmental requirements. Seller and its affiliates have not received any notice of an actual or alleged violation of environmental law relating to the Project Company or the Project from any governmental entity. There are no facts, circumstances, conditions or occurrences relating to the Project Company or the Project that could reasonably be expected to form the basis of a claim, requirement or obligation imposed by any governmental entity under any environmental law on Seller or its affiliates.
- Contracts – Schedule of contracts (i) binding on the Project Company, (ii) binding on Seller that relate to the Project, or (iii) to which the Project is subject or bound, and Seller has furnished to Buyer true, correct and complete copies of all such contracts. There is no, and has not been any, material breach or material default (including inchoate breaches and defaults) by the Seller or its affiliates or, to Seller's knowledge, by any other party to any schedule Contract.
- Real Property Agreements – The Real Property Agreements are in full force and effect, and shall, as of the Closing, comprise all of the real property interests necessary in connection with the acquisition, siting, development, construction, installation, interconnection, completion, ownership, and operation and maintenance of the Project, all in accordance with all laws, and are sufficient to enable the Project to be commercially operable as contemplated in the Agreement, including without limitation legal and physical ingress and egress rights to and from public rights-of-way. There is no, and has not been any, material breach or material default (including inchoate breaches and defaults) by the Seller or its affiliates or, to Seller's knowledge, by any other party to any Real Property Agreement.
- Permits – All permits required to develop, construct, own, and attain commercial operation of the Project are held by the Project Company, are written, final and non-appealable, are scheduled, and Seller has obtained and furnished to Buyer true, correct and complete copies of such permits. Such permits are in full force and effect and are legal, valid, binding and enforceable in accordance with their respective terms. The Seller and the Project Company are in compliance with all permits.
- Wind Data – Seller has delivered to Buyer true, correct and complete copies of all wind data, all installation, maintenance, and calibration records and installation photographs for the meteorological tower(s), and energy production estimates if any, related to the Project.
- Title – The Project Company is in possession of and has good and marketable title to the Project free and clear of all liens and encumbrances, except for permitted liens which have been scheduled or liens which have been scheduled and bonded to Buyer's satisfaction. Seller has good and marketable title to the Interests, free and clear of all liens and encumbrances. Seller and its affiliates have no legal obligation to, or non-binding agreement in principle with any other person, to sell or affect a sale of all, or any portion of, the Project or the Project Company.
- MAE – No "Material Adverse Effect" (as defined in the Agreement) has occurred.
- Financial Statements; No Undisclosed Liabilities – True and correct unaudited financial statements of the Project Company are attached to the Agreement and the same have been prepared in accordance with GAAP and present fairly the financial condition of the Project

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Company. There are no undisclosed liabilities other than those disclosed in the financial statements or included in the disclosure schedules.

- Taxes – Tax representation and warranties customary in a transaction of this nature, including without limitation relating to the federal production tax credit.
- Other representation and warranties customary in a transaction of this nature (including those pertaining to finders, intellectual property, studies and reports, bankruptcy/solvency, brokers, insurance, books and records, bank accounts, affiliate contracts, no subsidiaries, anti-corruption/OFAC and regulatory status) or that are required following Buyer's due diligence review.

Other Agreements

- Interconnection. Seller shall be responsible for complying with all costs and requirements necessary to attain the final interconnection of the Project, including, but not limited to, all costs for the construction of any gen-tie transmission line to **[insert]** substation/point of interconnection and any necessary network upgrade costs.
- Subject to limitations and conditions to be included in the Agreement, the parties will have the ability, and in certain cases the obligation, to update disclosure schedules for items arising between the Signing Date, the Firm Date, and Closing (each, an "Update").
- Technology. The major equipment components of the Project shall be manufactured by top tier manufacturers acceptable to Buyer as specified in Buyer's Technical Specifications.
- Buyer's right to inspect. Buyer and Buyer's authorized representatives shall have the right to inspect the work and to maintain personnel at the Project site for such purpose. Such inspection of any part of the work shall in no way relieve Seller of its obligations under the Agreement.
- Seller will cause the Project to satisfy (in accordance with the Internal Revenue Code and associated guidance) requirements that qualify the Project for the PTC at the full PTC rate (2.75 cents per kWh in 2023 for facilities placed in service after 2021, adjusted annually by Treasury and the IRS). Seller has qualified the Project for the PTC using the following process: **[Seller to provide detailed description of qualification method, any applicable adders, and whether and how construction began on or before January 28, 2023 or whether the prevailing wage and apprenticeship requirements are met.]**
- Build Out Restrictions. Seller agrees not to permit or construct a wind project within 5 miles of the Project.
- At Seller's cost, a legal opinion (the "Signing Opinion") from tax counsel selected by Buyer and in form and substance acceptable to Buyer shall be delivered to Buyer prior to the Signing Date, which Signing Opinion shall speak to the tax benefits associated with the transactions contemplated by the Agreement accruing to Buyer upon or after the Closing, and must include, without limitation, an opinion that, under the rules, regulations, and other laws in effect as of the date of the Signing Opinion, the Project will, based on among other things, the representations made by Seller on the date the Signing Opinion is delivered, generate a [2.75 cents per kWh] PTC (including, by qualifying for any applicable adders (such as the domestic content adder, the energy community adder, or the low-income adder) and by having begun construction, within the meaning of applicable IRS guidance, on or prior to January 28, 2023 or having met the applicable prevailing wage and apprenticeship requirements) and, assuming the Closing occurs, that Buyer will be able to claim such PTC upon the placed in service date of the Project in accordance with applicable law and tax rules.
- In addition, and independent of any pass-through warranties from the equipment manufacturers,

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balance of plant contractor and other suppliers and subcontractors, Seller shall provide a full wrap project warranty of no less than two years in duration as to defects in materials, workmanship and title, quality of work and performance as intended as a wind energy generation system.

- Seller shall assume all risks arising from any change in its commodity prices and all changes associated with any change in law affecting Seller's Project costs including, but not limited to, changes in tariff rates.
- Seller shall be responsible for all taxes relating to the pre-Closing period and all transfer taxes and any sales, use or other taxes related to the purchase and sale of the Interests and any purchase or conveyance of real or personal property to the Project Company to be used in the Project.
- Buyer will not be required to close if the aggregate nameplate capacity of the Project is less than 95% of the Expected Nameplate Capacity (the "Minimum Capacity").
- Liquidated Damages:
 - Delay Damages: Seller shall make a per diem liquidated damages payment, in an amount of \$400/MW, for each day after a guaranteed substantial completion date that the Project has not achieved substantial completion, such delay damages ("Delay LDs") not to exceed an agreed percentage of the Purchase Price in the aggregate.
 - SCADA Infrastructure Delay Damages: Seller agrees that if SCADA Infrastructure Completion (definition to be agreed in the Agreement) is not achieved by [date TBD] ("Guaranteed SCADA Infrastructure Completion Date"), then Seller shall pay as liquidated damages to Buyer an amount equal to \$5,000.00 per day for each day after the Guaranteed SCADA Infrastructure Completion Date but prior to the date on which SCADA Infrastructure Completion is achieved ("SCADA Infrastructure Delay LDs").
 - Buy-Down Damages: If the Closing occurs and the aggregate nameplate capacity of the Project as of the Closing Date is equal to or greater than the Minimum Capacity but less than the Expected Nameplate Capacity, Seller will be required to pay liquidated damages ("Buy-Down LDs") and together with the Delay LDs and the SCADA Infrastructure Delay LDs, the "Liquidated Damages") in an amount per lost kW to be agreed in the Agreement.
 - Lost or Delayed PTC Damages: If the Closing occurs and the Project fails to achieve substantial completion on or before [date TBD], Seller shall pay Buyer an amount equal to the net present value (using a discount rate corresponding to Buyer's then-current average weighted cost of capital) of the grossed-up pre-tax value of any resulting lost or delayed PTCs.
- NERC Matters: Seller shall comply with the NERC Reliability Requirements applicable to generating projects during commissioning and up until the Closing Date and shall ensure the Project meets all NERC Reliability Requirements under the interconnection agreement. Seller shall maintain records required by NERC of such compliance actions and shall perform such other tasks and responsibilities as are set forth in Buyer's Technical Specifications. No later than fifteen (15) business days before Closing, Seller will provide Buyer current applicable compliance records related to the Project developed during commissioning or prior to Closing (such as commissioning test records, relay settings, energization and synchronization reporting activities, and voltage schedule). Seller will provide Buyer design documents required by NERC (such as the Reactive Power Report, Reactive Power Control design (for VAR-002 and to meet

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the Voltage Schedule), Facility Ratings, Coordination Studies, etc.) no later than 30 days before Closing.

- In the event of a dispute between the parties, the parties shall waive their right to a jury trial, with the losing party responsible for all legal fees associated with any claim. No other remediation, arbitration or resolution shall be provided for in the event of a dispute between Buyer and Seller.
- Governing law and venue shall be in accordance with the laws of the state of Minnesota, with any action arising out of or related to the transaction to be brought in a court located in Minneapolis, Minnesota.
- From and after the signing of the Agreement, Seller will not, and will cause its representatives and affiliates not to, initiate, solicit or respond to the submission of, or enter into any negotiations in respect of, any indication of interest, proposal or offer from any person or entity relating to any sale or other transfer of any material asset of, or any equity or debt interest in, the Project Company, including any response to a request for proposal, bid or similar request from any person or entity (including Buyer and its affiliates but excluding the transaction contemplated by the Agreement).

Termination Provisions; Termination Payment

The Agreement may be terminated upon written notice by the terminating party (as described below) in the event of certain occurrences, including without limitation:

- By Buyer if the Firm Date has not occurred by the Outside Firm Date, regardless of the reason for such failure, provided that Buyer is not in breach of the Agreement.
- By either party if the Closing has not occurred by the Outside Closing Date [date TBD], regardless of the reason for such termination, provided that the terminating party is not in breach of the Agreement.
- By either party if State Regulatory Approvals for the transaction are not obtained by the Outside Firm Date.
- By either party if applicable law or any order issued by, or any other action taken by, an authority restrains, enjoins, or otherwise prohibits the consummation of the transactions contemplated by the Agreement.
- By either party in the event of a material uncured breach or repudiation of the Agreement by the other party or, in the case of Seller, a material uncured breach or repudiation of the relevant guaranty or letter of credit by the provider of the Seller Credit Support.
- By Buyer in the event of abandonment of the Project by Seller or the Project Company.
- By either party if the other party or, in the case of Seller, the provider of the Seller Credit Support, suffers insolvency or bankruptcy.
- By Buyer if there is a change of control of Seller.
- By Buyer if an Update from Seller has had or would reasonably be expected to have a Material Adverse Effect.

Termination Payment. Without limiting any other legal or contractual right or remedy available to Buyer (including Buyer's rights to Liquidated Damages under the Agreement that accrued prior to such termination), if the Agreement is terminated for any reason, Seller will pay to Buyer a termination payment (the "Termination Payment") in the indicated amount:

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- if the Firm Date has not occurred and the termination occurs on or prior to the Outside Firm Date, an amount equal to \$75.00 multiplied by the number of kW in the Expected Nameplate Capacity;
 - if the Closing has not occurred by the Outside Closing Date, an amount equal to \$125.00 multiplied by the number of kW in the Expected Nameplate Capacity;
- provided*, that Seller shall have no obligation to make a Termination Payment if the termination is a result of (i) a material uncured breach or repudiation by Buyer; (ii) Buyer's failure to obtain State Regulatory Approvals by [date TBD], or (iii) Buyer's insolvency or bankruptcy.

Return of Progress Payments. In addition to any Termination Payment owing by Seller to Buyer, if the Agreement is terminated prior to Closing, Seller will repay to Buyer the aggregate amount of any Progress Payments paid by Buyer as of such date.

Indemnification

From and after the Closing, each party shall indemnify and hold harmless the other party and its respective employees, representatives, officers, directors and agents from and against any and all damages arising out of any breach or violation of any representation, warranty or covenant in the Agreement, or any liability not assumed as part of the Agreement. No claim for indemnification shall be brought against the indemnifying party until the total damages for which such party is liable exceeds in the aggregate a threshold amount of \$100,000, at which point indemnification may be sought for the full aggregate amount of damages, including those amounts that do not exceed the threshold. The aggregate damages to which the indemnified parties are entitled in respect of breaches of representations and warranties shall not exceed an amount equal to 30% of the Purchase Price (the "Indemnity Cap"). Such threshold and Indemnity Cap shall not apply to damages to the extent they arise from a party's fraud, willful misconduct or gross negligence or a breach of certain "fundamental" representations (as applicable to each party) such as corporate existence, power, authority, conflicts, title, land contracts, real property, environmental, intellectual property, brokers, subsidiaries, employee benefits, tax matters, or any liability not assumed as part of the Agreement. The aggregate damages to which the indemnified parties are entitled shall not exceed the Purchase Price. Such aggregate damages cap shall not apply to damages to the extent they arise from a party's fraud, willful misconduct or gross negligence or any liability not assumed as part of the Agreement.

Changes to Transaction Structure

The parties recognize that changes to the PTC or associated guidance may be made, or other incentives for wind energy generation may become available for U.S. federal income tax purposes, and that the parties may need to restructure the transaction in order for Buyer to be able to utilize and maximize such revised PTC or other incentives. The parties agree that they will negotiate in good faith to restructure the transaction in a manner that will allow the parties to utilize and maximize any such revised PTC or other incentives.

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TERM SHEET for the Purchase and Sale of a
Wind Electric Generation Project and Battery Energy Storage System

*1al CSeller to provide the information
Highlighted in yellow.*

Buyer

Northern States Power Company, a [Minnesota / Wisconsin] corporation (“Buyer”).

Seller

[Developer/Seller Name], a [Seller entity type and state of formation], acting on its own behalf and on behalf of [Project Company Name], a [Project Company entity type and state of formation] (the “Project Company”), its wholly owned subsidiary (“Seller”). Buyer will also require Seller Credit Support (as defined below).

Project and Project Site

The Company is developing the [Project Name] energy project (the “Project”) located in [County Name] County, [State], consisting of (i) an approximately [XX] MW nameplate capacity (the “Expected Wind Nameplate Capacity”), integrated wind-powered electric generating plant (the “Wind Facility”), (ii) a battery energy storage system (the “Storage Facility”) with a nameplate capacity of [XX] MW_{AC} and [XX] MWh (the “Expected Storage Nameplate Capacity”), (iii) the gen-tie transmission line (the “T-Line”) that will connect the Wind Facility and Storage Facility to the [relevant point of interconnection], and (iv) all facilities and other real property (including fee simple interests, easements, rights-of-way and other real property interests), personal property (including tangible and intangible) and other assets and rights in each case relating to the Wind Facility, the Storage Facility or the T-Line. The Project will be located at [describe site] (the “Project Site”).

Type of Transaction

The transaction will be structured as an entity acquisition. Subject to the other terms and conditions contained in a definitive purchase and sale agreement pertaining to the transaction (the “Agreement”), including that, the Wind Facility is Investment Tax Credit (“ITC”) qualified and Production Tax Credit (“PTC”) qualified, and the Storage Facility is ITC qualified, and the Project is mechanically complete, ready to be tested and placed in service (but has not yet been placed in service for U.S. federal income tax purposes) and free and clear of all encumbrances and liabilities, except for permitted encumbrances and specific assumed liabilities as defined in the Agreement (the consummation of such purchase and sale transaction, the “Closing”), on the transaction closing date (the “Closing Date”), Buyer shall purchase and Seller shall sell 100% of the ownership interests of the Project Company (the “Interests”). Notwithstanding the Closing, Seller would remain obligated after the Closing to perform the *Seller’s Work and Other Responsibilities* (described below) and all of its other obligations described in the Agreement.

Purchase Price and Payment Terms

The “Purchase Price,” which is not to exceed the sum of (x) [] per MW of the nameplate capacity of the Wind Facility plus (y) [] per MW_{AC} of the nameplate capacity of the Storage Facility, will be paid by Buyer in two installments, one installment at Closing and one installment on the date (the “Substantial Completion Date”) upon which Seller has achieved an agreed set of “Substantial Completion CPs” (which Substantial Completion CPs shall include without limitation that the Project has been placed in service for U.S. federal income tax purposes in order to qualify for the ITCs and PTCs); provided, that

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Buyer will consider making Purchase Price installment payments (“Progress Payments”)¹ to Seller from and after the Firm Date (defined below) and prior to Closing upon Seller’s achievement (to Buyer’s satisfaction) of certain milestones specified in the Agreement (or, if later, a “payment not earlier than” date to be specified for each milestone). In no case would a Progress Payment be made if (a) Seller is in breach or default of its obligations under the Agreement, (b) the provider of the Seller Credit Support (as defined below) is in breach or default of its obligations under the relevant guaranty or letter of credit or (c) either Seller or the provider of the Seller Credit Support is suffering an insolvency or bankruptcy event. In no case will the amount of the Progress Payments made prior to the Substantial Completion Date exceed 80% of the total Purchase Price.

Buyer will be entitled to set off against a Purchase Price payment (including a Progress Payment) any amount then owed by Seller to Buyer under the Agreement, including, without limitation, any accrued and unpaid Liquidated Damages (as defined below).

Buyer will be entitled to withhold from the Purchase Price payment made on the Closing Date an amount equal to 150% of the amount sufficient to complete any Punch List Items (defined below) (collectively, the “Punch List Holdback Amount”). If Seller has not completed all Punch List Items within the period of time agreed to by the parties, Buyer will be entitled to permanently retain a portion of the Punch List Holdback Amount equal to the greater of (i) the portion of the Punch List Holdback Amount attributable to the uncompleted Punch List Items and (ii) fifty percent (50%) of the Punch List Holdback Amount.

Credit Support

On the date the Agreement is signed (“Signing Date”), Seller will be required to deliver to Buyer “Seller Credit Support” in the form of either (i) cash held by Buyer for Seller’s account (or pursuant to a third-party escrow arrangement acceptable to Buyer in its sole discretion and at Seller’s sole expense), (ii) a guaranty from a guarantor acceptable to Buyer in its sole discretion and in a pre-agreed form or a form otherwise acceptable to Buyer in its sole discretion, or (iii) a letter of credit from an issuer acceptable to Buyer in its sole discretion and in a pre-agreed form or a form otherwise acceptable to Buyer in its sole discretion. Seller will be required to maintain Seller Credit Support in the Seller Credit Support Amount from the Signing Date until the first to occur of (a) the pre-Closing termination of the Agreement (including the period following such termination until all resulting claims are satisfied in full) and (b) the date that is twenty-four (24) months after the Closing Date (plus an additional period of time until all remaining indemnity claims are satisfied in full).

At any point in time prior to the Closing Date, the “Seller Credit Support Amount” shall be equal to the aggregate Seller payment obligations Seller could have if the Agreement is terminated at that point in time, including without limitation the Termination Payment (as defined below), accrued and unpaid Liquidated Damages and the aggregate Progress Payments, if any, then paid by Buyer. For twenty-four (24) months from and after the Closing Date (plus an additional period of time until all remaining indemnity claims are satisfied in full), the Seller Credit Support Amount shall be equal to the Indemnity

¹ If Seller is interested in receiving Progress Payments, Seller’s bid forms must include a proposed schedule of Progress Payments for Buyer to consider.

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Cap (as defined below).

Conditions Precedent to the Firm Date

The Agreement shall provide for the satisfaction, on or prior to the Outside Firm Date (defined below) and in each case in form and substance acceptable to Buyer and at Seller's sole cost (except for costs of obtaining the State Regulatory Approvals, which shall be at Buyer's sole cost) certain conditions precedent ("Firm Date CPs," and the date all such Firm Date CPs have been satisfied or waived in writing by Buyer, the "Firm Date"). The Firm Date CPs will include, without limitation, that: (i) the State Regulatory Approvals have been obtained and are final, written, and non-appealable and in form and substance acceptable to Buyer in its sole discretion; (ii) all other required governmental approvals and permits (including without limitation the siting permit, environmental permits, and, if applicable, FERC approvals, approvals under the Hart-Scott-Rodino Antitrust Improvements Act of 1976, and any other permits necessary for the parties to consummate the transaction or for the Project Company to own, operate and maintain the Project) have been obtained and are final, written, non-appealable and in form and substance acceptable to Buyer in its sole discretion; (iii) Seller has obtained all land contracts (including that Seller shall obtain (x) amendments to the existing leases as needed to ensure that the lease payment provisions and other applicable terms provide for utility ownership, that the term of the leases is no shorter than the 35 years following construction of the Project and/or to address other matters reasonably required by Buyer, and (y) new lease agreements required for site setbacks or other requirements or otherwise reasonably required by Buyer) and otherwise secured full site control, including real estate rights required to interconnect the Project; (iv) Seller has obtained and delivered to Buyer title reports and title insurance commitments, and completed any curative work required by Buyer; (v) Seller has obtained and delivered to Buyer fully executed and enforceable agreements securing (A) the engineering, procurement and construction of the Project, including wind turbine generators ("WTGs") and other equipment necessary for the Project to generate and store electricity, and transmit such electricity upon command, (B) O&M services (if applicable), (C) letters of credit and guarantees, (D) all third-party reports and studies (including without limitation those relating to wildlife, environmental, tribal resource, cultural and historic preservation, geotechnical, archaeological, noise impact, wind energy resources, engineering and cost segregation) and related reliance letters, and (E) all required third-party estoppels (including with respect to each lease and other land contracts), required subordination, non-disturbance and attornment agreements and third-party consents; (vi) the design documents have been finalized; (vii) Seller has developed and delivered to Buyer the Decommissioning Plan (as defined below) in form and substance acceptable to Buyer; (viii) Buyer has received a bring down of the Signing Opinion (defined below) confirming the Signing Opinion as of the Firm Date and otherwise in form and substance acceptable to Buyer; and (ix) Seller has secured interconnection rights for the Project and obtained an effective interconnection agreement for the Project acceptable to Buyer. Seller will provide Buyer with evidence that the Firm Date CPs have been satisfied in accordance with the terms of the Agreement, and Buyer will have a stated period to object to whether the Firm Date CPs have in fact been so satisfied. The "Outside Firm Date" will be [date TBD].

Seller's Work and Other Responsibilities

Seller will be responsible, at its sole cost and expense, under the Agreement for all work required to achieve Project final completion, including with respect to the Project substation, O&M building, and all other integrated and operational infrastructure facilities, all radial transmission lines and other

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interconnection facilities required to deliver power from the electric grid to the Project and from the Project to **[insert]** substation/point of interconnection, and including without limitation the fully assembled, installed, tested and commercially operational WTGs, battery storage system, and related equipment, all in accordance with the applicable supply agreements, all manufacturer's warranties and the O&M agreement (if applicable), the applicable construction agreements, the Long-Term Services Agreement (if applicable), the interconnection agreement and the Agreement. All work shall be performed in accordance with prudent utility practices, prudent engineering practices, applicable law, applicable safety requirements, applicable permits, an agreed site plan, Seller's quality management plan, all manufacturer's warranties, specifications and recommendations, Buyer's policies and procedures governing electronic and physical access controls required by the North American Electric Reliability Corporation ("NERC") Critical Infrastructure Protection ("CIP") standards (if applicable), Buyer's Technical Specifications (to be provided by Buyer as part of the Agreement) that specify Buyer's standards and requirements for the design, construction, materials, equipment and supplies for certain aspects of the Project, and Seller's operating procedures for the operation of the Project (to be agreed upon by Buyer and Seller as part of the Agreement) (as defined below, the "Operating Guidelines"). Buyer and Buyer's authorized representatives shall have the right to inspect the work and to maintain personnel at the Project Site, including the entire Project footprint and point of interconnection, for such purpose. Seller will be responsible, at its sole cost and expense, under the Agreement for all work required to procure and deliver to Buyer the Decommissioning Contracts (as defined below). All such work shall be performed by Seller in consultation with and cooperation with Buyer and in a manner reasonably acceptable to Buyer, including that all resulting deliverables are in form and substance reasonably acceptable to Buyer (in each case, unless a higher Buyer approval standard is expressly otherwise provided for in the Agreement, in which case, such higher approval standard shall apply, or the deliverable is in substantially the form previously agreed to in writing by Buyer, including pre-agreed forms attached as exhibits to the Agreement, in which case such deliverables shall be deemed acceptable to Buyer).

Buyer may elect in its sole discretion to permit items of Seller's work required for final completion to be completed after Closing (such items, "Punch List Items"). For the avoidance of doubt, the foregoing obligations of Seller will continue after the Closing and Seller will remain responsible for all costs and expenses of completing the work, including those arising under any applicable supply and construction agreements.

Closing Conditions Precedent

The Agreement shall provide for the satisfaction, on or prior to the Closing, and in each case in form and substance acceptable to Buyer and at Seller's sole cost (except for costs of obtaining Buyer's regulatory approvals, which shall be at Buyer's sole cost) of certain conditions precedent ("Closing CPs"). The Closing CPs will include, without limitation, that: the Project has achieved mechanical completion; the Firm Date has been achieved; any applicable third-party and governmental approvals have been obtained as set forth below under *Required Approvals*; Seller has delivered to Buyer all final as-built drawings and related documentation, including all manufacturers' recommended operating and maintenance procedures required for maintenance of manufacturers' warranties; Seller has delivered to Buyer evidence that it has obtained and assigned to Buyer all manufacturers' warranties; Seller has delivered new or updated environmental reports, and no such reports identified any issues that are material and adverse to Buyer that were not identified in prior environmental reports delivered to Buyer; Seller has delivered to Buyer a

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complete and accurate list of all equipment, plant, machinery, installations, special tools, spare parts, supplies and other personal property owned by Seller included in the Project, excluding only those items which are immaterial and can be replaced in the ordinary course of business, and such list shall specifically indicate any such item of the Project which is not located on or at the Project Site and identify the location thereof; Seller has delivered to Buyer the Decommissioning Contracts in compliance with the Decommissioning Plan; all representations and warranties of Seller shall be true and correct in all respects; at the election of the Buyer, the Company and the LTSA Provider (as defined below) have entered into a Long-Term Services Agreement (as defined below); no event has occurred that has had or could reasonably be expected to have a material adverse effect, including any suit, action, dispute or other similar proceeding filed by any contractor, subcontractor, or other person against Seller, enjoining or limiting the transaction contemplated by the Agreement or the use or operation of the Project, or seeking to obtain damages or other relief in connection with the Agreement or any contracts to be transferred to Buyer under the Agreement; Seller has delivered to Buyer a claims statement identifying every dispute, suit, action or other proceeding that is pending, or threatened in writing, between Seller and any contractor or subcontractor connected with, or arising out of, the development and/or construction of the Project; and, if applicable, Seller or its operating personnel have completed all training requirements pertaining to the start-up, shut-down and operation of, and safety, general process understanding and emergency procedures for, the Project and all of its sub-systems, in accordance with the requirements of a training program to be prepared by Seller and approved by Buyer.

Required Approvals

The transactions contemplated hereby are subject to the execution and delivery of the Agreement and any ancillary agreements by the parties thereto and the obtaining of specified approvals, authorizations, or orders, including but not limited to the following (to the extent necessary):

- Approval of the board of directors of Buyer and the board of directors (or similar governing body) of Seller shall be obtained prior to execution of the Agreement.
- Third party consents.
- Governmental and regulatory approvals or consents necessary (as determined by Buyer in its sole discretion) from any state agencies or commissions regulating utility activities, each of which approval or consent shall have been obtained by Buyer and final, written, non-appealable and in form and substance acceptable to Buyer in its sole discretion (collectively, the “State Regulatory Approvals”).
- Applicable governmental and regulatory approvals, permits, licenses, etc. from any other government agencies having approval, consent or authority over Buyer or Seller or the transactions contemplated by the Agreement (e.g., the FAA, DOD, US Fish and Wildlife Service). Each of which approval or consent shall have been obtained and be final, written, non-appealable and in form and substance acceptable to Buyer in its sole discretion.

Seller’s Closing Deliverables

Upon the terms and conditions to be defined within the Agreement, the obligations of Buyer to consummate the transactions contemplated are subject to the satisfaction by Seller of certain conditions as of the Closing Date, in each case in a manner reasonably acceptable to Buyer, including that all resulting deliverables are in form and substance reasonably acceptable to Buyer (unless a higher Buyer approval

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standard is expressly otherwise provided for in the Agreement, in which case, such higher approval standard shall apply, or the deliverable is in substantially the form previously agreed to in writing by Buyer, including pre-agreed forms attached as exhibits to the Agreement, in which case such deliverables shall be deemed acceptable to Buyer), including, but not limited to:

- Achievement of the Firm Date.
- The transfer of all of the ownership interests in the assets relating to the Project, including without limitation those necessary for the commercial operation of the Project, to the Project Company.
- Certification that the Project has achieved project mechanical completion in accordance with the terms of the Agreement.
- Buyer's receipt, at Seller's sole cost, of a bring down of the Signing Opinion confirming the Signing Opinion as of the Closing Date and otherwise in form and substance acceptable to Buyer in its sole discretion.
- The delivery to Buyer of evidence that any liens on the Project Company, Interests, Project real property or any other assets or interests of the Project Company have been removed as of the Closing other than permitted liens which have been scheduled or liens which have been scheduled and bonded to Buyer's satisfaction.
- Seller has obtained all certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Seller pertaining to the Closing.
- Seller has delivered the title insurance commitment and title policy (premium to be paid by Seller on or before the Closing Date).

Buyer's Closing Deliverables

Upon the terms and conditions to be defined within the Agreement, the obligations of Seller to consummate the transactions contemplated are subject to the satisfaction by Buyer of certain conditions as of the Closing Date, in each case, to Seller's reasonable satisfaction, including:

- Delivery of the Purchase Price or any remaining portion thereof, subject to certain adjustments contemplated in the Agreement.
- Buyer has obtained all certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Buyer pertaining to the Closing.

Pre-COD Test

The "Pre-COD Test" shall measure at the point of delivery, among other things, the Project's grid charging capability, maximum charging rates, maximum discharging rates, minimum charging time, minimum discharging time, storage capacity, round-trip efficiency, ability to communicate with Buyer using Buyer's Supervisory Control and Data Acquisition ("SCADA") System, and other testing to be agreed by the Parties (including factory testing). Any failure to pass the Pre-COD Test will trigger Seller's obligation to complete the repairs needed to bring the Project into compliance with the pre-determined performance levels required to pass such test. Prior to performing any repair obligations, Seller may conduct a limited number of discretionary tests that Seller deems necessary for purposes of re-performing a required test.

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Long-Term Services Agreement

Buyer may elect to enter into a long-term services agreement for the Storage Facility with the supplier of the battery and battery enclosures or another third party acceptable to Buyer (which may include the Seller or an Affiliate of Seller) (the “LTSA Provider”) upon the terms set forth below (the “Long-Term Services Agreement”). If Buyer elects to enter into a Long-Term Services Agreement, the LTSA Provider shall provide the applicable operations and maintenance services (the “Services”) for an initial term of up to [] ten (10) years following the Closing. Thereafter, the Long-Term Services Agreement shall automatically renew in increments of five (5) years at the election of Buyer, up to three (3) times after the expiration of the initial term. The LTSA Provider shall provide the Services based upon (i) a fixed fee for certain work to be defined as in-scope; (ii) pre-agreed pricing for certain additional work that is outside of the scope but which Buyer may elect to purchase in its sole and absolute discretion; and (iii) cost-plus pricing for work not included in the preceding clauses (i) and (ii), which shall be subject to a mark-up of no more than 10% exclusive of equipment costs and focused on labor to cover, among other things, general and administrative and other overhead costs.

The Long-Term Services Agreement will (i) contain performance guarantees for the Project, as described further below, (ii) identify any Operating Limitations, as defined below, and (iii) address compliance with the NERC CIP standards (if applicable). The Long-Term Services Agreement will also contain terms and conditions related to the Services provided thereunder that are customary for the operation and maintenance of a wind generating plus battery energy storage system, subject to any necessary conforming changes to adjust for the applicable technology, the size, or the scope of the Project. The form of the Long-Term Services Agreement would be attached as an exhibit to the Agreement.

Performance Guaranties

The Long-Term Services Agreement shall specify the terms under which the parties will measure the performance of the Storage Facility’s battery energy storage system over the duration of the Agreement, which shall be dependent in part on the maturity of the battery storage technology used for the Storage Facility. Satisfactory performance will require the battery energy storage system to meet certain guaranteed performance criteria (the “Guaranteed Performance Levels”), which measurements shall be obtained through periodic testing, on an annual basis, or more frequently if requested by Buyer, of the following:

- Guaranteed Round Trip Efficiency;
- Guaranteed Storage Capacity;
- Self-Discharge Rate;
- Guaranteed Minimum Charging Time;
- Guaranteed Maximum Charging Rate;
- Guaranteed Minimum Discharging Time;
- Guaranteed Maximum Discharging Rate;
- Maximum Ramp Rate;
- Guaranteed Response Time; and
- [Others TBD].

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The LTSA Provider shall agree to maintain the Storage Facility such that it is capable of maintaining a base level of storage capacity of no less than [] MWh during the term of the Long-Term Services Agreement, [and to augment the battery energy storage system prior to the time the level of storage capacity falls below [] MWh].

The parties to the Long-Term Services Agreement will agree that the Performance Guaranties will be contingent upon the Project being operated, scheduled, and dispatched in accordance with the “Operating Limitations,” which shall specify the Project’s operating requirements and limitations.

The Operating Limitations shall, at a minimum, address the following regarding the operation of the Storage Facility: [maximum annual state of charge (averaged);] maximum number of annual equivalent cycles, which shall not be below [] equivalent cycles per year; [others TBD]; and the potential cost impact if Buyer were to exceed any of these limitations.

With respect to the Storage Facility’s maximum number of annual equivalent cycles, the Operating Limitations shall allow Buyer the flexibility to defer or extend a portion of the cycles allocated to a given operating year, such that (i) if Buyer does not use all of its cycles at the end of an operating year, Buyer may transfer up to [] cycles to the subsequent operating year, or (ii) if Buyer uses all of its cycles prior to the end of an operating year, Buyer may add up to [] cycles that are allocated to the subsequent operating year.

In addition, by no later than 90 days prior to the Closing Date, the parties shall develop “Operating Guidelines” to specify the parameters for the operation of the Project, such as operation modes for specific functionality (e.g., frequency response); set-points and limitations for each operating mode; scheduling parameters; the parties’ communication protocols; and the data points to be transmitted to Buyer’s SCADA. The parties agree that the Operating Guidelines can be reviewed annually to optimize operations for Buyer.

Wind, Battery, and Related Equipment Warranties

Seller shall not purchase or otherwise acquire any of the major equipment components or related materials or services from an entity that is not approved by Buyer as specified in the Buyer’s Technical Specifications without Buyer’s prior written consent (not to be unreasonably withheld or delayed).

Seller shall provide to Buyer a description of the terms and conditions of the equipment warranties that Seller shall obtain from the wind equipment, battery, power conversion system, thermal management system, enclosure and monitoring equipment manufacturers, balance of plant contractor and other suppliers, contractors, and subcontractors, which shall include (i) a serial defect warranty with respect to the wind equipment, batteries, battery enclosures, power conversion system, thermal management system, fire suppression and safety systems, and switchgear, medium voltage generator step-up transformers, and protection devices, and (ii) a lifetime warranty with respect to the Project control system. In addition, Seller shall provide a full wrap project warranty of no less than two (2) years in duration as to defects in materials, workmanship and title, quality of work and performance as intended as a wind generating plus battery energy storage system.

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If Buyer elects in its sole discretion not to enter into a Long-Term Services Agreement, Seller agrees to specify the base level of storage capacity the Storage Facility's battery energy storage system will sustain over its useful life.

To the extent a change in applicable law prohibits Seller's acquisition, importation, or installation of major equipment or associated software, firmware, and digital components that control the operation of such major equipment ("Prohibited Equipment"), Seller agrees to procure an equivalent or superior alternative to the Prohibited Equipment, subject to Buyer's approval.

Safety

Seller shall design and construct the Project in compliance with all applicable laws, codes, and standards that are applicable to the design of the Project and ensure that upon the Closing date the Project meets all such applicable laws, codes, and standards. Prior to the Closing date, Seller will provide Buyer with an independent registered professional engineer's certification stating that the Project has been mechanically completed in all material respects (including compliance with all applicable laws, codes, and standards). Only non-occupiable battery energy storage system enclosures shall be considered. Seller shall have the battery energy storage system enclosures certified to UL 9540. Seller shall design, construct, and install the Project under the guidance of NFPA 855 and shall comply with all applicable portions of that standard. Seller shall also complete first responder training for its and Buyer's operating personnel as well as any local first responders, which training shall be reconducted on a periodic basis.

Prior to the Closing date, Seller will also provide the following additional documents: all schematics, drawings, and other documentation needed for developing lock out-tag out procedures and performing hazard assessments of the facility, site level emergency response plans, and system operations training manual.

Representations and Warranties

The transaction is subject to customary representations and warranties to be made by Buyer and Seller as of the Signing Date, the Firm Date, and the Closing Date, including without limitation:

- Corporate existence and powers – Seller is a **[corporation]** validly existing and in good standing and has the power and authority to conduct its business as now conducted.
- Company existence and powers – the Project Company is a limited liability company validly existing and in good standing and has the power and authority to develop, construct, operate and own the Project and has been engaged in no other business since its formation.
- Authority (execution and delivery and performance of obligations).
- No conflicts - the transaction does not create any conflicts.
- Consents and approvals – no consent, approval or authorization is required in connection with the execution and performance of the Agreement.
- Legal proceedings of Buyer – there are no legal proceedings pending, or to Buyer's knowledge, threatened, against Buyer, that affect the consummation of the transaction contemplated by the Agreement.

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- Legal proceedings of Seller and the Project Company – there are no legal proceedings pending, or to Seller’s knowledge, threatened, against (i) Seller relating to the Project or affecting Seller’s ability to sell the Project Company or (ii) the Project Company or the Project.
- Compliance with Laws – Seller and the Project Company are in compliance with all laws applicable to Seller, the Project Company, the Project and the transactions contemplated by the Agreement.
- Environmental – Seller and its affiliates have no environmental liabilities relating to the Project. The Project Company has no environmental liabilities. Seller and its affiliates have been, and are in, compliance with environmental requirements relating to the Project. The Project Company has been, and is in, compliance with environmental requirements. Seller and its affiliates have not received any notice of an actual or alleged violation of environmental law relating to the Project Company or the Project from any governmental entity. There are no facts, circumstances, conditions or occurrences relating to the Project Company or the Project that could reasonably be expected to form the basis of a claim, requirement or obligation imposed by any governmental entity under any environmental law on Seller or its affiliates.
- Contracts – Schedule of contracts (i) binding on the Project Company, (ii) binding on Seller that relate to the Project, or (iii) to which the Project is subject or bound, and Seller has furnished to Buyer true, correct and complete copies of all such contracts. There is no, and has not been any, material breach or material default (including inchoate breaches and defaults) by the Seller or its affiliates, or, to Seller’s knowledge, by any other party to any schedule Contract.
- Real Property Agreements – The Real Property Agreements are in full force and effect, and shall, as of the Closing, comprise all of the real property interests necessary in connection with the acquisition, siting, development, construction, installation, interconnection, completion, ownership and operation of the Project, all in accordance with all laws, and are sufficient to enable the Project to be commercially operable as contemplated in the Agreement, including without limitation legal and physical ingress and egress rights to and from public rights-of-way. There is no, and has not been any, material breach or material default (including inchoate breaches and defaults) by the Seller or its affiliates, or, to Seller’s knowledge, by any other party to any Real Property Agreement.
- Permits - All permits required to develop, construct, own, and attain commercial operation of the Project are held by the Project Company, are written, final and non-appealable, are scheduled, and Seller has obtained and furnished to Buyer true, correct and complete copies of such permits. Such permits are in full force and effect and are legal, valid, binding and enforceable in accordance with their respective terms. The Seller and the Project Company are in compliance with all permits.
- Wind Data – Seller has delivered to Buyer true, correct and complete copies of all wind data, all installation, maintenance, and calibration records and installation photographs for the meteorological tower(s), and energy production estimates if any, related to the Project.
- Title – The Project Company is in possession of and has good and marketable title to the Project free and clear of all liens and encumbrances, except for permitted liens which have been scheduled or liens which have been scheduled and bonded to Buyer’s satisfaction. Seller has good and marketable title to the Interests, free and clear of all liens and encumbrances. Seller

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and its affiliates have no legal obligation to, or non-binding agreement in principle with any other person, to sell or affect a sale of all, or any portion of, the Project or the Project Company.

- MAE – No “Material Adverse Effect” (as defined in the Agreement) has occurred.
- Financial Statements; No Undisclosed Liabilities – True and correct unaudited financial statements of the Project Company are attached to the Agreement and the same have been prepared in accordance with GAAP and present fairly the financial condition of the Project Company. There are no undisclosed liabilities other than those disclosed in the financial statements or included in the disclosure schedules.
- Taxes – Tax representation and warranties customary in a transaction of this nature, including without limitation relating to the federal investment tax credit and the federal production tax credit.
- Other representation and warranties customary in a transaction of this nature (including those pertaining to finders, intellectual property, studies and reports, bankruptcy/solvency, brokers, insurance, books and records, bank accounts, affiliate contracts, no subsidiaries, anti-corruption/OFAC and regulatory status) or that are required following Buyer’s due diligence review.

Other Agreements

- Interconnection. Seller shall be responsible for complying with all costs and requirements necessary to attain the final interconnection of the Project, including, but not limited to, all costs for the construction of any radial transmission line to insert substation/point of interconnection and any necessary network upgrade costs.
- Subject to limitations and conditions to be included in the Agreement, the parties will have the ability, and in certain cases the obligation, to update disclosure schedules for items arising between the Signing Date, the Firm Date, and Closing (each, an “Update”).
- Technology. The major equipment components of the Project shall be manufactured by top tier manufacturers acceptable to Buyer or specified in the Buyer’s Technical Specifications.
- Buyer’s right to inspect. Buyer and Buyer’s authorized representatives shall have the right to inspect the work and to maintain personnel at the Project Site for such purpose. Such inspection of any part of the work shall in no way relieve Seller of its obligations under the Agreement.
- Seller will cause the Project to satisfy (in accordance with the Internal Revenue Code and associated guidance) requirements that qualify the Project for the ITC or PTC at the at the full ITC level (30% in 2023 for facilities placed in service after 2021) or the full PTC rate (2.75 cents per kWh in 2023 for facilities placed in service after 2021). Seller has qualified the project for the ITC or PTC using the following process: [Seller to provide detailed description of qualification method, any applicable adders, and whether and how construction began on or before January 28, 2023 or whether the prevailing wage and apprenticeship requirements are met.]
- Build Out Restrictions. Seller agrees not to permit or construct a wind project within 5 miles of the Project.
- At Seller’s cost, a legal opinion (the “Signing Opinion”) from tax counsel selected by Buyer and in form and substance acceptable to Buyer shall be delivered to Buyer prior to the Signing Date,

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which Signing Opinion shall speak to the tax benefits associated with the transactions contemplated by the Agreement accruing to Buyer upon or after the Closing, and must include, without limitation, an opinion that, under the rules, regulations, and other laws in effect as of the date of the Signing Opinion, the Project will, based on among other things, the representations made by Seller on the date the Signing Opinion is delivered, generate a [30%] ITC or [2.75 cents per kWh] PTC (including by qualifying for any applicable adders (such as the domestic content adder, the energy community adder, or the low-income adder) and by having begun construction, within the meaning of applicable IRS guidance, on or prior to January 28, 2023 or having met the applicable prevailing wage and apprenticeship requirements) and, assuming the Closing occurs, that Buyer will be able to claim such ITC or PTC upon the placed in service date of the Project in accordance with applicable law and tax rules.

- In addition to, and independent of any pass-through warranties from the WTG and monitoring equipment manufacturers, balance of plant contractor and other suppliers and subcontractors, Seller shall provide a full wrap project warranty of no less than two years in duration as to defects in materials, workmanship and title, quality of work and performance as intended as a wind energy generation system and battery energy storage system.
- Decommissioning. Seller shall be responsible for developing and implementing a plan for the decommissioning of the battery energy storage system and any related balance of plant (e.g., battery enclosures, power conversion system) in accordance with applicable law and the relevant permits and contracts (including relevant land contracts and equipment supply contracts (the “Decommissioning Plan”). The Decommissioning Plan will (x) address the end-of-life management of the battery energy storage system, including the dismantling, removal, transportation, and disposal of the batteries and any associated solid and hazardous waste and, if required, restoration of the Project Site (collectively, the “Decommissioning Requirements”), (y) specify the contract(s) (the “Decommissioning Contracts”) with the battery manufacturer, the LTSA Provider, a recycling facility, and/or other counterparties required to satisfy the Decommissioning Requirements and (z) summarize the material terms and conditions to be included in the Decommissioning Contracts.
- Seller shall assume all risks arising from any change in its commodity prices and all changes associated with any change in law affecting Seller’s Project costs including, but not limited to, changes in tariff rates.
- Seller shall be responsible for all taxes relating to the pre-Closing period and all transfer taxes and any sales, use or other taxes related to the purchase and sale of the Interests and any purchase or conveyance of real or personal property to the Project Company to be used in the Project.
- Buyer will not be required to close if (i) the nameplate capacity of the Wind Facility is less than 95% of the Expected Wind Nameplate Capacity, or (ii) the nameplate capacity of the Storage Facility is less than 100% of the Expected Storage Nameplate Capacity (the “Minimum Capacity”) or if the Storage Facility fails to pass the Pre-COD Test.
- Liquidated Damages:
 - Delay Damages: Seller shall make a per diem liquidated damages payment, in an amount of \$400/MW, for each day after the guaranteed substantial completion date that the Project has not achieved the Substantial Completion Date, such delay damages (“Delay LDs”) not to exceed an agreed percentage of the Purchase Price in the aggregate.

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o SCADA Infrastructure Delay Damages: Seller agrees that if SCADA Infrastructure Completion (definition to be agreed in the Agreement) is not achieved by [date TBD] (“Guaranteed SCADA Infrastructure Completion Date”), then Seller shall pay as liquidated damages to Buyer an amount equal to \$5,000.00 per day for each day after the Guaranteed SCADA Infrastructure Completion Date but prior to the date on which SCADA Infrastructure Completion is achieved (“SCADA Infrastructure Delay LDs”).

o Buy-Down Damages: If the Closing occurs and the aggregate nameplate capacity of the Wind Facility, as of the Closing Date is equal to or greater than the Minimum Capacity but less than the Expected Wind Nameplate Capacity, Seller will be required to pay liquidated damages (“Wind Facility Buy-Down LDs”) in an amount per lost kW to be agreed in the Agreement. If the Closing occurs and, as of the Substantial Completion Date, the round-trip efficiency measured by the Pre-COD Test is less than []%, Seller will be required to pay liquidated damages in an amount to be agreed in the Agreement (“Storage Facility Buy-Down LDs”).

o Outside SC Date Damages. If the Closing occurs and the Project fails to achieve the Substantial Completion Date on or before [date TBD], Seller shall pay Buyer an amount equal to the net present value (using a discount rate corresponding to Buyer’s then-current average weighted cost of capital) of the grossed-up pre-tax value of any resulting lost or delayed ITC or PTCs (“Outside SC Date LDs” and together with the Delay LDs, the SCADA Infrastructure Delay LDs, the Wind Facility Buy-Down LDs, and the Storage Facility Buy-Down LDs, the “Liquidated Damages”).

- NERC Matters: Seller shall comply with the NERC Reliability Requirements during commissioning and up until the Substantial Completion Date and shall ensure the Project meets all NERC Reliability Requirements under the interconnection agreement. Seller shall maintain records required by NERC of such compliance actions and shall perform such other tasks and responsibilities as are set forth in Buyer’s Technical Specifications. No later than fifteen (15) business days before the Closing, Seller will provide Buyer current applicable compliance records related to the Project developed during commissioning or prior to the Closing (such as test records, relay settings, energization and synchronization reporting activities, and voltage schedule). Seller will provide Buyer design documents required by NERC (such as the Reactive Power Report, Reactive Power Control Design for VAR-002 and to meet the Voltage Schedule) no later than 30 days before the Closing.
- In the event of a dispute between the parties, the parties shall waive their right to a jury trial, with the losing party responsible for all legal fees associated with any claim. No other remediation, arbitration or resolution shall be provided for in the event of a dispute between Buyer and Seller.
- Governing law and venue shall be in accordance with the laws of the state of Minnesota, with any action arising out of or related to the transaction to be brought in a court located in Minneapolis, Minnesota.
- From and after the signing of the Agreement, Seller will not, and will cause its representatives and affiliates not to, initiate, solicit or respond to the submission of, or enter into any negotiations in respect of, any indication of interest, proposal or offer from any person or entity relating to any sale or other transfer of any material asset of, or any equity or debt interest in, the Project Company, including any response to a request for proposal, bid or similar request from any

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person or entity (including Buyer and its affiliates but excluding the transaction contemplated by the Agreement).

Termination Provisions; Termination Payment

The Agreement may be terminated upon written notice by the terminating party (as described below) in the event of certain occurrences, including without limitation:

- By Buyer if the Firm Date has not occurred by the Outside Firm Date, regardless of the reason for such failure, provided that Buyer is not in breach of the Agreement.
- By either party if the Closing has not occurred by the Outside Closing Date [date TBD], regardless of the reason for such termination, provided that the terminating party is not in breach of the Agreement.
- By either party if State Regulatory Approvals for the transaction are not obtained by the Outside Firm Date.
- By either party if applicable law or any order issued by, or any other action taken by, an authority restrains, enjoins, or otherwise prohibits the consummation of the transactions contemplated by the Agreement.
- By either party in the event of a material uncured breach or repudiation of the Agreement by the other party, or, in the case of Seller, a material uncured breach or repudiation of the relevant guaranty or letter of credit by the provider of the Seller Credit Support.
- By Buyer in the event of abandonment of the Project by Seller or the Project Company.
- By either party if the other party or, in the case of Seller, the provider of the Seller Credit Support, suffers insolvency or bankruptcy.
- By Buyer if there is a change of control of Seller.
- By Buyer if Closing has occurred but the Substantial Completion Date has not occurred by [date TBD].
- By Buyer if an Update from Seller has had or would reasonably be expected to have a Material Adverse Effect.

Termination Payment. Without limiting any other legal or contractual right or remedy available to Buyer (including Buyer's rights to Liquidated Damages under the Agreement that accrued prior to such termination), if the Agreement is terminated for any reason, Seller will pay to Buyer a termination payment (the "Termination Payment") in the indicated amount:

- if the Firm Date has not occurred and the termination occurs on or prior to the Outside Firm Date, an amount equal to \$75.00 multiplied by the sum of the number of kW in the Expected Wind Nameplate Capacity and the number of kW in the Expected Storage Nameplate Capacity;
- if the Closing has not occurred by the Outside Closing Date, an amount equal to \$125.00 multiplied by the sum of the number of kW in the Expected Wind Nameplate Capacity and the number of kW in the Expected Storage Nameplate Capacity; or

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o if the Closing has occurred but the Substantial Completion Date has not occurred by on or before [date TBD], and without duplication of Outside SC Date Damages described above that accrued prior to the termination, an amount equal to:

- the net present value (using a discount rate corresponding to Buyer's then-current average weighted cost of capital) of the grossed-up pre-tax value of any resulting lost or delayed ITCs or PTCs; plus
- an amount, which may be positive or negative, equal to Buyer's costs to achieve final completion of the Project *less* the remaining unpaid Purchase Price.

provided, that Seller shall have no obligation to make a Termination Payment if the termination is a result of (i) a material uncured breach or repudiation by Buyer; (ii) Buyer's failure to obtain State Regulatory Approvals by [date TBD], or (iii) Buyer's insolvency or bankruptcy.

Return of Progress Payments. In addition to any Termination Payment owing by Seller to Buyer, if the Agreement is terminated prior to Closing, Seller will repay to Buyer the aggregate amount of Progress Payments paid by Buyer as of such date.

Indemnification

From and after the Closing, each party shall indemnify and hold harmless the other party and its respective employees, representatives, officers, directors and agents from and against any and all damages arising out of any breach or violation of any representation, warranty, or covenant in the Agreement, or any liability not assumed as part of the Agreement. No claim for indemnification shall be brought against the indemnifying party until the total damages for which such party is liable exceeds in the aggregate a threshold amount of \$100,000, at which point indemnification may be sought for the full aggregate amount of damages, including those amounts that do not exceed the threshold. The aggregate damages to which the indemnified parties are entitled in respect of breaches or representations and warranties shall not exceed an amount equal to 30% of the Purchase Price (the "Indemnity Cap"). Such threshold and Indemnity Cap shall not apply to damages to the extent they arise from a party's fraud, willful misconduct or gross negligence or a breach of certain "fundamental" representations (as applicable to each party) such as corporate existence, power, authority, conflicts, title, land contracts, real property, environmental, intellectual property, brokers, subsidiaries, employee benefits, tax matters, or any liability not assumed as part of the Agreement. The aggregate damages to which the indemnified parties are entitled shall not exceed the Purchase Price. Such aggregate damages cap shall not apply to damages to the extent they arise from a party's fraud, willful misconduct or gross negligence or any liability not assumed as part of the Agreement.

Changes to Transaction Structure

The parties recognize that changes to the ITC or PTC or associated guidance may be made, or other incentives for wind energy generation or energy storage may become available for U.S. federal income tax purposes, and that the parties may need to restructure the transaction in order for Buyer to be able to utilize and maximize such revised ITC or PTC or other incentives. The parties agree that they will negotiate in good faith to restructure the transaction in a manner that will allow the parties to utilize any such revised ITC, PTC or other incentives.

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*Seller to provide the information
Highlighted in yellow.*

Buyer

Northern States Power Company, a [Minnesota / Wisconsin] corporation (“Buyer”).

Seller

[Developer/Seller Name], a [Seller entity type and state of formation], acting on its own behalf and on behalf of [Project Company Name], a [Project Company entity type and state of formation] (the “Project Company”), its wholly owned subsidiary (“Seller”). Buyer will also require Seller Credit Support (as defined below).

Project and Project Site

The Project Company is developing the [Project Name] energy project, an approximately [XX] MW_{AC} and [XX] MWh nameplate capacity (the “Expected Nameplate Capacity”) battery energy storage system located in [County Name] County, [State], and all other assets and rights relating to the project (the “Project”). For all purposes herein “Project” includes the gen-tie transmission line (the “T-Line”) that will connect the Project to the [relevant point of interconnection], and all electrical transmission line easements, rights-of-way or other real property interests necessary for the T-Line. Electric energy used to charge, and that will be discharged by, the Project’s battery energy storage system will be transmitted via the T-Line. The Project will be located at [describe site] (the “Project Site”).

Type of Transaction

The transaction will be structured as an entity acquisition. Subject to the other terms and conditions contained in a definitive purchase and sale agreement pertaining to the transaction (the “Agreement”), including that the Project is Investment Tax Credit (“ITC”) qualified, and the Project is mechanically complete, ready to be tested and placed in service (but has not yet been placed in service for U.S. federal income tax purposes) and free and clear of all encumbrances and liabilities, except for permitted encumbrances and specific assumed liabilities as defined in the Agreement (the consummation of such purchase and sale transaction, the “Closing”), on the transaction closing date (the “Closing Date”), Buyer shall purchase and Seller shall sell 100% of the ownership interests of the Project Company (the “Interests”). In any case, Seller would remain obligated after the Closing to perform the *Seller’s Work and Other Responsibilities* (described below) and all of its other obligations described in the Agreement.

Purchase Price and Payment Terms

The “Purchase Price,” which is not to exceed [] per MW_{AC}, will be paid by Buyer in two installments, one installment at Closing and one installment on the date (the “Substantial Completion Date”) upon which Seller has achieved an agreed set of “Substantial Completion CPs”; provided, that Buyer will consider making purchase price installment payments (“Progress Payments”)¹ to Seller from and after the Firm Date (defined below) and prior to Closing upon Seller’s achievement (to Buyer’s satisfaction) of certain milestones specified in the Agreement (or, if later, a “payment not earlier than” date to be specified for each milestone). In no case would a Progress Payment be made if (a) Seller is in breach or default of its obligations under the Agreement, (b) the provider of the Seller Credit Support (as defined

¹ If Seller is interested in receiving Progress Payments, Seller’s bid forms must include a proposed schedule of Progress Payments for Buyer to consider.

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below) is in breach or default of its obligations under the relevant guaranty or letter of credit or (c) either Seller or the provider of the Seller Credit Support is suffering an insolvency or bankruptcy event. In no case will the amount of the Progress Payments made prior to the Substantial Completion Date exceed 80% of the total Purchase Price.

Buyer will be entitled to set off against a Purchase Price payment (including a Progress Payment) any amount then owed by Seller to Buyer under the Agreement, including, without limitation, any accrued and unpaid Liquidated Damages (as defined below).

Buyer will be entitled to withhold from the Purchase Price payment made on the Closing Date an amount equal to 150% of the amount sufficient to complete any Punch List Items (defined below) (collectively, the “Punch List Holdback Amount”). If Seller has not completed all Punch List Items within the period of time agreed to by the parties, Buyer will be entitled to permanently retain a portion of the Punch List Holdback Amount equal to the greater of (i) the portion of the Punch List Holdback Amount attributable to the uncompleted Punch List Items and (ii) fifty percent (50%) of the Punch List Holdback Amount.

Credit Support

On the date the Agreement is signed (“Signing Date”), Seller will be required to deliver to Buyer “Seller Credit Support” in the form of either (i) cash held by Buyer for Seller’s account (or pursuant to a third-party escrow arrangement acceptable to Buyer in its sole discretion and at Seller’s sole expense), (ii) a guaranty from a guarantor acceptable to Buyer in its sole discretion and in a pre-agreed form or a form otherwise acceptable to Buyer in its sole discretion, or (iii) a letter of credit from an issuer acceptable to Buyer in its sole discretion and in a pre-agreed form or a form otherwise acceptable to Buyer in its sole discretion. Seller will be required to maintain Seller Credit Support in the Seller Credit Support Amount from the Signing Date until the first to occur of (a) the pre-Closing termination of the Agreement (including the period following such termination until all resulting claims are satisfied in full) and (b) the date that is twenty-four (24) months after the Closing Date (plus an additional period of time until all remaining indemnity claims are satisfied in full).

At any point in time prior to the Closing Date, the “Seller Credit Support Amount” shall be equal to the aggregate Seller payment obligations Seller could have if the Agreement is terminated at that point in time, including without limitation the Termination Payment (as defined below), accrued and unpaid Liquidated Damages and the aggregate Progress Payments, if any, then paid by Buyer. For twenty-four (24) months from and after the Closing Date (plus an additional period of time until all remaining indemnity claims are satisfied in full), the Seller Credit Support Amount shall be equal to the Indemnity Cap (as defined below).

Conditions Precedent to the Firm Date

The Agreement shall provide for the satisfaction, on or prior to the Outside Firm Date (defined below) and in each case in form and substance acceptable to Buyer and at Seller’s sole cost (except for costs of obtaining the State Regulatory Approvals, which shall be at Buyer’s sole cost) certain conditions precedent (“Firm Date CPs,” and the date all such Firm Date CPs have been satisfied or waived in writing by Buyer, the “Firm Date”). The Firm Date CPs will include, without limitation, that: (i) the State Regulatory Approvals have been obtained and are final, written, and non-appealable and in form and substance acceptable to Buyer in its sole discretion; (ii) all other required governmental approvals and permits (including without limitation the siting permit, environmental permits, and, if applicable, FERC approvals, approvals under the Hart-Scott-Rodino Antitrust Improvements Act of 1976, and any other

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permits necessary for the parties to consummate the transaction or for the Project Company to own, operate and maintain the project) have been obtained and are final, written, non-appealable and in form and substance acceptable to Buyer in its sole discretion; (iii) Seller has obtained all land contracts (including that Seller shall obtain (x) amendments to the existing leases as needed to ensure that the lease payment provisions and other applicable terms provide for utility ownership, that the term of the leases is no shorter than the 35 years following construction of the Project and/or to address other matters reasonably required by Buyer, and (y) new lease agreements required for site setbacks or other requirements or otherwise reasonably required by Buyer) and otherwise secured full site control, including real estate rights required to interconnect the Project; (iv) Seller has obtained and delivered to Buyer title reports and title insurance commitments, and completed any curative work required by Buyer; (v) Seller has obtained and delivered to Buyer fully executed and enforceable agreements securing (A) the engineering, procurement and construction of the Project, including batteries, power electronic systems, enclosures and other equipment necessary for the Project to store electricity and transmit such electricity upon command, (B) O&M services (if applicable), (C) letters of credit and guarantees, (D) all third-party reports and studies (including without limitation those relating to wildlife, environmental, tribal resource, cultural and historic preservation, geotechnical, archaeological, noise impact, engineering and cost segregation) and related reliance letters, and (E) all required third-party estoppels (including with respect to each lease and other land contracts), required subordination, non-disturbance and attornment agreements and third-party consents; (vi) the design documents have been finalized; (vii) Seller has developed and delivered to Buyer the Decommissioning Plan (as defined below) in form and substance acceptable to Buyer; (viii) Buyer has received a bring down of the Signing Opinion (defined below) confirming the Signing Opinion as of the Firm Date and otherwise in form and substance acceptable to Buyer; and (ix) Seller has secured interconnection rights for the Project and obtained an effective interconnection agreement for the Project acceptable to Buyer. Seller will provide Buyer with evidence that the Firm Date CPs have been satisfied in accordance with the terms of the Agreement, and Buyer will have a stated period to object to whether the Firm Date CPs have in fact been so satisfied. The “Outside Firm Date” will be [date TBD].

Seller’s Work and Other Responsibilities

Seller will be responsible, at its sole cost and expense, under the Agreement for all work required to achieve Project final completion, including with respect to the Project substation, O&M building, and all other integrated and operational infrastructure facilities, all radial transmission lines and other interconnection facilities required to deliver power from the electric grid to the Project and from the Project to **insert** substation/point of interconnection, and including without limitation the fully assembled, installed, tested and commercially operational battery storage system and related equipment, all in accordance with the applicable supply agreements, all manufacturer’s warranties and the O&M agreement (if applicable), the applicable construction agreements, the Long-Term Services Agreement (if applicable), the interconnection agreement and the Agreement. All work shall be performed in accordance with prudent utility practices, prudent engineering practices, applicable law, applicable safety requirements, applicable permits, an agreed site plan, Seller’s quality management plan, manufacturer’s warranties, specifications and recommendations, Buyer’s policies and procedures governing electronic and physical access controls required by the North American Electric Reliability Corporation (“NERC”) Critical Infrastructure Protection (“CIP”) standards (if applicable), Buyer’s Technical Specifications (to be provided by Buyer as part of the Agreement) that specify Buyer’s standards and requirements for the design, construction, materials, equipment and supplies for certain aspects of the Project, and Seller’s operating procedures for the operation of the Project (to be agreed upon by Buyer and Seller

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as part of the Agreement) (as defined below, the “Operating Guidelines”). Buyer and Buyer’s authorized representatives shall have the right to inspect the work and to maintain personnel at the Project Site, including the entire Project footprint and point of interconnection, for such purpose. Seller will be responsible, at its sole cost and expense, under the Agreement for all work required to procure and deliver to Buyer the Decommissioning Contracts (as defined below). All such work shall be performed by Seller in consultation with and cooperation with Buyer and in a manner reasonably acceptable to Buyer, including that all resulting deliverables are in form and substance reasonably acceptable to Buyer (in each case, unless a higher Buyer approval standard is expressly otherwise provided for in the Agreement, in which case, such higher approval standard shall apply, or the deliverable is in substantially the form previously agreed to in writing by Buyer, including pre-agreed forms attached as exhibits to the Agreement, in which case such deliverables shall be deemed acceptable to Buyer).

Buyer may elect in its sole discretion to permit items of Seller’s work required for final completion to be completed after Closing (such items, “Punch List Items”). For the avoidance of doubt, the foregoing obligations of Seller will continue after the Closing and Seller will remain responsible for all costs and expenses of completing the work, including those arising under any applicable supply and construction agreements.

Closing Conditions Precedent

The Agreement shall provide for the satisfaction, on or prior to the Closing, and in each case in form and substance acceptable to Buyer and at Seller’s sole cost (except for costs of obtaining Buyer’s regulatory approvals, which shall be at Buyer’s sole cost) of certain conditions precedent (“Closing CPs”). The Closing CPs will include, without limitation, that: the Project has achieved mechanical completion; the Firm Date has been achieved; any applicable third-party and governmental approvals have been obtained as set forth below under *Required Approvals*; Seller has delivered to Buyer all final as-built drawings and related documentation, including all manufacturers’ recommended operating and maintenance procedures required for maintenance of manufacturers’ warranties; Seller has delivered to Buyer evidence that it has obtained and assigned to Buyer all manufacturers’ warranties; Seller has delivered new or updated environmental reports, and no such reports identified any issues that are material and adverse to Buyer that were not identified in prior environmental reports delivered to Buyer; Seller has delivered to Buyer a complete and accurate list of all equipment, plant, machinery, installations, special tools, spare parts, supplies and other personal property owned by Seller included in the Project, excluding only those items which are immaterial and can be replaced in the ordinary course of business, and such list shall specifically indicate any such item of the Project which is not located on or at the Project Site and identify the location thereof; Seller has delivered to Buyer the Decommissioning Contracts in compliance with the Decommissioning Plan; all representations and warranties of Seller shall be true and correct in all respects; at the election of the Buyer, the Company and the LTSA Provider (as defined below) have entered into a Long-Term Services Agreement (as defined below); no event has occurred that has had or could reasonably be expected to have a material adverse effect, including any suit, action, dispute or other similar proceeding filed by any contractor, subcontractor, or other person against Seller, enjoining or limiting the transaction contemplated by the Agreement or the use or operation of the Project, or seeking to obtain damages or other relief in connection with the Agreement or any contracts to be transferred to Buyer under the Agreement; Seller has delivered to Buyer a claims statement identifying every dispute, suit, action or other proceeding that is pending, or threatened in writing, between Seller and any contractor or subcontractor connected with, or arising out of, the development and/or construction of the Project; and, if applicable, Seller or its operating personnel have completed all

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training requirements pertaining to the start-up, shut-down and operation of, and safety, general process understanding and emergency procedures for, the Project and all of its sub-systems, in accordance with the requirements of a training program to be prepared by Seller and approved by Buyer.

Required Approvals

The transactions contemplated hereby are subject to the execution and delivery of the Agreement and any ancillary agreements by the parties thereto and the obtaining of specified approvals, authorizations, or orders, including but not limited to the following (to the extent necessary):

- Approval of the board of directors of Buyer and the board of directors (or similar governing body) of Seller shall be obtained prior to execution of the Agreement.
- Third party consents.
- Governmental and regulatory approvals or consents necessary (as determined by Buyer in its sole discretion) from any state agencies or commissions regulating utility activities, each of which approval or consent shall have been obtained by Buyer and final, written, non-appealable and in form and substance acceptable to Buyer in its sole discretion (collectively, the “State Regulatory Approvals”).
- Applicable governmental and regulatory approvals, permits, licenses, etc. from any other government agencies having approval, consent or authority over Buyer or Seller or the transactions contemplated by the Agreement (e.g., the FAA, DOD, US Fish and Wildlife Service). Each of which approval or consent shall have been obtained and be final, written, non-appealable and in form and substance acceptable to Buyer in its sole discretion.

Seller’s Closing Deliverables

Upon the terms and conditions to be defined within the Agreement, the obligations of Buyer to consummate the transactions contemplated are subject to the satisfaction by Seller of certain conditions on or before the Closing Date, including without limitation:

- Transfer of all of the ownership interests of the Company, which include all rights and title to assets relating to the Project, to Buyer or its designated affiliate.
- Certification that the Project has achieved project mechanical completion in accordance with the terms of the Agreement.
- Buyer’s receipt, at Seller’s sole cost, of a bring down of the Signing Opinion confirming the Signing Opinion as of the Closing Date and otherwise in form and substance acceptable to Buyer in its sole discretion.
- The delivery to Buyer of evidence that any liens on the Project Company, Interests, Project real property or any other assets or interests of the Project Company have been removed as of the Closing other than permitted liens which have been scheduled or liens which have been scheduled and bonded to Buyer’s satisfaction.
- Seller has obtained all certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Seller pertaining to the Closing.
- Seller has delivered the title insurance commitment and title policy (premium to be paid by the Seller on or before the Closing Date).

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Buyer's Closing Deliverables

Upon the terms and conditions to be defined within the Agreement, the obligations of Seller to consummate the transactions contemplated are subject to the satisfaction by Buyer of certain conditions as of the Closing Date, in each case, to Seller's reasonable satisfaction, including:

- Payment of the Purchase Price or any remaining portion thereof, subject to certain adjustments contemplated in the Agreement.
- Buyer has obtained all certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Buyer pertaining to the Closing.

Pre-COD Test

The Pre-COD Test shall measure at the point of delivery, among other things, the Project's grid charging capability, maximum charging rates, maximum discharging rates, minimum charging time, minimum discharging time, storage capacity, round-trip efficiency, ability to communicate with Buyer using Buyer's Supervisory Control and Data Acquisition ("SCADA") System, and other testing to be agreed by the Parties (including factory testing). Any failure to pass the Pre-COD Test will trigger Seller's obligation to complete the repairs needed to bring the Project into compliance with the pre-determined performance levels required to pass such test. Prior to performing any repair obligations, Seller may conduct a limited number of discretionary tests that Seller deems necessary for purposes of re-performing a required test.

Long-Term Services Agreement

Buyer may elect to enter into a long-term services agreement for the Project with the supplier of the battery and battery enclosures or another third party acceptable to Buyer (which may include the Seller or an Affiliate of Seller) (the "LTSA Provider") upon the terms set forth below (the "Long-Term Services Agreement"). If Buyer elects to enter into a Long-Term Services Agreement, the LTSA Provider shall provide the applicable operations and maintenance services (the "Services") for an initial term of up to [] ten (10) years following the Closing. Thereafter, the Long-Term Services Agreement shall automatically renew in increments of five (5) years at the election of Buyer, up to three (3) times after the expiration of the initial term. The LTSA Provider shall provide the Services based upon (i) a fixed fee for certain work to be defined as in-scope; (ii) pre-agreed pricing for certain additional work that is outside of the scope but which Buyer may elect to purchase in its sole and absolute discretion; and (iii) cost-plus pricing for work not included in the preceding clauses (i) and (ii), which shall be subject to a mark-up of no more than 10% exclusive of equipment costs and focused on labor to cover, among other things, general and administrative and other overhead costs.

The Long-Term Services Agreement will (i) contain performance guarantees for the Project, as described further below, (ii) identify any Operating Limitations, as defined below, (iii) address the supply for any needed auxiliary or house power if the Project is located outside of Buyer's franchised retail electric service territory; and (iv) address compliance with the NERC CIP standards (if applicable). The Long-Term Services Agreement will also contain terms and conditions related to the Services provided thereunder that are customary for the operation and maintenance of a battery energy storage system, subject to any necessary conforming changes to adjust for the applicable technology, the size, or the scope of the Project. The form of the Long-Term Services Agreement would be attached as an exhibit

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to the Agreement.

Performance Guaranties

The Long-Term Services Agreement shall specify the terms under which the parties will measure the performance of the Project's battery energy storage system over the duration of the Agreement, which shall be dependent in part on the maturity of the battery storage technology used for the Project. Satisfactory performance will require the battery energy storage system to meet certain guaranteed performance criteria (the "Guaranteed Performance Levels"), which measurements shall be obtained through periodic testing, on an annual basis, or more frequently if requested by Buyer, of the following:

- Guaranteed Round Trip Efficiency;
- Guaranteed Storage Capacity;
- Self-Discharge Rate;
- Guaranteed Minimum Charging Time;
- Guaranteed Maximum Charging Rate;
- Guaranteed Minimum Discharging Time;
- Guaranteed Maximum Discharging Rate
- Maximum Ramp Rate;
- Guaranteed Response Time; and
- [Others TBD].

The LTSA Provider shall agree to maintain the battery energy storage system such that it is capable of maintaining a base level of storage capacity of no less than [__] MWh during the term of the Long-Term Services Agreement, [and to augment the battery energy storage system prior to the time the level of storage capacity falls below [__] MWh].

The parties to the Long-Term Services Agreement will agree that the Performance Guaranties will be contingent upon the Project being operated, scheduled, and dispatched in accordance with the "Operating Limitations", which shall specify the Project's operating requirements and limitations.

The Operating Limitations shall, at a minimum, address the following: [maximum annual state of charge (averaged);] maximum number of annual equivalent cycles, which shall not be below [__] equivalent cycles per year; [others TBD]; and the potential cost impact if Buyer were to exceed any of these limitations.

With respect to the maximum number of annual equivalent cycles, the Operating Limitations shall allow Buyer the flexibility to defer or extend a portion of the cycles allocated to a given operating year, such that (i) if Buyer does not use all of its cycles at the end of an operating year, Buyer may transfer up to [__] cycles to the subsequent operating year, or (ii) if Buyer uses all of its cycles prior to the end of an operating year, Buyer may add up to [__] cycles that are allocated to the subsequent operating year.

In addition, by no later than 90 days prior to the Closing Date, the parties shall develop "Operating Guidelines" to specify the parameters for the operation of the Project, such as operation modes for specific functionality (e.g., frequency response); set-points and limitations for each operating mode; scheduling parameters; the parties' communication protocols; and the data points to be transmitted to

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Buyer's SCADA. The parties agree that the Operating Guidelines can be reviewed annually to optimize operations for Buyer.

Battery and Related Equipment Warranties

Seller shall not purchase or otherwise acquire any of the major equipment components or related materials or services from an entity that is not approved by Buyer as specified in the Buyer's Technical Specifications without Buyer's prior written consent (not to be unreasonably withheld or delayed).

Seller shall provide to Buyer a description of the terms and conditions of the equipment warranties that Seller shall obtain from the battery, power conversion system, thermal management system, enclosure and monitoring equipment manufacturers, balance of plant contractor and other suppliers, contractors, and subcontractors, which shall include (i) a serial defect warranty with respect to the batteries, battery enclosures, power conversion system, thermal management system, fire suppression and safety systems, and switchgear, medium voltage generator step-up transformers, and protection devices, and (ii) a lifetime warranty with respect to the battery control system. In addition, Seller shall provide a full wrap project warranty of no less than two (2) years in duration as to defects in materials, workmanship and title, quality of work and performance as intended as a battery energy storage system.

If Buyer elects in its sole discretion not to enter into a Long-Term Services Agreement, Seller agrees to specify the base level of storage capacity the battery energy storage system will sustain over its useful life.

To the extent a change in applicable law prohibits Seller's acquisition, importation, or installation of major equipment or associated software, firmware, and digital components that control the operation of such major equipment ("Prohibited Equipment"), Seller agrees to procure an equivalent or superior alternative to the Prohibited Equipment, subject to Buyer's approval.

Safety

Seller shall design and construct the Project in compliance with all applicable laws, codes, and standards that are applicable to the design of the Project and ensure that upon the Closing Date the Project meets all such applicable laws, codes, and standards. Prior to the Closing Date, Seller will provide Buyer with an independent registered professional engineer's certification stating that the Project has been mechanically completed in all material respects (including compliance with all applicable laws, codes, and standards). Only non-occupiable battery energy storage system enclosures shall be considered. Seller shall have the battery energy storage system enclosures certified to UL 9540. Seller shall design, construct, and install the Project under the guidance of NFPA 855 and shall comply with all applicable portions of that standard. Seller shall also complete first responder training for its and Buyer's operating personnel as well as any local first responders, which training shall be reconducted on a periodic basis.

Prior to the Closing Date, Seller will also provide the following additional documents: All schematics, drawings, and other documentation needed for developing lock out-tag out procedures and performing hazard assessments of the facility, site level emergency response plans, and system operations training manual.

Representations and Warranties

The transaction is subject to customary representations and warranties to be made by Buyer and Seller as of the Signing Date, the Firm Date, and the Closing Date, including without limitation:

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- Corporate existence and powers – Seller is a **corporation** validly existing and in good standing and has the power and authority to conduct its business as now conducted.
- Company existence and powers – the Project Company is a limited liability company validly existing and in good standing and has the power and authority to develop, construct, operate and own the Project and has been engaged in no other business since its formation.
- Authority (execution and delivery and performance of obligations).
- No conflicts - the transaction does not create any conflicts.
- Consents and approvals – no consent, approval or authorization is required in connection with the execution and performance of the Agreement.
- Legal proceedings of Buyer – there are no legal proceedings pending, or to Buyer's knowledge, threatened, against Buyer, that affect the consummation of the transaction contemplated by the Agreement.
- Legal proceedings of Seller and the Project Company – there are no legal proceedings pending, or to Seller's knowledge, threatened, against (i) Seller relating to the Project or affecting Seller's ability to sell the Project Company or (ii) the Project Company or the Project.
- Compliance with Laws – Seller and the Project Company are in compliance with all laws applicable to Seller, the Project Company, the Project and the transactions contemplated by the Agreement.
- Environmental – Seller and its affiliates have no environmental liabilities relating to the Project. The Project Company has no environmental liabilities. Seller and its affiliates have been, and are in, compliance with environmental requirements relating to the Project. The Project Company has been, and is in, compliance with environmental requirements. Seller and its affiliates have not received any notice of an actual or alleged violation of environmental law relating to the Project Company or the Project from any governmental entity. There are no facts, circumstances, conditions or occurrences relating to the Project Company or the Project that could reasonably be expected to form the basis of a claim, requirement or obligation imposed by any governmental entity under any environmental law on Seller or its affiliates.
- Contracts – Schedule of contracts (i) binding on the Project Company, (ii) binding on Seller that relate to the Project, or (iii) to which the Project is subject or bound, and Seller has furnished to Buyer true, correct and complete copies of all such contracts. There is no, and has not been any, material breach or material default (including inchoate breaches and defaults) by the Seller or its affiliates, or, to Seller's knowledge, by any other party to any schedule Contract.
- Real Property Agreements – The Real Property Agreements in full force and effect, and shall, as of the Closing, comprise all of the real property interests necessary in connection with the acquisition, siting, development, construction, installation, interconnection, completion, ownership and operation of the Project, all in accordance with all laws, and are sufficient to enable the Project to be commercially operable as contemplated in the Agreement, including without limitation legal and physical ingress and egress rights to and from public rights-of-way. There is no, and has not been any, material breach or material default (including inchoate breaches and defaults) by the Seller or its affiliates, or, to Seller's knowledge, by any other party to any Real Property Agreement.
- Permits - All permits required to develop, construct, own, and attain commercial operation of the Project are held by the Project Company, are written, final and non-appealable, are scheduled, and Seller has obtained and furnished to Buyer true, correct and complete copies of such permits. Such permits are in full force and effect and are legal, valid, binding and enforceable in accordance

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with their respective terms. The Seller and the Project Company are in compliance with all permits.

- Title – The Project Company is in possession of and has good and marketable title to the Project free and clear of all liens and encumbrances, except for permitted liens which have been scheduled or liens which have been scheduled and bonded to Buyer's satisfaction. Seller has good and marketable title to the Interests, free and clear of all liens and encumbrances. Seller and its affiliates have no legal obligation to, or non-binding agreement in principle with any other person, to sell or affect a sale of all, or any portion of, the Project or the Project Company.
- MAE – No "Material Adverse Effect" (as defined in the Agreement) has occurred.
- Financial Statements; No Undisclosed Liabilities – True and correct unaudited financial statements of the Project Company are attached to the Agreement and the same have been prepared in accordance with GAAP and present fairly the financial condition of the Project Company. There are no undisclosed liabilities other than those disclosed in the financial statements or included in the disclosure schedules.
- Taxes – Tax representation and warranties customary in a transaction of this nature, including without limitation relating to the federal investment tax credit and the federal production tax credit.
- Other representation and warranties customary in a transaction of this nature (including those pertaining to finders, intellectual property, studies and reports, bankruptcy/solvency, brokers, insurance, books and records, bank accounts, affiliate contracts, no subsidiaries, anti-corruption/OFAC and regulatory status) or that are required following Buyer's due diligence review.

Other Agreements

- Interconnection. Seller shall be responsible for complying with all costs and requirements necessary to attain the final interconnection of the Project, including, but not limited to, all costs for the construction of any radial transmission line to [insert] substation/point of interconnection and any necessary network upgrade costs.
- Subject to limitations and conditions to be included in the Agreement, the parties will have the ability, and in certain cases the obligation, to update disclosure schedules for items arising between the Signing Date, the Firm Date, and Closing (each, an "Update").
- Technology. The major equipment components of the Project shall be manufactured by top tier manufacturers acceptable to Buyer or specified in the Buyer's Technical Specifications.
- Buyer's right to inspect. Buyer and Buyer's authorized representatives shall have the right to inspect the work and to maintain personnel at the Project Site for such purpose. Such inspection of any part of the work shall in no way relieve Seller of its obligations under the Agreement.
- Seller will cause the Project to satisfy (in accordance with the Internal Revenue Code and associated guidance) requirements that qualify the project for the ITC at the full ITC level (30% in 2023 for facilities placed in service after 2021). Seller has qualified the project for the ITC using the following process: *[Seller to provide detailed description of qualification method, any applicable adders, and whether and how construction began on or before January 28, 2023 or whether the prevailing wage and apprenticeship requirements are met.]*
- At Seller's cost, a legal opinion (the "Signing Opinion") from tax counsel selected by Buyer and in form and substance acceptable to Buyer shall be delivered to Buyer prior to the Signing Date, which Signing Opinion shall speak to the tax benefits associated with the transactions

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contemplated by the Agreement accruing to Buyer upon or after the Closing, and must include, without limitation, an opinion that, under the rules, regulations, and other laws in effect as of the date of the Signing Opinion, the Project will, based on among other things, the representations made by Seller on the date the Signing Opinion is delivered, generate a [30%] ITC (including by qualifying for any applicable adders (such as the domestic content adder, the energy community adder, or the low-income adder) and by having begun construction, within the meaning of applicable IRS guidance, on or prior to January 28, 2023 or having met the applicable prevailing wage and apprenticeship requirements) and, assuming the Closing occurs, that Buyer will be able to claim such ITC upon the placed in service date of the Project in accordance with applicable law and tax rules.

- Decommissioning. Seller shall be responsible for developing and implementing a plan for the decommissioning of the battery energy storage system and any related balance of plant (e.g., battery enclosures, power conversion system) in accordance with applicable law and the relevant permits and contracts (including relevant land contracts and equipment supply contracts) (the “Decommissioning Plan”). The Decommissioning Plan will (x) address the end-of-life management of the battery energy storage system, including the dismantling, removal, transportation, and disposal of the batteries and any associated solid and hazardous waste and, if required, restoration of the Project Site (collectively, the “Decommissioning Requirements”), (y) specify the contract(s) (the “Decommissioning Contracts”) with the battery manufacturer, the LTSA Provider, a recycling facility, and/or other counterparties required to satisfy the Decommissioning Requirements and (z) summarize the material terms and conditions to be included in the Decommissioning Contracts.
- Seller shall assume all risks arising from any change in its commodity prices and all changes associated with any change in law affecting Seller’s Project costs including, but not limited to, changes in tariff rates.
- Seller shall be responsible for all taxes relating to the pre-Closing period and all transfer taxes and any sales, use or other taxes related to the purchase and sale of the Interests and any purchase or conveyance of real or personal property to the Project Company to be used in the Project.
- Buyer will not be required to close if the aggregate nameplate capacity of the Project is less than 100% of the Expected Nameplate Capacity (the “Minimum Capacity”) or if the Project fails to pass the Pre-COD Test.
- Liquidated Damages:
 - o Delay Damages: Seller shall make a per diem liquidated damages payment, in an amount of \$400/MW, for each day after the guaranteed closing date that the Closing has not occurred, such delay damages (“Delay LDs”) not to exceed an agreed percentage of the Purchase Price in the aggregate.
 - o SCADA Infrastructure Delay Damages: Seller agrees that if SCADA Infrastructure Completion (definition to be agreed in the Agreement) is not achieved by [date TBD] (“Guaranteed SCADA Infrastructure Completion Date”), then Seller shall pay as liquidated damages to Buyer an amount equal to \$5,000.00 per day for each day after the Guaranteed SCADA Infrastructure Completion Date but prior to the date on which SCADA Infrastructure Completion is achieved (“SCADA Infrastructure Delay LDs”).
 - o Buy-Down Damages: If the Closing occurs and, as of the Substantial Completion Date, the round-trip efficiency measured by the Pre-COD Test is less than [__]%, Seller will be required to pay liquidated damages in an amount to be agreed in the Agreement (“Buy-Down LDs”).

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- o Outside SC Date Damages: If the Closing occurs and the Project fails to achieve the Substantial Completion Date on or before [date TBD], Seller shall pay Buyer an amount equal to the net present value (using a discount rate corresponding to Buyer's then-current average weighted cost of capital) of the grossed-up pre-tax value of any resulting lost or delayed ITCs ("Outside SC Date LDs" and together with the Delay LDs, the SCADA Infrastructure Delay LDs, and the Buy-Down LDs, the "Liquidated Damages").
- NERC Matters: Seller shall comply with the NERC Reliability Requirements during commissioning and up until the Closing Date and shall ensure the Project meets all NERC Reliability Requirements under the interconnection agreement. Seller shall maintain records required by NERC of such compliance actions and shall perform such other tasks and responsibilities as are set forth in Buyer's Technical Specifications. No later than fifteen (15) business days before the Closing Date, Seller will provide Buyer current applicable compliance records related to the Project developed during commissioning or prior to the Closing Date (such as test records, relay settings, energization and synchronization reporting activities, and voltage schedule). Seller will provide Buyer design documents required by NERC (such as the Reactive Power Report, Reactive Power Control Design for VAR-002 and to meet the Voltage Schedule) no later than 30 days before the Closing.
- In the event of a dispute between the parties, the parties shall waive their right to a jury trial, with the losing party responsible for all legal fees associated with any claim. No other remediation, arbitration or resolution shall be provided for in the event of a dispute between Buyer and Seller.
- Governing law and venue shall be in accordance with the laws of the state of Minnesota, with any action arising out of or related to the transaction to be brought in a court located in Minneapolis, Minnesota.
- From and after the signing of the Agreement, Seller will not, and will cause its representatives and affiliates not to, initiate, solicit or respond to the submission of, or enter into any negotiations in respect of, any indication of interest, proposal or offer from any person or entity relating to any sale or other transfer of any material asset of, or any equity or debt interest in, the Project Company, including any response to a request for proposal, bid or similar request from any person or entity (including Buyer and its affiliates but excluding the transaction contemplated by the Agreement).

Termination Provisions; Termination Payment

The Agreement may be terminated prior to the Closing Date upon written notice by the terminating party (as described below) in the event of certain occurrences, including without limitation:

- By Buyer if the Firm Date has not occurred by the Outside Firm Date, regardless of the reason for such failure, provided that Buyer is not in breach of the Agreement.
- By either party if the Closing Date has not occurred by the Outside Closing Date [date TBD], regardless of the reason for such termination, provided that the terminating party is not in breach of the Agreement.
- By either party if State Regulatory Approvals for the transaction are not obtained by the Outside Firm Date.
- By either party if applicable law or any order issued by, or any other action taken by, an authority restrains, enjoins, or otherwise prohibits the consummation of the transactions contemplated by the Agreement.

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- By either party in the event of a material uncured breach or repudiation of the Agreement by the other party, or, in the case of Seller, a material uncured breach or repudiation of the relevant guaranty or letter of credit by the provider of the Seller Credit Support.
- By Buyer in the event of abandonment of the Project by Seller or the Project Company.
- By either party if the other party or, in the case of Seller, the provider of the Seller Credit Support, suffers insolvency or bankruptcy.
- By Buyer if there is a change of control of Seller.
- By Buyer if Closing has occurred but the Substantial Completion Date has not occurred by [date TBD].
- By Buyer if an Update from Seller has had or would reasonably be expected to have a Material Adverse Effect.

Termination Payment. Without limiting any other legal or contractual right or remedy available to Buyer (including Buyer's rights to Liquidated Damages under the Agreement that accrued prior to such termination), if the Agreement is terminated for any reason, Seller will pay to Buyer a termination payment (the "Termination Payment") in the indicated amount:

- o if the Firm Date has not occurred and the termination occurs on or prior to the Outside Firm Date, an amount equal to \$75.00 multiplied by the number of kW in the Expected Nameplate Capacity;
- o if the Closing has not occurred by the Outside Closing Date, an amount equal to \$125.00 multiplied by the number of kW AC in the Expected Nameplate Capacity;
- o if the Closing has occurred but the Substantial Completion Date has not occurred by on or before [date TBD], and without duplication of Outside SC Date Damages described above that accrued prior to the termination, an amount equal to:
 - the net present value (using a discount rate corresponding to Buyer's then-current average weighted cost of capital) of the grossed-up pre-tax value of any resulting lost or delayed ITCs; plus
 - an amount, which may be positive or negative, equal to Buyer's costs to achieve final completion of the Project *less* the remaining unpaid Purchase Price.

provided, that Seller shall have no obligation to make a Termination Payment if the termination is a result of (i) a material uncured breach or repudiation by Buyer; (ii) Buyer's failure to obtain State Regulatory Approvals by [date TBD], or (iii) Buyer's insolvency or bankruptcy.

Return of Progress Payments. In addition to any termination payment owing by Seller to Buyer, if the Agreement is terminated prior to Closing, Seller will repay to Buyer the aggregate amount of Progress Payments paid by Buyer as of such date.

Indemnification

From and after the Closing, each party shall indemnify and hold harmless the other party and its respective employees, representatives, officers, directors and agents from and against any and all damages arising out of any breach or violation of any representation, warranty, or covenant in the Agreement, or any liability not assumed as part of the Agreement. No claim for indemnification shall be brought against the indemnifying party until the total damages for which such party is liable exceeds in the aggregate a threshold amount of \$100,000, at which point indemnification may be sought for the

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full aggregate amount of damages, including those amounts that do not exceed the threshold. The aggregate damages to which the indemnified parties are entitled in respect of breaches or representations and warranties shall not exceed an amount equal to 30% of the Purchase Price (the “Indemnity Cap”). Such threshold and Indemnity Cap shall not apply to damages to the extent they arise from a party’s fraud, willful misconduct or gross negligence or a breach of certain “fundamental” representations (as applicable to each party) such as corporate existence, power, authority, conflicts, title, land contracts, real property, environmental, intellectual property, brokers, subsidiaries, employee benefits, tax matters, or any liability not assumed as part of the Agreement. The aggregate damages to which the indemnified parties are entitled shall not exceed the Purchase Price. Such aggregate damages cap shall not apply to damages to the extent they arise from a party’s fraud, willful misconduct or gross negligence or any liability not assumed as part of the Agreement.

Changes to Transaction Structure

The parties recognize that changes to the ITC or associated guidance may be made, or other incentives for stand-alone energy storage may become available and that the parties may need to restructure the transaction in order for Buyer to be able to utilize and maximize such ITC or other incentives, including, in the case of an ITC, by requiring that Buyer acquire the Project prior to the Project being placed in service for U.S. federal income tax purposes. The parties agree that they will negotiate in good faith to restructure the transaction in a manner that will allow the parties to utilize and maximize any such ITC or other incentives.

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*Seller to provide the information
Highlighted in yellow.*

Buyer

Northern States Power Company, a [Minnesota / Wisconsin] corporation (“Buyer”).

Seller

[Developer/Seller Name], a [Seller entity type and state of formation] (“Seller”), acting on its own behalf and on behalf of [Project Company Name], a [Project Company entity type and state of formation] (the “Project Company”), its wholly owned subsidiary. Buyer will also require Seller Credit Support (as defined below).

Project

The Project Company is developing the [Project Name] energy project, an approximately [•] MW_{AC} nameplate capacity (the “Expected Nameplate Capacity”), integrated solar photovoltaic-powered electricity generating plant located in [County Name] County, [State], with single-axis tracking design, and all facilities and all other assets and rights relating to the project (the “Project”). For all purposes herein “Project” includes the gen-tie transmission line (the “T-Line”) that will connect the Project to the [relevant point of interconnection], and all electrical transmission line easements, rights-of-way or other real property interests necessary for the T-Line.

Type of Transaction

The transaction will be structured as an entity acquisition. Subject to the other terms and conditions of a definitive purchase and sale agreement pertaining to the transaction (the “Agreement”), including (x) if Buyer elects, in its sole discretion, to claim the Investment Tax Credit (“ITC”) in respect of the Project (an “ITC Election”), that the Project is mechanically complete, ready to be tested and placed in service (but has not yet been placed in service for U.S. federal income tax purposes), and (y) if Buyer elects, in its sole discretion, to claim the Production Tax Credit (“PTC”) in respect of the Project (a “PTC Election”), that the Project has achieved an agreed set of “Substantial Completion CPs” (which Substantial Completion CPs shall include, without limitation, that the Project has been placed in service for U.S. federal income tax purposes), in either case free and clear of all encumbrances and liabilities, except for permitted encumbrances and specific assumed liabilities as defined in the Agreement (the consummation of such purchase and sale transaction, the “Closing”), on the transaction closing date (the “Closing Date”), Buyer shall purchase and Seller shall sell 100% of the ownership interests of the Project Company (the “Interests”). In any case, Seller would remain obligated after the Closing to perform the *Seller’s Work and Other Responsibilities* (described below) and all its other obligations described in the Agreement.

Purchase Price and Payment Terms

The “Purchase Price,” which is not to exceed [] per MW_{AC}, will be paid by Buyer (x) if the ITC Election applies, in two installments, one installment at Closing and one installment on the date (the “Substantial Completion Date”) upon which Seller has achieved the Substantial Completion CPs and (y) if the PTC Election applies, at Closing; provided, that Buyer will consider making Purchase Price

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installment payments (“Progress Payments”)¹ to Seller from and after the Firm Date (defined below) and prior to Closing upon Seller’s achievement (to Buyer’s satisfaction) of certain milestones specified in the Agreement (or, if later, a “payment not earlier than” date to be specified for each milestone). In no case would a Progress Payment be made if (a) Seller is in breach or default of its obligations under the Agreement, (b) the provider of the Seller Credit Support (as defined below) is in breach or default of its obligations under the relevant guaranty or letter of credit or (c) either Seller or the provider of the Seller Credit Support is suffering an insolvency or bankruptcy event. In no case will the amount of the Progress Payments made prior to the Substantial Completion Date exceed 80% of the total Purchase Price.

Buyer will be entitled to set off against a Purchase Price payment (including a Progress Payment) any amount then owed by Seller to Buyer under the Agreement, including, without limitation, any accrued and unpaid Liquidated Damages (as defined below).

Buyer will be entitled to withhold from the Purchase Price payment made on the Closing Date an amount equal to 150% of the amount sufficient to complete any Punch List Items (defined below) (collectively, the “Punch List Holdback Amount”). If Seller has not completed all Punch List Items within the period of time agreed to by the parties, Buyer will be entitled to permanently retain a portion of the Punch List Holdback Amount equal to the greater of (i) the portion of the Punch List Holdback Amount attributable to the uncompleted Punch List Items and (ii) fifty percent (50%) of the Punch List Holdback Amount.

Credit Support

On the date the Agreement is signed (“Signing Date”), Seller will be required to deliver to Buyer “Seller Credit Support” in the form of either (i) cash held by Buyer for Seller’s account (or pursuant to a third-party escrow arrangement acceptable to Buyer in its sole discretion and at Seller’s sole expense), (ii) a guaranty from a guarantor acceptable to Buyer in its sole discretion and in a pre-agreed form or a form otherwise acceptable to Buyer in its sole discretion, or (iii) a letter of credit from an issuer acceptable to Buyer in its sole discretion and in a pre-agreed form or a form otherwise acceptable to Buyer in its sole discretion. Seller will be required to maintain Seller Credit Support in the Seller Credit Support Amount from the Signing Date until the first to occur of (a) the pre-Closing termination of the Agreement (including the period following such termination until all resulting claims are satisfied in full) and (b) the date that is twenty-four (24) months after the Closing Date (plus an additional period of time until all remaining indemnity claims are satisfied in full).

At any point in time prior to the Closing Date, the “Seller Credit Support Amount” shall be equal to the aggregate Seller payment obligations Seller could have if the Agreement is terminated at that point in time, including without limitation the Termination Payment (as defined below), accrued and unpaid Liquidated Damages and the aggregate Progress Payments, if any, then paid by Buyer. For twenty-four (24) months from and after the Closing Date (plus an additional period of time until all remaining indemnity claims are satisfied in full), the Seller Credit Support Amount shall be equal to the Indemnity Cap (as defined below).

Conditions Precedent to the Firm Date

¹ If Seller is interested in receiving Progress Payments, Seller’s bid forms must include a proposed schedule of Progress Payments for Buyer to consider.

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The Agreement shall provide for the satisfaction, on or prior to the Outside Firm Date (defined below) and in each case in form and substance acceptable to Buyer and at Seller's sole cost (except for costs of obtaining the State Regulatory Approvals, which shall be at Buyer's sole cost) certain conditions precedent ("Firm Date CPs," and the date all such Firm Date CPs have been satisfied or waived in writing by Buyer, the "Firm Date"). The Firm Date CPs will include, without limitation, that: (i) the State Regulatory Approvals have been obtained and are final, written, and non-appealable and in form and substance acceptable to Buyer in its sole discretion; (ii) all other required governmental approvals and permits (including without limitation the siting permit, environmental permits, and, if applicable, FERC approvals, approvals under the Hart-Scott-Rodino Antitrust Improvements Act of 1976, and any other permits necessary for the parties to consummate the transaction or for the Project Company to own, operate and maintain the Project) have been obtained and are final, written, non-appealable and in form and substance acceptable to Buyer in its sole discretion; (iii) Seller has obtained all land contracts (including that Seller shall obtain (x) amendments to the existing leases as needed to ensure that the lease payment provisions and other applicable terms provide for utility ownership, that the term of the leases is no shorter than the 35 years following construction of the Project and/or to address other matters reasonably required by Buyer, and (y) new lease agreements required for site setbacks or other requirements or otherwise reasonably required by Buyer) and otherwise secured full site control, including real estate rights required to interconnect the Project; (iv) Seller has obtained and delivered to Buyer title reports and title insurance commitments, and completed any curative work required by Buyer; (v) Seller has obtained and delivered to Buyer fully executed and enforceable agreements securing (A) the engineering, procurement and construction of the Project, including solar equipment and other equipment necessary for the Project to generate electricity and to transmit such electricity upon command, (B) O&M services (if applicable), (C) letters of credit and guarantees, (D) all third-party reports and studies (including without limitation those relating to wildlife, environmental, tribal resource, cultural and historic preservation, geotechnical, archaeological, noise impact, solar energy resources, engineering and cost segregation) and related reliance letters, and (E) all required third-party estoppels (including with respect to each lease and other land contracts), required subordination, non-disturbance and attornment agreements and third-party consents; (vi) the design documents have been finalized; (vii) Buyer has received a bring down of the Signing Opinion (defined below) confirming the Signing Opinion as of the Firm Date and otherwise in form and substance acceptable to Buyer; and (viii) Seller has secured interconnection rights for the Project and obtained an effective interconnection agreement for the Project acceptable to Buyer. Seller will provide Buyer with evidence that the Firm Date CPs have been satisfied in accordance with the terms of the Agreement, and Buyer will have a stated period to object to whether the Firm Date CPs have in fact been so satisfied. The "Outside Firm Date" will be [date TBD].

Seller's Work and Other Responsibilities

Seller will be responsible, at its sole cost and expense, under the Agreement for all work required to achieve Project final completion, including with respect to the Project substation, O&M building, and all other integrated and operational infrastructure facilities, all radial transmission lines and other interconnection facilities required to deliver power from the electric grid to the Project and from the Project to [insert] substation/point of interconnection, and including without limitation the fully assembled, installed, tested and commercially operational solar photovoltaic panels and inverters and related equipment, all in accordance with the applicable supply agreements, all manufacturer's warranties and the O&M agreement (if applicable), the applicable construction agreements, the interconnection agreement and the Agreement. All work shall be performed in accordance with prudent

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utility practices, prudent engineering practices, applicable law, applicable permits, an agreed site plan, Seller's quality management plan, manufacturer's specifications and recommendations, and Buyer's Technical Specifications (to be provided by Buyer as part of the Agreement) as to standards and requirements for the design, construction, materials, equipment and supplies for certain aspects of the Project. Buyer and Buyer's authorized representatives shall have the right to inspect the work and to maintain personnel at the Project site, including the entire Project footprint and point of interconnection, for such purpose. All such work shall be performed by Seller in consultation with and cooperation with Buyer and in a manner reasonably acceptable to Buyer, including that all resulting deliverables are in form and substance reasonably acceptable to Buyer (in each case, unless a higher Buyer approval standard is expressly otherwise provided for in the Agreement, in which case, such higher approval standard shall apply, or the deliverable is in substantially the form previously agreed to in writing by Buyer, including pre-agreed forms attached as exhibits to the Agreement, in which case such deliverables shall be deemed acceptable to Buyer).

Buyer may elect in its sole discretion to permit items of Seller's work required for final completion to be completed after Closing (such items, "Punch List Items"). For the avoidance of doubt, the foregoing obligations of Seller will continue after the Closing and Seller will remain responsible for all costs and expenses of completing the work, including those arising under any applicable supply and construction agreements.

Required Approvals

The transactions contemplated hereby are subject to the execution and delivery of the Agreement and any ancillary agreements by the parties thereto and the obtaining of specified approvals, authorizations, or orders, including but not limited to the following (to the extent necessary):

- Approval of the board of directors of Buyer and the board of directors (or similar governing body) of Seller shall be obtained prior to execution of the Agreement.
- Third party consents.
- Governmental and regulatory approvals or consents necessary (as determined by Buyer in its sole discretion) from any state agencies or commissions regulating utility activities, each of which approval or consent shall have been obtained by Buyer and final, written, non-appealable and in form and substance acceptable to Buyer in its sole discretion (collectively, the "State Regulatory Approvals").
- Applicable governmental and regulatory approvals, permits, licenses, etc. from any other government agencies having approval, consent or authority over Buyer or Seller or the transactions contemplated by the Agreement (e.g., the FAA, DOD, US Fish and Wildlife Service). Each of which approval or consent shall have been obtained and be final, written, non-appealable and in form and substance acceptable to Buyer in its sole discretion.

Seller's Closing Deliverables

Upon the terms and conditions to be defined within the Agreement, the obligations of Buyer to consummate the transactions contemplated are subject to the satisfaction by Seller of certain conditions as of the Closing Date, in each case in a manner reasonably acceptable to Buyer, including that all resulting deliverables are in form and substance reasonably acceptable to Buyer (unless a higher Buyer approval standard is expressly otherwise provided for in the Agreement, in which case, such higher approval standard shall apply, or the deliverable is in substantially the form previously agreed to in

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writing by Buyer, including pre-agreed forms attached as exhibits to the Agreement, in which case such deliverables shall be deemed acceptable to Buyer), including, but not limited to:

- Achievement of the Firm Date.
- The transfer of all the ownership interests in the assets relating to the Project, including without limitation those necessary for the commercial operation of the Project, to the Project Company.
- Certification that the Substantial Completion CPs have been satisfied in accordance with the terms of the Agreement.
- Buyer's receipt, at Seller's sole cost, of a bring down of the Signing Opinion confirming the Signing Opinion as of the Closing Date and otherwise in form and substance acceptable to Buyer in its sole discretion.
- The delivery to Buyer of evidence that any liens on the Project Company, Interests, Project real property or any other assets or interests of the Project Company have been removed as of the Closing other than permitted liens which have been scheduled or liens which have been scheduled and bonded to Buyer's satisfaction.
- Seller has obtained all certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Seller pertaining to the Closing.
- Seller has delivered the title insurance commitment and title policy (premium to be paid by Seller on or before the Closing Date).

Buyer's Closing Deliverables

Upon the terms and conditions to be defined within the Agreement, the obligations of Seller to consummate the transactions contemplated are subject to the satisfaction by Buyer of certain conditions as of the Closing Date, in each case, to Seller's reasonable satisfaction, including:

- Delivery of the Purchase Price or any remaining portion thereof, subject to certain adjustments contemplated in the Agreement.
- Buyer has obtained all certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Buyer pertaining to the Closing.

Representations and Warranties

The transaction is subject to customary representations and warranties to be made by Buyer and Seller as of the Signing Date, the Firm Date, and the Closing Date, including, without limitation:

- Corporate existence and powers – Seller is a **[corporation]** validly existing and in good standing and has the power and authority to conduct its business as now conducted.
- Company existence and powers – the Project Company is a limited liability company validly existing and in good standing and has the power and authority to develop, construct, operate and own the Project and has been engaged in no other business since its formation.
- Authority (execution and delivery and performance of obligations).
- No conflicts - the transaction does not create any conflicts.
- Consents and approvals – no consent, approval or authorization is required in connection with the execution and performance of the Agreement.

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- Legal proceedings of Buyer – there are no legal proceedings pending, or to Buyer’s knowledge, threatened, against Buyer, that affect the consummation of the transaction contemplated by the Agreement.
- Legal proceedings of Seller and the Project Company – there are no legal proceedings pending, or to Seller’s knowledge, threatened, against (i) Seller relating to the Project or affecting Seller’s ability to sell the Project Company or (ii) the Project Company or the Project.
- Compliance with Laws – Seller and the Project Company are in compliance with all laws applicable to Seller, the Project Company, the Project and the transactions contemplated by the Agreement.
- Environmental – Seller and its affiliates have no environmental liabilities relating to the Project. The Project Company has no environmental liabilities. Seller and its affiliates have been, and are in, compliance with environmental requirements relating to the Project. The Project Company has been, and is in, compliance with environmental requirements. Seller and its affiliates have not received any notice of an actual or alleged violation of environmental law relating to the Project Company or the Project from any governmental entity. There are no facts, circumstances, conditions or occurrences relating to the Project Company or the Project that could reasonably be expected to form the basis of a claim, requirement or obligation imposed by any governmental entity under any environmental law on Seller or its affiliates.
- Contracts – Schedule of contracts (i) binding on the Project Company, (ii) binding on Seller that relate to the Project, or (iii) to which the Project is subject or bound, and Seller has furnished to Buyer true, correct and complete copies of all such contracts. There is no, and has not been any, material breach or material default (including inchoate breaches and defaults) by the Seller or its affiliates, or, to Seller’s knowledge, by any other party to any schedule Contract.
- Real Property Agreements – The Real Property Agreements are in full force and effect, and shall, as of the Closing, comprise all of the real property interests necessary in connection with the acquisition, siting, development, construction, installation, interconnection, completion, ownership, and operation and maintenance of the Project, all in accordance with all laws, and are sufficient to enable the Project to be commercially operable as contemplated in the Agreement, including without limitation legal and physical ingress and egress rights to and from public rights-of-way. There is no, and has not been any, material breach or material default (including inchoate breaches and defaults) by the Seller or its affiliates or, to Seller’s knowledge, by any other party to any Real Property Agreement.
- Permits - All permits required to develop, construct, own, and attain commercial operation of the Project are held by the Project Company, are written, final and non-appealable, are scheduled, and Seller has obtained and furnished to Buyer true, correct and complete copies of such permits. Such permits are in full force and effect and are legal, valid, binding and enforceable in accordance with their respective terms. The Seller and the Project Company are in compliance with all permits.
- Solar Data – Seller has delivered to buyer true, correct and complete copies of all solar data, all insolation and related meteorological data, and energy production estimates if any, related to the Project.
- Title – The Project Company is in possession of and has good and marketable title to the Project free and clear of all liens and encumbrances, except for permitted liens which have been scheduled or liens which have been scheduled and bonded to Buyer’s satisfaction. Seller has good and marketable title to the Interests, free and clear of all liens and encumbrances. Seller

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and its affiliates have no legal obligation to, or non-binding agreement in principle with any other person, to sell or affect a sale of all, or any portion of, the Project or the Project Company.

- MAE – No “Material Adverse Effect” (as defined in the Agreement) has occurred.
- Financial Statements; No Undisclosed Liabilities – True and correct unaudited financial statements of the Project Company are attached to the Agreement and the same have been prepared in accordance with GAAP and present fairly the financial condition of the Project Company. There are no undisclosed liabilities other than those disclosed in the financial statements or included in the disclosure schedules.
- Taxes – Tax representation and warranties customary in a transaction of this nature, including without limitation relating to the federal investment tax credit and the federal production tax credit.
- Other representation and warranties customary in a transaction of this nature (including those pertaining to finders, intellectual property, studies and reports, bankruptcy/solvency, brokers, insurance, books and records, bank accounts, affiliate contracts, no subsidiaries, anti-corruption/OFAC and regulatory status) or that are required following Buyer’s due diligence review.

Other Agreements

- Interconnection. Seller shall be responsible for complying with all costs and requirements necessary to attain the final interconnection of the Project, including, but not limited to, all costs for the construction of any gen tie transmission line to insert substation/point of interconnection and any necessary network upgrade costs.
- Subject to limitations and conditions to be included in the Agreement, the parties will have the ability, and in certain cases the obligation, to update disclosure schedules for items arising between the Signing Date, the Firm Date, and Closing (each, an “Update”).
- Technology. The major equipment components of the Project shall be manufactured by top tier manufacturers acceptable to Buyer as specified in Buyer’s Technical Specifications.
- Buyer’s right to inspect. Buyer and Buyer’s authorized representatives shall have the right to inspect the work and to maintain personnel at the Project site for such purpose. Such inspection of any part of the work shall in no way relieve Seller of its obligations under the Agreement.
- Seller will cause the Project to satisfy (in accordance with the Internal Revenue Code and associated guidance) requirements that qualify the Project for the ITC or PTC at the full ITC level (30% in 2023 for facilities placed in service after 2021) or the full PTC rate (2.75 cents per kWh in 2023 for facilities placed in service after 2021, adjusted annually by Treasury and the IRS). Seller has qualified the project for the ITC or PTC using the following process: [Seller to provide detailed description of qualification method, any applicable adders, and whether and how construction began on or before January 28, 2023 or whether the prevailing wage and apprenticeship requirements are met.]
- At Seller’s cost, a legal opinion (the “Signing Opinion”) from tax counsel selected by Buyer and in form and substance acceptable to Buyer shall be delivered to Buyer prior to the Signing Date, which Signing Opinion shall speak to the tax benefits associated with the transactions contemplated by the Agreement accruing to Buyer upon or after the Closing, and must include, without limitation, an opinion that, under the rules, regulations, and other laws in effect as of the date of the Signing Opinion, the Project will, based on among other things, the representations

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made by Seller on the date the Signing Opinion is delivered, generate a [30%] ITC or [2.75 cents per kWh] PTC (including by qualifying for any applicable adders (such as the domestic content adder, the energy community adder, or the low-income adder) and by having begun construction, within the meaning of applicable IRS guidance, on or prior to January 28, 2023 or having met the applicable prevailing wage and apprenticeship requirements) and, assuming the Closing occurs, that Buyer will be able to claim such ITC or PTC upon the placed in service date of the Project in accordance with applicable law and tax rules.

- In addition to, and independent of any pass-through warranties from the panel, inverter, racking and monitoring equipment manufacturers, balance of plant contractor and other suppliers and subcontractors, Seller shall provide a full wrap project warranty of no less than two years in duration as to defects in materials, workmanship and title, quality of work and performance as intended as a solar photovoltaic energy generation system.
- Seller shall assume all risks arising from any change in its commodity prices and all changes associated with any change in law affecting Seller's Project costs including, but not limited to, changes in tariff rates.
- Seller shall be responsible for all taxes relating to the pre-Closing period and all transfer taxes and any sales, use or other taxes related to the purchase and sale of the Interests and any purchase or conveyance of real or personal property to the Project Company to be used in the Project.
- Buyer will not be required to close if the aggregate nameplate capacity of the Project is less than 95% of the Expected Nameplate Capacity (the "Minimum Capacity").
- Liquidated Damages:
 - Delay Damages: Seller shall make a per diem liquidated damages payment, in an amount of \$400/MW, for each day after a guaranteed substantial completion date that the Project has not achieved substantial completion, such delay damages ("Delay LDs") not to exceed an agreed percentage of the Purchase Price in the aggregate.
 - SCADA Infrastructure Delay Damages: Seller agrees that if SCADA Infrastructure Completion (definition to be agreed in the Agreement) is not achieved by [date TBD] ("Guaranteed SCADA Infrastructure Completion Date"), then Seller shall pay as liquidated damages to Buyer an amount equal to \$5,000.00 per day for each day after the Guaranteed SCADA Infrastructure Completion Date but prior to the date on which SCADA Infrastructure Completion is achieved ("SCADA Infrastructure Delay LDs").
 - Buy-Down Damages: If the Closing occurs and the aggregate nameplate capacity of the Project as of the Closing Date is equal to or greater than the Minimum Capacity but less than the Expected Nameplate Capacity, Seller will be required to pay liquidated damages ("Buy-Down LDs") in an amount per lost kW to be agreed in the Agreement.
 - Outside SC Date Damages: If the Closing occurs and the Project fails to achieve the Substantial Completion Date on or before [date TBD], Seller shall pay Buyer an amount equal to the net present value (using a discount rate corresponding to Buyer's then-current average weighted cost of capital) of the grossed-up pre-tax value of any resulting lost or delayed ITC or PTCs ("Outside SC Date LDs") and together with the Delay LDs, the SCADA Infrastructure Delay LDs and the Buy-Down LDs, the "Liquidated Damages").
- NERC Matters: Seller shall comply with the NERC Reliability Requirements applicable to generating projects during commissioning and up until the Closing Date and shall ensure the Project meets all NERC Reliability Requirements under the interconnection agreement. Seller shall maintain records required by NERC of such compliance actions and shall perform such

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other tasks and responsibilities as are set forth in Buyer's Technical Specifications. No later than fifteen (15) business days before Closing, Seller will provide Buyer current applicable compliance records related to the Project developed during testing or prior to Closing (such as test records, relay settings, energization and synchronization reporting activities, and voltage schedule). Seller will provide Buyer design documents required by NERC (such as the Reactive Power Report, Reactive Power Control design (for VAR-002 and to meet the Voltage Schedule), Facility Ratings, Coordination Studies, etc.) no later than 30 days before Closing.

- In the event of a dispute between the parties, the parties shall waive their right to a jury trial, with the losing party responsible for all legal fees associated with any claim. No other remediation, arbitration or resolution shall be provided for in the event of a dispute between Buyer and Seller.
- Governing law and venue shall be in accordance with the laws of the state of Minnesota, with any action arising out of or related to the transaction to be brought in a court located in Minneapolis, Minnesota.
- From and after the signing of the Agreement, Seller will not, and will cause its representatives and affiliates not to, initiate, solicit or respond to the submission of, or enter into any negotiations in respect of, any indication of interest, proposal or offer from any person or entity relating to any sale or other transfer of any material asset of, or any equity or debt interest in, the Project Company, including any response to a request for proposal, bid or similar request from any person or entity (including Buyer and its affiliates but excluding the transaction contemplated by the Agreement).

Termination Provisions; Termination Payment

The Agreement may be terminated upon written notice by the terminating party (as described below) in the event of certain occurrences, including without limitation:

- By Buyer if the Firm Date has not occurred by the Outside Firm Date, regardless of the reason for such failure, provided that Buyer is not in breach of the Agreement.
- By either party if the Closing has not occurred by the Outside Closing Date [date TBD], regardless of the reason for such termination, provided that the terminating party is not in breach of the Agreement.
- By either party if State Regulatory Approvals for the transaction are not obtained by the Outside Firm Date.
- By either party if applicable law or any order issued by, or any other action taken by, an authority restrains, enjoins, or otherwise prohibits the consummation of the transactions contemplated by the Agreement.
- By either party in the event of a material uncured breach or repudiation of the Agreement by the other party or, in the case of Seller, a material uncured breach or repudiation of the relevant guaranty or letter of credit by the provider of the Seller Credit Support.
- By Buyer in the event of abandonment of the Project by Seller or the Project Company.
- By either party if the other party or, in the case of Seller, the provider of the Seller Credit Support, suffers insolvency or bankruptcy.
- By Buyer if there is a change of control of Seller.
- By Buyer if Closing has occurred but the Substantial Completion Date has not occurred by [date TBD].

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- By Buyer if an Update from Seller has had or would reasonably be expected to have a Material Adverse Effect.

Termination Payment. Without limiting any other legal or contractual right or remedy available to Buyer (including Buyer's rights to Liquidated Damages under the Agreement that accrued prior to such termination), if the Agreement is terminated for any reason, Seller will pay to Buyer a termination payment (the "Termination Payment") in the indicated amount:

- if the Firm Date has not occurred and the termination occurs on or prior to the Outside Firm Date, an amount equal to \$75.00 multiplied by the number of kW in the Expected Nameplate Capacity;
- if the Closing has not occurred by the Outside Closing Date, an amount equal to \$125.00 multiplied by the number of kW in the Expected Nameplate Capacity;
- if the Closing has occurred but the Substantial Completion Date has not occurred by on or before [date TBD], and without duplication of Outside SC Date Damages described above that accrued prior to the termination, an amount equal to:
 - the net present value (using a discount rate corresponding to Buyer's then-current average weighted cost of capital) of the grossed-up pre-tax value of any resulting lost or delayed ITCs or PTCs; *plus*
 - an amount, which may be positive or negative, equal to Buyer's costs to achieve final completion of the Project *less* the remaining unpaid Purchase Price;

provided, that Seller shall have no obligation to make a Termination Payment if the termination is a result of (i) a material uncured breach or repudiation by Buyer; (ii) Buyer's failure to obtain State Regulatory Approvals by [date TBD], or (iii) Buyer's insolvency or bankruptcy.

Return of Progress Payments. In addition to any Termination Payment owing by Seller to Buyer, if the Agreement is terminated prior to Closing, Seller will repay to Buyer the aggregate amount of Progress Payments paid by Buyer as of such date.

Indemnification

From and after the Closing, each party shall indemnify and hold harmless the other party and its respective employees, representatives, officers, directors and agents from and against any and all damages arising out of any breach or violation of any representation, warranty, or covenant in the Agreement, or any liability not assumed as part of the Agreement. No claim for indemnification shall be brought against the indemnifying party until the total damages for which such party is liable exceeds in the aggregate a threshold amount of \$100,000, at which point indemnification may be sought for the full aggregate amount of damages, including those amounts that do not exceed the threshold. The aggregate damages to which the indemnified parties are entitled in respect of breaches or representations and warranties shall not exceed an amount equal to 30% of the Purchase Price (the "Indemnity Cap"). Such threshold and Indemnity Cap shall not apply to damages to the extent they arise from a party's fraud, willful misconduct or gross negligence or a breach of certain "fundamental" representations (as applicable to each party) such as corporate existence, power, authority, conflicts, title, land contracts, real property, environmental, intellectual property, brokers, subsidiaries, employee benefits, tax matters,

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or any liability not assumed as part of the Agreement. The aggregate damages to which the indemnified parties are entitled shall not exceed the Purchase Price. Such aggregate damages cap shall not apply to damages to the extent they arise from a party's fraud, willful misconduct or gross negligence or any liability not assumed as part of the Agreement.

Changes to Transaction Structure

The parties recognize that changes to the ITC or PTC or associated guidance may be made, or other incentives for solar energy generation may become available for U.S. federal income tax purposes, and that the parties may need to restructure the transaction in order for Buyer to be able to utilize and maximize such revised ITC, PTC, or other incentives. The parties agree that they will negotiate in good faith to restructure the transaction in a manner that will allow the parties to utilize any such revised ITC, PTC, or other incentives.

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*Seller to provide the information
Highlighted in yellow.*

Buyer

Northern States Power Company, a [Minnesota / Wisconsin] corporation (“Buyer”).

Seller

[Developer/Seller Name], a [Seller entity type and state of formation], acting on its own behalf and on behalf of [Project Company Name], a [Project Company entity type and state of formation] (the “Project Company”), its wholly owned subsidiary (“Seller”). Buyer will also require Seller Credit Support (as defined below).

Project and Project Site

The Company is developing the [Project Name] energy project (the “Project”) located in [County Name] County, [State], consisting of (i) an approximately [XX] MW_{AC} nameplate capacity (the “Expected Solar Nameplate Capacity”), integrated solar photovoltaic-powered electricity generating plant, with single-axis tracking design (the “Solar Facility”), (ii) a battery energy storage system (the “Storage Facility”) with a nameplate capacity of [XX] MW_{AC} and [XX] MWh (the “Expected Storage Nameplate Capacity”), (iii) the gen-tie transmission line (the “T-Line”) that will connect the Solar Facility and Storage Facility to the [relevant point of interconnection], and (iv) all facilities and other real property (including fee simple interests, easements, rights-of-way and other real property interests), personal property (including tangible and intangible) and other assets and rights in each case relating to the Solar Facility, the Storage Facility or the T-Line. The Project will be located at [describe site] (the “Project Site”).

Type of Transaction

The transaction will be structured as an entity acquisition. Subject to the other terms and conditions contained in a definitive purchase and sale agreement pertaining to the transaction (the “Agreement”), including that, the Solar Facility is Investment Tax Credit (“ITC”) qualified and Production Tax Credit (“PTC”) qualified, and the Storage Facility is ITC qualified, and the Project is mechanically complete, ready to be tested and placed in service (but has not yet been placed in service for U.S. federal income tax purposes) and free and clear of all encumbrances and liabilities, except for permitted encumbrances and specific assumed liabilities as defined in the Agreement (the consummation of such purchase and sale transaction, the “Closing”), on the transaction closing date (the “Closing Date”), Buyer shall purchase and Seller shall sell 100% of the ownership interests of the Project Company (the “Interests”). Notwithstanding the Closing, Seller would remain obligated after the Closing to perform the *Seller’s Work and Other Responsibilities* (described below) and all of its other obligations described in the Agreement.

Purchase Price and Payment Terms

The “Purchase Price,” which is not to exceed the sum of (x) [] per MW_{AC} of the nameplate capacity of the Solar Facility plus (y) [] per MW_{AC} of the nameplate capacity of the Storage Facility, will be paid by Buyer in two installments, one installment at Closing and one installment on the date (the “Substantial Completion Date”) upon which Seller has achieved an agreed set of “Substantial Completion CPs” (which Substantial Completion CPs shall include without limitation that the Project has been placed in service for U.S. federal income tax purposes in order to qualify for the ITCs and

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PTCs); provided, that Buyer will consider making Purchase Price installment payments (“Progress Payments”)¹ to Seller from and after the Firm Date (defined below) and prior to Closing upon Seller’s achievement (to Buyer’s satisfaction) of certain milestones specified in the Agreement (or, if later, a “payment not earlier than” date to be specified for each milestone). In no case would a Progress Payment be made if (a) Seller is in breach or default of its obligations under the Agreement, (b) the provider of the Seller Credit Support (as defined below) is in breach or default of its obligations under the relevant guaranty or letter of credit or (c) either Seller or the provider of the Seller Credit Support is suffering an insolvency or bankruptcy event. In no case will the amount of the Progress Payments made prior to the Substantial Completion Date exceed 80% of the total Purchase Price.

Buyer will be entitled to set off against a Purchase Price payment (including a Progress Payment) any amount then owed by Seller to Buyer under the Agreement, including, without limitation, any accrued and unpaid Liquidated Damages (as defined below).

Buyer will be entitled to withhold from the Purchase Price payment made on the Closing Date an amount equal to 150% of the amount sufficient to complete any Punch List Items (defined below) (collectively, the “Punch List Holdback Amount”). If Seller has not completed all Punch List Items within the period of time agreed to by the parties, Buyer will be entitled to permanently retain a portion of the Punch List Holdback Amount equal to the greater of (i) the portion of the Punch List Holdback Amount attributable to the uncompleted Punch List Items and (ii) fifty percent (50%) of the Punch List Holdback Amount.

Credit Support

On the date the Agreement is signed (“Signing Date”), Seller will be required to deliver to Buyer “Seller Credit Support” in the form of either (i) cash held by Buyer for Seller’s account (or pursuant to a third-party escrow arrangement acceptable to Buyer in its sole discretion and at Seller’s sole expense), (ii) a guaranty from a guarantor acceptable to Buyer in its sole discretion and in a pre-agreed form or a form otherwise acceptable to Buyer in its sole discretion, or (iii) a letter of credit from an issuer acceptable to Buyer in its sole discretion and in a pre-agreed form or a form otherwise acceptable to Buyer in its sole discretion. Seller will be required to maintain Seller Credit Support in the Seller Credit Support Amount from the Signing Date until the first to occur of (a) the pre-Closing termination of the Agreement (including the period following such termination until all resulting claims are satisfied in full) and (b) the date that is twenty-four (24) months after the Closing Date (plus an additional period of time until all remaining indemnity claims are satisfied in full).

At any point in time prior to the Closing Date, the “Seller Credit Support Amount” shall be equal to the aggregate Seller payment obligations Seller could have if the Agreement is terminated at that point in time, including without limitation the Termination Payment (as defined below), accrued and unpaid Liquidated Damages and the aggregate Progress Payments, if any, then paid by Buyer. For twenty-four (24) months from and after the Closing Date (plus an additional period of time until all remaining indemnity claims are satisfied in full), the Seller Credit Support Amount shall be equal to the Indemnity

¹ If Seller is interested in receiving Progress Payments, Seller’s bid forms must include a proposed schedule of Progress Payments for Buyer to consider.

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Cap (as defined below).

Conditions Precedent to the Firm Date

The Agreement shall provide for the satisfaction, on or prior to the Outside Firm Date (defined below) and in each case in form and substance acceptable to Buyer and at Seller's sole cost (except for costs of obtaining the State Regulatory Approvals, which shall be at Buyer's sole cost) certain conditions precedent ("Firm Date CPs," and the date all such Firm Date CPs have been satisfied or waived in writing by Buyer, the "Firm Date"). The Firm Date CPs will include, without limitation, that: (i) the State Regulatory Approvals have been obtained and are final, written, and non-appealable and in form and substance acceptable to Buyer in its sole discretion; (ii) all other required governmental approvals and permits (including without limitation the siting permit, environmental permits, and, if applicable, FERC approvals, approvals under the Hart-Scott-Rodino Antitrust Improvements Act of 1976, and any other permits necessary for the parties to consummate the transaction or for the Project Company to own, operate and maintain the Project) have been obtained and are final, written, non-appealable and in form and substance acceptable to Buyer in its sole discretion; (iii) Seller has obtained all land contracts (including that Seller shall obtain (x) amendments to the existing leases as needed to ensure that the lease payment provisions and other applicable terms provide for utility ownership, that the term of the leases is no shorter than the 35 years following construction of the Project and/or to address other matters reasonably required by Buyer, and (y) new lease agreements required for site setbacks or other requirements or otherwise reasonably required by Buyer) and otherwise secured full site control, including real estate rights required to interconnect the Project; (iv) Seller has obtained and delivered to Buyer title reports and title insurance commitments, and completed any curative work required by Buyer; (v) Seller has obtained and delivered to Buyer fully executed and enforceable agreements securing (A) the engineering, procurement and construction of the Project, including solar equipment, panels, batteries, power electronic systems, enclosures and other equipment necessary for the Project to generate and store electricity, and transmit such electricity upon command, (B) O&M services (if applicable), (C) letters of credit and guarantees, (D) all third-party reports and studies (including without limitation those relating to wildlife, environmental, tribal resource, cultural and historic preservation, geotechnical, archaeological, noise impact, solar energy resources, engineering and cost segregation) and related reliance letters, and (E) all required third-party estoppels (including with respect to each lease and other land contracts), required subordination, non-disturbance and attornment agreements and third-party consents; (vi) the design documents have been finalized; (vii) Seller has developed and delivered to Buyer the Decommissioning Plan (as defined below) in form and substance acceptable to Buyer; (viii) Buyer has received a bring down of the Signing Opinion (defined below) confirming the Signing Opinion as of the Firm Date and otherwise in form and substance acceptable to Buyer; and (ix) Seller has secured interconnection rights for the Project and obtained an effective interconnection agreement for the Project acceptable to Buyer. Seller will provide Buyer with evidence that the Firm Date CPs have been satisfied in accordance with the terms of the Agreement, and Buyer will have a stated period to object to whether the Firm Date CPs have in fact been so satisfied. The "Outside Firm Date" will be [date TBD].

Seller's Work and Other Responsibilities

Seller will be responsible, at its sole cost and expense, under the Agreement for all work required to achieve Project final completion, including with respect to the Project substation, O&M building, and all other integrated and operational infrastructure facilities, all radial transmission lines and other

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interconnection facilities required to deliver power from the electric grid to the Project and from the Project to **[insert]** substation/point of interconnection, and including without limitation the fully assembled, installed, tested and commercially operational solar photovoltaic panels, inverters, battery storage system, and related equipment, all in accordance with the applicable supply agreements, all manufacturer's warranties and the O&M agreement (if applicable), the applicable construction agreements, the Long-Term Services Agreement (if applicable), the interconnection agreement and the Agreement. All work shall be performed in accordance with prudent utility practices, prudent engineering practices, applicable law, applicable safety requirements, applicable permits, an agreed site plan, Seller's quality management plan, all manufacturer's warranties, specifications and recommendations, Buyer's policies and procedures governing electronic and physical access controls required by the North American Electric Reliability Corporation ("NERC") Critical Infrastructure Protection ("CIP") standards (if applicable), Buyer's Technical Specifications (to be provided by Buyer as part of the Agreement) that specify Buyer's standards and requirements for the design, construction, materials, equipment and supplies for certain aspects of the Project, and Seller's operating procedures for the operation of the Project (to be agreed upon by Buyer and Seller as part of the Agreement) (as defined below, the "Operating Guidelines"). Buyer and Buyer's authorized representatives shall have the right to inspect the work and to maintain personnel at the Project Site, including the entire Project footprint and point of interconnection, for such purpose. Seller will be responsible, at its sole cost and expense, under the Agreement for all work required to procure and deliver to Buyer the Decommissioning Contracts (as defined below). All such work shall be performed by Seller in consultation with and cooperation with Buyer and in a manner reasonably acceptable to Buyer, including that all resulting deliverables are in form and substance reasonably acceptable to Buyer (in each case, unless a higher Buyer approval standard is expressly otherwise provided for in the Agreement, in which case, such higher approval standard shall apply, or the deliverable is in substantially the form previously agreed to in writing by Buyer, including pre-agreed forms attached as exhibits to the Agreement, in which case such deliverables shall be deemed acceptable to Buyer).

Buyer may elect in its sole discretion to permit items of Seller's work required for final completion to be completed after Closing (such items, "Punch List Items"). For the avoidance of doubt, the foregoing obligations of Seller will continue after the Closing and Seller will remain responsible for all costs and expenses of completing the work, including those arising under any applicable supply and construction agreements.

Closing Conditions Precedent

The Agreement shall provide for the satisfaction, on or prior to the Closing, and in each case in form and substance acceptable to Buyer and at Seller's sole cost (except for costs of obtaining Buyer's regulatory approvals, which shall be at Buyer's sole cost) of certain conditions precedent ("Closing CPs"). The Closing CPs will include, without limitation, that: the Project has achieved mechanical completion; the Firm Date has been achieved; any applicable third-party and governmental approvals have been obtained as set forth below under *Required Approvals*; Seller has delivered to Buyer all final as-built drawings and related documentation, including all manufacturers' recommended operating and maintenance procedures required for maintenance of manufacturers' warranties; Seller has delivered to Buyer evidence that it has obtained and assigned to Buyer all manufacturers' warranties; Seller has delivered new or updated environmental reports, and no such reports identified any issues that are material and adverse to Buyer that were not identified in prior environmental reports delivered to Buyer; Seller has delivered to Buyer a

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complete and accurate list of all equipment, plant, machinery, installations, special tools, spare parts, supplies and other personal property owned by Seller included in the Project, excluding only those items which are immaterial and can be replaced in the ordinary course of business, and such list shall specifically indicate any such item of the Project which is not located on or at the Project Site and identify the location thereof; Seller has delivered to Buyer the Decommissioning Contracts in compliance with the Decommissioning Plan; all representations and warranties of Seller shall be true and correct in all respects; at the election of the Buyer, the Company and the LTSA Provider (as defined below) have entered into a Long-Term Services Agreement (as defined below); no event has occurred that has had or could reasonably be expected to have a material adverse effect, including any suit, action, dispute or other similar proceeding filed by any contractor, subcontractor, or other person against Seller, enjoining or limiting the transaction contemplated by the Agreement or the use or operation of the Project, or seeking to obtain damages or other relief in connection with the Agreement or any contracts to be transferred to Buyer under the Agreement; Seller has delivered to Buyer a claims statement identifying every dispute, suit, action or other proceeding that is pending, or threatened in writing, between Seller and any contractor or subcontractor connected with, or arising out of, the development and/or construction of the Project; and, if applicable, Seller or its operating personnel have completed all training requirements pertaining to the start-up, shut-down and operation of, and safety, general process understanding and emergency procedures for, the Project and all of its sub-systems, in accordance with the requirements of a training program to be prepared by Seller and approved by Buyer.

Required Approvals

The transactions contemplated hereby are subject to the execution and delivery of the Agreement and any ancillary agreements by the parties thereto and the obtaining of specified approvals, authorizations, or orders, including but not limited to the following (to the extent necessary):

- Approval of the board of directors of Buyer and the board of directors (or similar governing body) of Seller shall be obtained prior to execution of the Agreement.
- Third party consents.
- Governmental and regulatory approvals or consents necessary (as determined by Buyer in its sole discretion) from any state agencies or commissions regulating utility activities, each of which approval or consent shall have been obtained by Buyer and final, written, non-appealable and in form and substance acceptable to Buyer in its sole discretion (collectively, the “State Regulatory Approvals”).
- Applicable governmental and regulatory approvals, permits, licenses, etc. from any other government agencies having approval, consent or authority over Buyer or Seller or the transactions contemplated by the Agreement (e.g., the FAA, DOD, US Fish and Wildlife Service). Each of which approval or consent shall have been obtained and be final, written, non-appealable and in form and substance acceptable to Buyer in its sole discretion.

Seller’s Closing Deliverables

Upon the terms and conditions to be defined within the Agreement, the obligations of Buyer to consummate the transactions contemplated are subject to the satisfaction by Seller of certain conditions as of the Closing Date, in each case in a manner reasonably acceptable to Buyer, including that all resulting deliverables are in form and substance reasonably acceptable to Buyer (unless a higher Buyer approval

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standard is expressly otherwise provided for in the Agreement, in which case, such higher approval standard shall apply, or the deliverable is in substantially the form previously agreed to in writing by Buyer, including pre-agreed forms attached as exhibits to the Agreement, in which case such deliverables shall be deemed acceptable to Buyer), including, but not limited to:

- Achievement of the Firm Date.
- The transfer of all of the ownership interests in the assets relating to the Project, including without limitation those necessary for the commercial operation of the Project, to the Project Company.
- Certification that the Project has achieved project mechanical completion in accordance with the terms of the Agreement.
- Buyer's receipt, at Seller's sole cost, of a bring down of the Signing Opinion confirming the Signing Opinion as of the Closing Date and otherwise in form and substance acceptable to Buyer in its sole discretion.
- The delivery to Buyer of evidence that any liens on the Project Company, Interests, Project real property or any other assets or interests of the Project Company have been removed as of the Closing other than permitted liens which have been scheduled or liens which have been scheduled and bonded to Buyer's satisfaction.
- Seller has obtained all certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Seller pertaining to the Closing.
- Seller has delivered the title insurance commitment and title policy (premium to be paid by Seller on or before the Closing Date).

Buyer's Closing Deliverables

Upon the terms and conditions to be defined within the Agreement, the obligations of Seller to consummate the transactions contemplated are subject to the satisfaction by Buyer of certain conditions as of the Closing Date, in each case, to Seller's reasonable satisfaction, including:

- Delivery of the Purchase Price or any remaining portion thereof, subject to certain adjustments contemplated in the Agreement.
- Buyer has obtained all certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Buyer pertaining to the Closing.

Pre-COD Test

The "Pre-COD Test" shall measure at the point of delivery, among other things, the Project's grid charging capability, maximum charging rates, maximum discharging rates, minimum charging time, minimum discharging time, storage capacity, round-trip efficiency, ability to communicate with Buyer using Buyer's Supervisory Control and Data Acquisition ("SCADA") System, and other testing to be agreed by the Parties (including factory testing). Any failure to pass the Pre-COD Test will trigger Seller's obligation to complete the repairs needed to bring the Project into compliance with the pre-determined performance levels required to pass such test. Prior to performing any repair obligations, Seller may conduct a limited number of discretionary tests that Seller deems necessary for purposes of re-performing a required test.

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Long-Term Services Agreement

Buyer may elect to enter into a long-term services agreement for the Storage Facility with the supplier of the battery and battery enclosures or another third party acceptable to Buyer (which may include the Seller or an Affiliate of Seller) (the “LTSA Provider”) upon the terms set forth below (the “Long-Term Services Agreement”). If Buyer elects to enter into a Long-Term Services Agreement, the LTSA Provider shall provide the applicable operations and maintenance services (the “Services”) for an initial term of up to [] ten (10) years following the Closing. Thereafter, the Long-Term Services Agreement shall automatically renew in increments of five (5) years at the election of Buyer, up to three (3) times after the expiration of the initial term. The LTSA Provider shall provide the Services based upon (i) a fixed fee for certain work to be defined as in-scope; (ii) pre-agreed pricing for certain additional work that is outside of the scope but which Buyer may elect to purchase in its sole and absolute discretion; and (iii) cost-plus pricing for work not included in the preceding clauses (i) and (ii), which shall be subject to a mark-up of no more than 10% exclusive of equipment costs and focused on labor to cover, among other things, general and administrative and other overhead costs.

The Long-Term Services Agreement will (i) contain performance guarantees for the Project, as described further below, (ii) identify any Operating Limitations, as defined below, and (iii) address compliance with the NERC CIP standards (if applicable). The Long-Term Services Agreement will also contain terms and conditions related to the Services provided thereunder that are customary for the operation and maintenance of a solar generating plus battery energy storage system, subject to any necessary conforming changes to adjust for the applicable technology, the size, or the scope of the Project. The form of the Long-Term Services Agreement would be attached as an exhibit to the Agreement.

Performance Guaranties

The Long-Term Services Agreement shall specify the terms under which the parties will measure the performance of the Storage Facility’s battery energy storage system over the duration of the Agreement, which shall be dependent in part on the maturity of the battery storage technology used for the Storage Facility. Satisfactory performance will require the battery energy storage system to meet certain guaranteed performance criteria (the “Guaranteed Performance Levels”), which measurements shall be obtained through periodic testing, on an annual basis, or more frequently if requested by Buyer, of the following:

- Guaranteed Round Trip Efficiency;
- Guaranteed Storage Capacity;
- Self-Discharge Rate;
- Guaranteed Minimum Charging Time;
- Guaranteed Maximum Charging Rate;
- Guaranteed Minimum Discharging Time;
- Guaranteed Maximum Discharging Rate;
- Maximum Ramp Rate;
- Guaranteed Response Time; and
- [Others TBD].

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The LTSA Provider shall agree to maintain the Storage Facility such that it is capable of maintaining a base level of storage capacity of no less than [] MWh during the term of the Long-Term Services Agreement, [and to augment the battery energy storage system prior to the time the level of storage capacity falls below [] MWh].

The parties to the Long-Term Services Agreement will agree that the Performance Guaranties will be contingent upon the Project being operated, scheduled, and dispatched in accordance with the “Operating Limitations,” which shall specify the Project’s operating requirements and limitations.

The Operating Limitations shall, at a minimum, address the following regarding the operation of the Storage Facility: [maximum annual state of charge (averaged);] maximum number of annual equivalent cycles, which shall not be below [] equivalent cycles per year; [others TBD]; and the potential cost impact if Buyer were to exceed any of these limitations.

With respect to the Storage Facility’s maximum number of annual equivalent cycles, the Operating Limitations shall allow Buyer the flexibility to defer or extend a portion of the cycles allocated to a given operating year, such that (i) if Buyer does not use all of its cycles at the end of an operating year, Buyer may transfer up to [] cycles to the subsequent operating year, or (ii) if Buyer uses all of its cycles prior to the end of an operating year, Buyer may add up to [] cycles that are allocated to the subsequent operating year.

In addition, by no later than 90 days prior to the Closing Date, the parties shall develop “Operating Guidelines” to specify the parameters for the operation of the Project, such as operation modes for specific functionality (e.g., frequency response); set-points and limitations for each operating mode; scheduling parameters; the parties’ communication protocols; and the data points to be transmitted to Buyer’s SCADA. The parties agree that the Operating Guidelines can be reviewed annually to optimize operations for Buyer.

Solar, Battery, and Related Equipment Warranties

Seller shall not purchase or otherwise acquire any of the major equipment components or related materials or services from an entity that is not approved by Buyer as specified in the Buyer’s Technical Specifications without Buyer’s prior written consent (not to be unreasonably withheld or delayed).

Seller shall provide to Buyer a description of the terms and conditions of the equipment warranties that Seller shall obtain from the solar equipment, panels, battery, power conversion system, thermal management system, enclosure and monitoring equipment manufacturers, balance of plant contractor and other suppliers, contractors, and subcontractors, which shall include (i) a serial defect warranty with respect to the solar equipment, panels, batteries, battery enclosures, power conversion system, thermal management system, fire suppression and safety systems, and switchgear, medium voltage generator step-up transformers, and protection devices, and (ii) a lifetime warranty with respect to the Project control system. In addition, Seller shall provide a full wrap project warranty of no less than two (2) years in duration as to defects in materials, workmanship and title, quality of work and performance as intended as a solar generating plus battery energy storage system.

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If Buyer elects in its sole discretion not to enter into a Long-Term Services Agreement, Seller agrees to specify the base level of storage capacity the Storage Facility's battery energy storage system will sustain over its useful life.

To the extent a change in applicable law prohibits Seller's acquisition, importation, or installation of major equipment or associated software, firmware, and digital components that control the operation of such major equipment ("Prohibited Equipment"), Seller agrees to procure an equivalent or superior alternative to the Prohibited Equipment, subject to Buyer's approval.

Safety

Seller shall design and construct the Project in compliance with all applicable laws, codes, and standards that are applicable to the design of the Project and ensure that upon the Closing date the Project meets all such applicable laws, codes, and standards. Prior to the Closing date, Seller will provide Buyer with an independent registered professional engineer's certification stating that the Project has been mechanically completed in all material respects (including compliance with all applicable laws, codes, and standards). Only non-occupiable battery energy storage system enclosures shall be considered. Seller shall have the battery energy storage system enclosures certified to UL 9540. Seller shall design, construct, and install the Project under the guidance of NFPA 855 and shall comply with all applicable portions of that standard. Seller shall also complete first responder training for its and Buyer's operating personnel as well as any local first responders, which training shall be reconducted on a periodic basis.

Prior to the Closing date, Seller will also provide the following additional documents: all schematics, drawings, and other documentation needed for developing lock out-tag out procedures and performing hazard assessments of the facility, site level emergency response plans, and system operations training manual.

Representations and Warranties

The transaction is subject to customary representations and warranties to be made by Buyer and Seller as of the Signing Date, the Firm Date, and the Closing Date, including without limitation:

- Corporate existence and powers – Seller is a [corporation] validly existing and in good standing and has the power and authority to conduct its business as now conducted.
- Company existence and powers – the Project Company is a limited liability company validly existing and in good standing and has the power and authority to develop, construct, operate and own the Project and has been engaged in no other business since its formation.
- Authority (execution and delivery and performance of obligations).
- No conflicts - the transaction does not create any conflicts.
- Consents and approvals – no consent, approval or authorization is required in connection with the execution and performance of the Agreement.
- Legal proceedings of Buyer – there are no legal proceedings pending, or to Buyer's knowledge, threatened, against Buyer, that affect the consummation of the transaction contemplated by the Agreement.

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- Legal proceedings of Seller and the Project Company – there are no legal proceedings pending, or to Seller’s knowledge, threatened, against (i) Seller relating to the Project or affecting Seller’s ability to sell the Project Company or (ii) the Project Company or the Project.
- Compliance with Laws – Seller and the Project Company are in compliance with all laws applicable to Seller, the Project Company, the Project and the transactions contemplated by the Agreement.
- Environmental – Seller and its affiliates have no environmental liabilities relating to the Project. The Project Company has no environmental liabilities. Seller and its affiliates have been, and are in, compliance with environmental requirements relating to the Project. The Project Company has been, and is in, compliance with environmental requirements. Seller and its affiliates have not received any notice of an actual or alleged violation of environmental law relating to the Project Company or the Project from any governmental entity. There are no facts, circumstances, conditions or occurrences relating to the Project Company or the Project that could reasonably be expected to form the basis of a claim, requirement or obligation imposed by any governmental entity under any environmental law on Seller or its affiliates.
- Contracts – Schedule of contracts (i) binding on the Project Company, (ii) binding on Seller that relate to the Project, or (iii) to which the Project is subject or bound, and Seller has furnished to Buyer true, correct and complete copies of all such contracts. There is no, and has not been any, material breach or material default (including inchoate breaches and defaults) by the Seller or its affiliates, or, to Seller’s knowledge, by any other party to any schedule Contract.
- Real Property Agreements – The Real Property Agreements are in full force and effect, and shall, as of the Closing, comprise all of the real property interests necessary in connection with the acquisition, siting, development, construction, installation, interconnection, completion, ownership and operation of the Project, all in accordance with all laws, and are sufficient to enable the Project to be commercially operable as contemplated in the Agreement, including without limitation legal and physical ingress and egress rights to and from public rights-of-way. There is no, and has not been any, material breach or material default (including inchoate breaches and defaults) by the Seller or its affiliates, or, to Seller’s knowledge, by any other party to any Real Property Agreement.
- Permits - All permits required to develop, construct, own, and attain commercial operation of the Project are held by the Project Company, are written, final and non-appealable, are scheduled, and Seller has obtained and furnished to Buyer true, correct and complete copies of such permits. Such permits are in full force and effect and are legal, valid, binding and enforceable in accordance with their respective terms. The Seller and the Project Company are in compliance with all permits.
- Solar Data – Seller has delivered to buyer true, correct and complete copies of all solar data, all insolation and related meteorological data, and energy production estimates, if any, related to the Project.
- Title – The Project Company is in possession of and has good and marketable title to the Project free and clear of all liens and encumbrances, except for permitted liens which have been scheduled or liens which have been scheduled and bonded to Buyer’s satisfaction. Seller has good and marketable title to the Interests, free and clear of all liens and encumbrances. Seller

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and its affiliates have no legal obligation to, or non-binding agreement in principle with any other person, to sell or affect a sale of all, or any portion of, the Project or the Project Company.

- MAE – No “Material Adverse Effect” (as defined in the Agreement) has occurred.
- Financial Statements; No Undisclosed Liabilities – True and correct unaudited financial statements of the Project Company are attached to the Agreement and the same have been prepared in accordance with GAAP and present fairly the financial condition of the Project Company. There are no undisclosed liabilities other than those disclosed in the financial statements or included in the disclosure schedules.
- Taxes – Tax representation and warranties customary in a transaction of this nature, including without limitation relating to the federal investment tax credit and the federal production tax credit.
- Other representation and warranties customary in a transaction of this nature (including those pertaining to finders, intellectual property, studies and reports, bankruptcy/solvency, brokers, insurance, books and records, bank accounts, affiliate contracts, no subsidiaries, anti-corruption/OFAC and regulatory status) or that are required following Buyer’s due diligence review.

Other Agreements

- Interconnection. Seller shall be responsible for complying with all costs and requirements necessary to attain the final interconnection of the Project, including, but not limited to, all costs for the construction of any radial transmission line to insert substation/point of interconnection and any necessary network upgrade costs.
- Subject to limitations and conditions to be included in the Agreement, the parties will have the ability, and in certain cases the obligation, to update disclosure schedules for items arising between the Signing Date, the Firm Date, and Closing (each, an “Update”).
- Technology. The major equipment components of the Project shall be manufactured by top tier manufacturers acceptable to Buyer or specified in the Buyer’s Technical Specifications.
- Buyer’s right to inspect. Buyer and Buyer’s authorized representatives shall have the right to inspect the work and to maintain personnel at the Project Site for such purpose. Such inspection of any part of the work shall in no way relieve Seller of its obligations under the Agreement.
- Seller will cause the Project to satisfy (in accordance with the Internal Revenue Code and associated guidance) requirements that qualify the Project for the ITC or PTC at the full ITC level (30% in 2023 for facilities placed in service after 2021) or the full PTC rate (2.75 cents per kWh in 2023 for facilities placed in service after 2021, adjusted annually by Treasury and the IRS). Seller has qualified the project for the ITC or PTC using the following process: [Seller to provide detailed description of qualification method, any applicable adders, and whether and how construction began on or before January 28, 2023 or whether the prevailing wage and apprenticeship requirements are met.]
- At Seller’s cost, a legal opinion (the “Signing Opinion”) from tax counsel selected by Buyer and in form and substance acceptable to Buyer shall be delivered to Buyer prior to the Signing Date, which Signing Opinion shall speak to the tax benefits associated with the transactions contemplated by the Agreement accruing to Buyer upon or after the Closing, and must include, without limitation, an opinion that, under the rules, regulations, and other laws in effect as of the

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date of the Signing Opinion, the Project will, based on among other things, the representations made by Seller on the date the Signing Opinion is delivered, generate a [30%] ITC or [2.75 cents per kWh] PTC (including by qualifying for any applicable adders (such as the domestic content adder, the energy community adder, or the low-income adder) and by having begun construction, within the meaning of applicable IRS guidance, on or prior to January 28, 2023 or having met the applicable prevailing wage and apprenticeship requirements) and, assuming the Closing occurs, that Buyer will be able to claim such ITC or PTC upon the placed in service date of the Project in accordance with applicable law and tax rules.

- In addition to, and independent of any pass-through warranties from the panel, battery, inverter, racking and monitoring equipment manufacturers, balance of plant contractor and other suppliers and subcontractors, Seller shall provide a full wrap project warranty of no less than two years in duration as to defects in materials, workmanship and title, quality of work and performance as intended as a solar photovoltaic energy generation system and battery energy storage system.
- Decommissioning. Seller shall be responsible for developing and implementing a plan for the decommissioning of the battery energy storage system and any related balance of plant (e.g., battery enclosures, power conversion system) in accordance with applicable law and the relevant permits and contracts (including relevant land contracts and equipment supply contracts (the “Decommissioning Plan”). The Decommissioning Plan will (x) address the end-of-life management of the battery energy storage system, including the dismantling, removal, transportation, and disposal of the batteries and any associated solid and hazardous waste and, if required, restoration of the Project Site (collectively, the “Decommissioning Requirements”), (y) specify the contract(s) (the “Decommissioning Contracts”) with the battery manufacturer, the LTSA Provider, a recycling facility, and/or other counterparties required to satisfy the Decommissioning Requirements and (z) summarize the material terms and conditions to be included in the Decommissioning Contracts.
- Seller shall assume all risks arising from any change in its commodity prices and all changes associated with any change in law affecting Seller’s Project costs including, but not limited to, changes in tariff rates.
- Seller shall be responsible for all taxes relating to the pre-Closing period and all transfer taxes and any sales, use or other taxes related to the purchase and sale of the Interests and any purchase or conveyance of real or personal property to the Project Company to be used in the Project.
- Buyer will not be required to close if (i) the nameplate capacity of the Solar Facility is less than 95% of the Expected Solar Nameplate Capacity, or (ii) the nameplate capacity of the Storage Facility is less than 100% of the Expected Storage Nameplate Capacity (the “Minimum Capacity”) or if the Storage Facility fails to pass the Pre-COD Test.
- Liquidated Damages:
 - o Delay Damages: Seller shall make a per diem liquidated damages payment, in an amount of \$400/MW, for each day after the guaranteed substantial completion date that the Project has not achieved the Substantial Completion Date, such delay damages (“Delay LDs”) not to exceed an agreed percentage of the Purchase Price in the aggregate.
 - o SCADA Infrastructure Delay Damages: Seller agrees that if SCADA Infrastructure Completion (definition to be agreed in the Agreement) is not achieved by [date TBD] (“Guaranteed SCADA Infrastructure Completion Date”), then Seller shall pay as

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liquidated damages to Buyer an amount equal to \$5,000.00 per day for each day after the Guaranteed SCADA Infrastructure Completion Date but prior to the date on which SCADA Infrastructure Completion is achieved (“SCADA Infrastructure Delay LDs”).

o Buy-Down Damages: If the Closing occurs and the aggregate nameplate capacity of the Solar Facility, as of the Closing Date is equal to or greater than the Minimum Capacity but less than the Expected Solar Nameplate Capacity, Seller will be required to pay liquidated damages (“Solar Facility Buy-Down LDs”) in an amount per lost kW to be agreed in the Agreement. If the Closing occurs and, as of the Substantial Completion Date, the round-trip efficiency measured by the Pre-COD Test is less than []%, Seller will be required to pay liquidated damages in an amount to be agreed in the Agreement (“Storage Facility Buy-Down LDs”).

o Outside SC Date Damages. If the Closing occurs and the Project fails to achieve the Substantial Completion Date on or before [date TBD], Seller shall pay Buyer an amount equal to the net present value (using a discount rate corresponding to Buyer’s then-current average weighted cost of capital) of the grossed-up pre-tax value of any resulting lost or delayed ITC or PTCs (“Outside SC Date LDs” and together with the Delay LDs, the SCADA Infrastructure Delay LDs, the Solar Facility Buy-Down LDs, and the Storage Facility Buy-Down LDs, the “Liquidated Damages”).

- NERC Matters: Seller shall comply with the NERC Reliability Requirements during commissioning and up until the Substantial Completion Date and shall ensure the Project meets all NERC Reliability Requirements under the interconnection agreement. Seller shall maintain records required by NERC of such compliance actions and shall perform such other tasks and responsibilities as are set forth in Buyer’s Technical Specifications. No later than fifteen (15) business days before the Closing, Seller will provide Buyer current applicable compliance records related to the Project developed during commissioning or prior to the Closing (such as test records, relay settings, energization and synchronization reporting activities, and voltage schedule). Seller will provide Buyer design documents required by NERC (such as the Reactive Power Report, Reactive Power Control Design for VAR-002 and to meet the Voltage Schedule) no later than 30 days before the Closing.
- In the event of a dispute between the parties, the parties shall waive their right to a jury trial, with the losing party responsible for all legal fees associated with any claim. No other remediation, arbitration or resolution shall be provided for in the event of a dispute between Buyer and Seller.
- Governing law and venue shall be in accordance with the laws of the state of Minnesota, with any action arising out of or related to the transaction to be brought in a court located in Minneapolis, Minnesota.
- From and after the signing of the Agreement, Seller will not, and will cause its representatives and affiliates not to, initiate, solicit or respond to the submission of, or enter into any negotiations in respect of, any indication of interest, proposal or offer from any person or entity relating to any sale or other transfer of any material asset of, or any equity or debt interest in, the Project Company, including any response to a request for proposal, bid or similar request from any person or entity (including Buyer and its affiliates but excluding the transaction contemplated by the Agreement).

Termination Provisions; Termination Payment

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TERM SHEET for the Purchase and Sale of a
Solar Photovoltaic Electric Generation Project and Battery Energy Storage System

The Agreement may be terminated upon written notice by the terminating party (as described below) in the event of certain occurrences, including without limitation:

- By Buyer if the Firm Date has not occurred by the Outside Firm Date, regardless of the reason for such failure, provided that Buyer is not in breach of the Agreement.
- By either party if the Closing has not occurred by the Outside Closing Date [date TBD], regardless of the reason for such termination, provided that the terminating party is not in breach of the Agreement.
- By either party if State Regulatory Approvals for the transaction are not obtained by the Outside Firm Date.
- By either party if applicable law or any order issued by, or any other action taken by, an authority restrains, enjoins, or otherwise prohibits the consummation of the transactions contemplated by the Agreement.
- By either party in the event of a material uncured breach or repudiation of the Agreement by the other party, or, in the case of Seller, a material uncured breach or repudiation of the relevant guaranty or letter of credit by the provider of the Seller Credit Support.
- By Buyer in the event of abandonment of the Project by Seller or the Project Company.
- By either party if the other party or, in the case of Seller, the provider of the Seller Credit Support, suffers insolvency or bankruptcy.
- By Buyer if there is a change of control of Seller.
- By Buyer if Closing has occurred but the Substantial Completion Date has not occurred by [date TBD].
- By Buyer if an Update from Seller has had or would reasonably be expected to have a Material Adverse Effect.

Termination Payment. Without limiting any other legal or contractual right or remedy available to Buyer (including Buyer's rights to Liquidated Damages under the Agreement that accrued prior to such termination), if the Agreement is terminated for any reason, Seller will pay to Buyer a termination payment (the "Termination Payment") in the indicated amount:

- if the Firm Date has not occurred and the termination occurs on or prior to the Outside Firm Date, an amount equal to \$75.00 multiplied by the sum of the number of kW in the Expected Solar Nameplate Capacity and the number of kW in the Expected Storage Nameplate Capacity;
- if the Closing has not occurred by the Outside Closing Date, an amount equal to \$125.00 multiplied by the sum of the number of kW in the Expected Solar Nameplate Capacity and the number of kW in the Expected Storage Nameplate Capacity; or
- if the Closing has occurred but the Substantial Completion Date has not occurred by on or before [date TBD], and without duplication of Outside SC Date Damages described above that accrued prior to the termination, an amount equal to:
 - the net present value (using a discount rate corresponding to Buyer's then-current average weighted cost of capital) of the grossed-up pre-tax value of any resulting lost or delayed ITCs or PTCs; plus

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TERM SHEET for the Purchase and Sale of a
Solar Photovoltaic Electric Generation Project and Battery Energy Storage System

- an amount, which may be positive or negative, equal to Buyer's costs to achieve final completion of the Project *less* the remaining unpaid Purchase Price.

provided, that Seller shall have no obligation to make a Termination Payment if the termination is a result of (i) a material uncured breach or repudiation by Buyer; (ii) Buyer's failure to obtain State Regulatory Approvals by [date TBD], or (iii) Buyer's insolvency or bankruptcy.

Return of Progress Payments. In addition to any Termination Payment owing by Seller to Buyer, if the Agreement is terminated prior to Closing, Seller will repay to Buyer the aggregate amount of Progress Payments paid by Buyer as of such date.

Indemnification

From and after the Closing, each party shall indemnify and hold harmless the other party and its respective employees, representatives, officers, directors and agents from and against any and all damages arising out of any breach or violation of any representation, warranty, or covenant in the Agreement, or any liability not assumed as part of the Agreement. No claim for indemnification shall be brought against the indemnifying party until the total damages for which such party is liable exceeds in the aggregate a threshold amount of \$100,000, at which point indemnification may be sought for the full aggregate amount of damages, including those amounts that do not exceed the threshold. The aggregate damages to which the indemnified parties are entitled in respect of breaches or representations and warranties shall not exceed an amount equal to 30% of the Purchase Price (the "Indemnity Cap"). Such threshold and Indemnity Cap shall not apply to damages to the extent they arise from a party's fraud, willful misconduct or gross negligence or a breach of certain "fundamental" representations (as applicable to each party) such as corporate existence, power, authority, conflicts, title, land contracts, real property, environmental, intellectual property, brokers, subsidiaries, employee benefits, tax matters, or any liability not assumed as part of the Agreement. The aggregate damages to which the indemnified parties are entitled shall not exceed the Purchase Price. Such aggregate damages cap shall not apply to damages to the extent they arise from a party's fraud, willful misconduct or gross negligence or any liability not assumed as part of the Agreement.

Changes to Transaction Structure

The parties recognize that changes to the ITC or PTC or associated guidance may be made, or other incentives for solar energy generation or energy storage may become available for U.S. federal income tax purposes, and that the parties may need to restructure the transaction in order for Buyer to be able to utilize and maximize such revised ITC or PTC or other incentives. The parties agree that they will negotiate in good faith to restructure the transaction in a manner that will allow the parties to utilize any such revised ITC, PTC or other incentives.

Northern States Power Company Storage Energy Purchase Agreement

[BATTERY]¹ STORAGE

ENERGY PURCHASE AGREEMENT

BETWEEN

NORTHERN STATES POWER COMPANY

AND

[REDACTED]



- [date] -

¹ **Note to Seller:** This form has been designed primarily for battery energy storage but can be adapted to accommodate other storage technologies.

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Northern States Power Company Storage Energy Purchase Agreement

**BATTERY STORAGE
ENERGY PURCHASE AGREEMENT
BETWEEN
NORTHERN STATES POWER COMPANY
AND
[REDACTED], LLC**

This Battery Storage Energy Purchase Agreement (this “PPA”) is made as of this [REDACTED] day of [REDACTED], 20[REDACTED] (“Effective Date”), by and between (i) Northern States Power Company, a [Minnesota or Wisconsin] corporation with a principal place of business at [414 Nicollet Mall, Minneapolis, MN 55401/1414 W Hamilton Ave, Eau Claire, WI 54701-7252] (“Company”), and (ii) [REDACTED], LLC, a [REDACTED] [limited liability company] with a principal place of business at [REDACTED] (“Seller”). Company and Seller are hereinafter referred to individually as a “Party” and collectively as the “Parties.”

WHEREAS Seller desires to develop, design, construct, interconnect, own, operate and maintain the Facility as defined herein; and

WHEREAS Seller desires to sell and deliver, and Company desires to accept and receive, certain products and services, including but not limited to the Energy (including all Environmental Attributes) and Ancillary Services delivered from the Facility to the Point of Delivery at the prices and on the terms and conditions set forth in this PPA.

NOW THEREFORE, in consideration of the mutual covenants herein contained, the sufficiency and adequacy of which are hereby acknowledged, the Parties agree to the following:

Article 1 - Rules of Interpretation

1.1 Interpretation.

(A) Capitalized terms listed in this PPA shall have the meanings set forth in Exhibit A - Definitions or as otherwise defined in this PPA, whether in the singular or the plural or in the present or past tense. Words not otherwise defined in this PPA shall (i) have meanings as commonly used in the English language, (ii) be given their generally accepted meaning consistent with Good Utility Practices, and (iii) be given their well-known and generally accepted technical or trade meanings.

(B) The following rules of interpretation shall apply: (1) The masculine shall include the feminine and neuter; (2) references to “Articles,” “Sections” or “Exhibits” shall be to articles, sections, or exhibits of this PPA except as the context may otherwise require; (3) all Exhibits are incorporated into this PPA (*provided, however*, that in the event of a conflict with the terms of this PPA, this PPA shall control); and (4) use of the words “include” or “including” or similar words shall be interpreted as “include without limitation” or “including, without limitation.”

Northern States Power Company Storage Energy Purchase Agreement

(C) This PPA was negotiated and prepared by both Parties with the advice and participation of counsel. None of the provisions hereof shall be construed against one Party on the ground that such Party is the author of this PPA or any part hereof.

(D) Unless specifically designated as DC, each reference to “MW” or “kW” herein shall be AC MW or AC kW, as applicable. “AC” means alternating electric current; “DC” means direct electric current.

1.2 Interpretation with Other Agreements.

(A) This PPA does not provide Seller authorization to interconnect the Facility or inject power into the Transmission Authority’s System. Seller shall contract for interconnection services in accordance with the applicable Transmission Tariff. Seller acknowledges that the Interconnection Agreement is/will be a separate contract and that (i) this PPA is not binding on the Transmission Authority, (ii) this PPA does not create any rights between Seller and the Transmission Authority, and (iii) the Interconnection Agreement does not modify the Parties’ rights and obligations under this PPA. The applicable Transmission Authority shall be deemed to be a separate and unaffiliated contracting party for purposes of this PPA, regardless of whether such Transmission Authority is Company or an Affiliate of Company.

(B) This PPA does not provide for the supply of retail power for purposes of operating the Facility, including start-up, shutdown, lighting, HVAC or any other purpose (“House Power”). For the avoidance of doubt, House Power expressly excludes any Charging Energy. Seller shall contract with the utility providing House Power to the Site (the “Local Provider”) for the supply of House Power. Seller acknowledges that (i) Seller must obtain House Power independently, (ii) this PPA is not binding on the Local Provider, (iii) this PPA does not create any rights between Seller and the Local Provider, and (iv) Seller’s contract for House Power does not affect the Parties’ rights and obligations under this PPA. For purposes of this PPA, the Local Provider shall be deemed to be a separate and unaffiliated contracting party regardless of whether the Local Provider is Company or an Affiliate of Company.

1.3 Good Faith and Fair Dealing. The Parties shall act reasonably and in accordance with the principles of good faith and fair dealing in the performance of this PPA. Unless expressly provided otherwise in this PPA, (a) when this PPA specifically references the consent, approval, or similar action by a Party, such consent or approval shall not be unreasonably withheld, conditioned or delayed, and (b) wherever this PPA specifically gives a Party a right to determine, require, specify or take similar action with respect to a matter, such determination, requirement, specification or similar action shall be Commercially Reasonable.

Article 2 - Term and Termination

2.1 This PPA shall become effective as of the date of its execution and shall remain in full force and effect until 11:59 pm on the last Day of the calendar month during

Northern States Power Company Storage Energy Purchase Agreement

which occurs the []th anniversary of the Commercial Operation Date (the “Scheduled Termination Date”), subject to early termination as provided in this PPA. Applicable provisions of this PPA shall continue in effect after termination to the extent necessary to (i) provide for final billings, payments and adjustments, (ii) enforce or complete the duties, obligations or responsibilities of the Parties (including under Section 12.1(B)-(E), Section 12.2(C), Section 12.3(B)-(C), Article 13 - and Article 17 - below), and (iii) address any remedies or indemnifications arising prior to termination.

Article 3 - Facility Description

3.1 Description. Seller shall construct, interconnect, own, operate, and maintain the Facility, as further described in Exhibit C - Facility Description and Site Maps. A scaled map that identifies the Site, the location of the Facility, the Battery Units, the Interconnection Point and Interconnection Facilities, the Point of Delivery, the Battery Storage System metering point and other important facilities, is included in Exhibit C - Facility Description and Site Maps.

3.2 General Design of the Facility.

(A) Seller shall design, construct, operate and maintain the Facility according to Good Utility Practices and the Interconnection Agreement.

(B) The Facility shall include all equipment specified in Exhibit C - Facility Description and Site Maps and otherwise necessary to fulfill Seller’s obligations under this PPA, including all equipment necessary (i) to meet the requirements of Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection and Exhibit O - Battery Storage System Operating Procedures, and (ii) to interconnect successfully with the Transmission Authority’s System for the delivery of Energy to the Point of Delivery.

(C) The Battery Storage System Nameplate Capacity shall be [] MW AC and [] MWh. Seller shall certify to Company the final actual Battery Storage System Nameplate Capacity promptly following COD.

Article 4 - Implementation

4.1 Project Development.

(A) Seller shall enter into and perform at its expense all contracts, including any equipment procurement contracts, required for (i) the engineering, procurement, construction, acquisition, manufacture, delivery and installation of the Facility, including any equipment procurement contracts, and (ii) the storage and delivery of Energy from the Facility (generally, the “Construction Contracts”) with qualified and experienced contractors. Upon written request by Company, Seller shall promptly provide copies of any or all Construction Contracts to Company. At Company’s sole discretion, Seller may also provide a memorandum of agreement executed by Seller and the contracting party related to a Construction Contract. Such memorandum of agreement shall set forth the basic terms of such contract, including the names of the parties thereto,

Northern States Power Company Storage Energy Purchase Agreement

the date of such contract, a summary of any products or services to be provided and other information reasonably sufficient for Company to determine that the Construction Contract contains those obligations necessary for Seller to satisfy the Construction Milestones. All Construction Contracts or memorandum of agreements obtained by Company shall be deemed Confidential Information subject to Section 20.18 below.

(B) In its efforts to achieve COD, Seller shall use Commercially Reasonable Efforts to achieve the milestones set forth in Exhibit B - Construction Milestones and shall notify Company promptly following achievement of each such Construction Milestone. In addition, Seller shall achieve each such milestone set forth in the table below (the "Critical Path Development Milestone") on or before the applicable deadline for achieving such Critical Path Development Milestone specified in the table below. Seller shall provide to Company, on or before the applicable deadline to achieve each Critical Path Development Milestone, evidence reasonably satisfactory to Company that the Critical Path Development Milestone has been achieved. Seller shall also provide any additional evidence reasonably requested by Company that the Critical Path Development Milestone has been achieved, including certifications from an officer of Seller.

Critical Path Development Milestone	To be completed no later than (completion deadline):
Acquisition of all Seller's Needed Permits required to construct the Facility	<i>[To be based on bid submission and RFP requirements]</i>
Execution of all Construction Contracts	<i>[To be based on bid submission and RFP requirements]</i>
Closing of project financing for the Facility or providing the Company with proof of financial capability to construct the Facility	<i>[To be based on bid submission and RFP requirements]</i>

If Seller anticipates a CPD Delay because it is unable, using Commercially Reasonable Efforts, to achieve any of the Critical Path Development Milestones by the applicable deadline, then Seller may extend the timeframe to achieve such Critical Path Development Milestones as set forth in Section 12.2(B) subject to the payment of Liquidated Delay Damages so long as the following conditions are satisfied:

1. At least thirty (30) Days prior to the applicable completion deadline set forth above, Seller shall submit to Company (a) a written description of the reason for the expected failure; and (b) a Recovery Plan for completing all necessary work to achieve completion of the missed Critical Path Development

Northern States Power Company Storage Energy Purchase Agreement

Milestone by a date certain (which plan may contemplate the payment of Liquidated Delay Damages).

2. Seller shall commence the work contemplated by the Recovery Plan within five (5) Days after submitting such Recovery Plan to Company.

3. Seller shall be solely responsible for any costs or expenses incurred by Seller as a result of the formulation and implementation of the Recovery Plan.

Nothing in this Section 4.1(B) shall be construed to: (i) relieve Seller of its obligations under this PPA; (ii) modify the deadlines for achieving the remaining Critical Path Development Milestones, including the Target COD, as applicable (except for the update to the milestone schedule pursuant to Section 12.2(B) and the missed Critical Path Development Milestone which Seller is attempting to cure under this Section 4.1(B) or (iii) extend the applicable cure period set forth in Section 12.2(B) or impair the Company's right to terminate this PPA pursuant to Section 12.2(C). For clarity, failure to cure a CPD Delay within the applicable cure period set forth in Section 12.2(B) shall be subject to termination as set forth in Section 12.2(C).

(C) Prior to the Commercial Operation Date, Seller shall (i) submit monthly progress reports to Company in a form agreed to by the Parties, advising Company of the current status of each Construction Milestone and Critical Path Development Milestone, any significant developments or delays (along with an action plan for making up delays), and Seller's best estimate of the Commercial Operation Date; (ii) provide copies of reports submitted to the Facility Lender relating to status, progress and development of the Facility, and (iii) invite Company to participate in monthly meetings to discuss the progress reports, answer questions, and assess the schedule. Seller shall make all relevant counterparties under the Construction Contracts available to Company, upon request, in order to keep Company fully informed on the status of development.

(D) Upon request, Company shall have the right to monitor the construction, start-up, testing, and operation of the Facility at the Site to verify compliance with this PPA, *provided, however*, that Company shall comply with all of Seller's applicable safety and health rules and requirements.

(E) Neither Company's review of any Construction Contracts, memoranda thereof and Seller's reports, nor its discussions with Seller and its contractors, nor its monitoring of development and construction of the Facility, shall be construed as an endorsement by Company of the design, engineering, construction or testing thereof nor as any express or implied warranty as to the performance, safety, durability, or reliability of the Facility.

4.2 Environmental Matters.

Northern States Power Company Storage Energy Purchase Agreement

(A) No later than sixty (60) Days following PUC Approval, Seller shall complete and provide to Company a valid and comprehensive independent “Phase I” environmental site assessment of the Site that is conducted in compliance with ASTM E1527-21 or E2247-16, as applicable (including associated raw data, if requested by Company), which report shall have been prepared within a reasonably proximate time such that it reflects the then-current conditions of the Site. Seller shall notify Company promptly (i) if (and to what extent) any Environmental Contamination on the Site will preclude or interfere with Seller’s ability to perform its obligations under this PPA, and (ii) Seller’s plan for remediation thereof that would allow Seller to perform under this PPA as and when due. The Phase I report delivered to Company under this paragraph shall be deemed Confidential Information for purposes of Section 20.18.

(B) Throughout the Term, Seller promptly shall

1. disclose to Company and remediate, at Seller’s sole cost and expense, any Environmental Contamination identified at the Site;
2. provide to Company copies of any further environmental assessments or investigations of the Site (including associated raw data, if requested by Company); and
3. disclose to Company the existence of any enforcement, legal, or regulatory action or proceeding relating to any alleged presence of Environmental Contamination and/or the alleged violation of any Applicable Law related to protection of human health, the environment, or natural resources, including protected species.

(C) For purposes hereof:

1. “Environmental Contamination” means the introduction or presence of Hazardous Materials at such levels, quantities or location, or of such form or character, that (i) requires remediation under Applicable Law, (ii) presents a material risk that the Site will not be available or usable for the purposes contemplated by this PPA, and/or (iii) will preclude or interfere with Seller’s ability to perform its obligations under this PPA as and when due.
2. “Hazardous Materials” means any substance, contaminant, chemical, material, gas, or particulate matter that is regulated by any Governmental Authority as an environmental pollutant or which is deemed or may be deemed hazardous, dangerous, damaging or toxic to public health, public welfare, or the natural environment (including protection of non-human forms of life, land, water, groundwater, and air), including any material or substance that is (i) defined as “toxic,” “polluting,” “hazardous waste,” “hazardous material,” “hazardous substance,” “extremely hazardous waste,” “solid waste” or “restricted hazardous waste” under any provision of Applicable Law; (ii) petroleum, including any fraction, derivative or additive; (iii) asbestos; (iv) polychlorinated biphenyls; (v) per- and polyfluoroalkyl substances; (vi) radioactive material; (vii) designated as

Northern States Power Company Storage Energy Purchase Agreement

a “hazardous substance” pursuant to the Clean Water Act, 33 U.S.C. §1251 *et seq.* (33 U.S.C. §1251); (viii) defined as a “hazardous waste” pursuant to the Resource Conservation and Recovery Act, 42 U.S.C. §6901 *et seq.* (42 U.S.C. §6901); (ix) defined as a “hazardous substance” pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §9601 *et seq.* (42 U.S.C. §9601); (x) defined as a “chemical substance” under the Toxic Substances Control Act, 15 U.S.C. §2601 *et seq.* (15 U.S.C. §2601); or (xi) defined as a pesticide under the Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. §136 *et seq.* (7 U.S.C. §136).

4.3 Permits.

(A) Seller shall obtain and pay for all Permits necessary under Applicable Law or advisable pursuant to Good Utility Practices for the construction, ownership, operation and maintenance of the Facility and the charging and delivery of the products and services required by this PPA. Seller shall keep Company informed as to the status of its permitting efforts and shall provide Company the opportunity to review and comment on major applications for draft and final Permits. Seller shall promptly inform Company of (i) any Permits that Seller is unable to obtain, which are delayed, limited, suspended, terminated or otherwise constrained, along with a statement of whether and to what extent this circumstance may limit or preclude Seller’s ability to perform under this PPA, and (ii) Seller’s plan to overcome such issue(s) to allow Seller to perform this PPA as and when due. Company shall have the right to inspect and obtain copies of all Permits held by Seller.

(B) Seller represents and warrants to Company that, (i) except for those Permits identified in Exhibit F - Seller’s Needed Permits (each of which Seller anticipates will be obtained by Seller in the ordinary course of business), all Permits and other actions required or recommended by applicable Governmental Authorities to authorize Seller’s execution, delivery and performance of this PPA have been duly obtained and are in full force and effect; (ii) no event has occurred which allows, or after notice of lapse of time would allow, revocation or termination by the issuer thereof or which results in any other material impairment of the rights of the holder of any such Permit; and (iii) Seller has no reason to believe that any Governmental Authority is considering limiting, suspending or revoking any such Permit.

(C) Throughout the Term, Seller shall promptly disclose to Company the existence of any enforcement, legal, or regulatory action or proceeding relating to the alleged violation of any Permit held by Seller, which proceeding (if successful) could materially interfere with Seller’s performance of this PPA.

(D) For purposes hereof, “Permits” means all applicable licenses, permits, certificates of authority, authorizations, approvals, registrations, and similar consents and orders issued or granted by a Governmental Authority for construction, ownership, operation and maintenance of the Facility and the charging and delivery of Energy therefrom.

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4.4 Safety Requirements; Governmental Inspections. Seller shall, and shall cause its Affiliates and contractors to, design and construct the Facility and conduct all work or cause all work in connection therewith to be conducted in accordance with Exhibit P - Safety Requirements. Seller shall, and shall cause its Affiliates and contractors to, take all actions to comply with Exhibit P - Safety Requirements. Seller shall notify Company (i) sufficiently in advance of any known upcoming significant inspections by any Governmental Authority relating to the Facility, to allow Company the opportunity to attend, and (ii) promptly after any unscheduled or impromptu inspection with a description of the nature and outcome of such inspection.

4.5 Commercial Operation.

(A) Seller shall cause COD to occur no later than [REDACTED], 20[REDACTED] (the “Target COD”). Company shall not be obligated to accept and establish a Commercial Operation Date earlier than [REDACTED], 20[REDACTED] (*insert date that is [90] days prior to Target COD*).

(B) Seller shall notify Company of the date on which Seller believes the Facility has achieved Commercial Operation in writing (a “COD Notice”). A COD Notice shall include all necessary supporting documentation of the satisfaction or occurrence of all COD Conditions. Company shall have ten (10) Business Days to review a COD Notice and raise any Commercially Reasonable objection to Seller’s satisfaction of any of the COD Conditions, *provided, however*, that Seller’s COD Notice shall be deemed accepted by Company if Company fails to object within such time period. Seller may notify Company of completion of one or more COD Conditions on an individual and incremental basis prior to COD, *provided, however*, that Company shall in all cases have up to ten (10) Business Days to review and object to each such notice.

(C) For purposes hereof, the “Commercial Operation Date” or “COD” means 12:01 am on the Day after which Seller’s COD Notice has been accepted by Company or deemed accepted by Company pursuant to Section 4.5(B); and

1. the “COD Conditions” are:

a. an officer of Seller, authorized to bind Seller and who is familiar with the Facility, has confirmed in writing that (1) all necessary and material Permits have been obtained, are in full force and effect, and the entity granting the Permit has not placed any temporary or conditional restrictions or limitations on the Facility or its operation (2) Seller is in compliance with this PPA in all material respects, (3) Seller has made all necessary arrangements to obtain and pay the Local Provider for House Power, and (4) the Facility is available to commence normal operations in accordance with Seller’s operating agreements, Construction Contracts, and applicable manufacturers’ warranties;

b. Seller has proven to Company’s reasonable satisfaction that (1) Seller and the Transmission Authority have executed

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the Interconnection Agreement, and Seller has received no notice of breach thereof from the Transmission Authority, (2) the Facility is interconnected to the Transmission Authority's System, and has been fully tested, achieved initial synchronization, and been successfully operated at charging and dispatch levels acceptable to the Transmission Authority, without experiencing any abnormal or unsafe operating conditions on any interconnected system (3) Seller has or is capable of declaring commercial operation under the Interconnection Agreement and (4) Seller has made all other arrangements necessary to deliver Energy during the Term;

c. Seller has obtained and provided to Company an independent registered professional engineer's certification stating that the Facility has been completed in all material respects, except for "punch list" items that do not have a Material Adverse Effect on the ability of the Facility to operate for its intended purpose and are not required for the safe operation of the Facility or otherwise affect the capacity, efficiency, reliability, operability, safety or mechanical or electrical integrity of the Facility;

d. Seller has demonstrated the functionality and reliability of the Facility's communications systems and AGC interface with Company's EMCC, the capability of the Facility to receive and respond to signals from Company's SCADA System;

e. Seller has successfully completed a Commercial Operation Test in accordance with Section 5.6(A);

f. Battery Units comprising one hundred percent (100%) of the Battery Storage System Nameplate Capacity planned for the Facility, and associated equipment sufficient to allow such Battery Units to store Charging Energy and deliver Discharging Energy to the Point of Delivery, have been installed and become operable;

g. Seller has demonstrated the accuracy and reliability of the Real Time Data required by Section 10.7 and completed a comprehensive check of the AGC data points to be sent from Seller to Company via the SCADA System to the Company's satisfaction, all in accordance with Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection;

h. Seller has demonstrated the accuracy of the Electric Metering Devices and their ability to communicate with the Company in accordance with Exhibit R - Meter and Communications Requirements;

i. Seller has demonstrated the ability to fulfill the forecasting requirements including the usage of the availability forecast

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system as described in Exhibit O - Battery Storage System Operating Procedures;

j. Seller has executed and delivered to Company all documents or instruments required under Article 16 -

k. Seller has provided to Company all documentation submitted consistent with Exhibit P - Safety Requirements; and

l. Seller has provided evidence reasonably satisfactory to Company that it is compliant with and has adopted and implemented the appropriate policies pertaining to, the Forced Labor Laws consistent with Section 15.2(B). Seller shall also provide any additional evidence or certifications reasonably requested by Company that the requirements of this subsection have been met, including certifications from an officer of Seller or third-parties, certificates of origin documentation or importer statements.

m. an officer of Seller, authorized to bind Seller and who is familiar with the Facility, shall certify in writing that all Construction Craft Employees were covered by a collective bargaining agreement with a union affiliated with the local council of North America's Building Trades Unions ("Building Trades CBA"). If Seller cannot provide such certification as to a specified portion of the work, then an officer of Seller, authorized to bind Seller and who is familiar with the Facility shall certify in writing that Seller met and conferred, in good faith, with the local council of North America's Building Trades Unions and attempted to find and hire those trade(s) of Construction Craft Employee(s) covered by a Building Trades CBA for that portion of the work, and, if such Construction Craft Employee(s) covered by a Building Trades CBA were not available, that Seller (or Seller's construction contractor) entered into a site-specific building trades collective bargaining agreement covering that portion of the work.

(D) Prior to COD, should Seller require Company's assistance in meeting the COD Conditions because the Transmission Authority considers Company to be the market participant for the Facility, Company shall use Commercially Reasonable Efforts to cooperate with and provide assistance to Seller, so long as Seller provides any security the Transmission Authority requires and reimburses Company for all expenses, including fees of counsel, Company may incur in providing such cooperation and assistance.

(E) For purposes hereof, the first "Commercial Operation Year" shall mean the period starting at 12:01 a.m. on the Commercial Operation Date and ending at 11:59 pm on the last Day of the calendar month in which the first anniversary of COD occurs, and each successive "Commercial Operation Year" shall mean the 12-month period following the prior Commercial Operation Year. The Annual Throughput Limit [**bid-specific - may be n/a**] for the first Commercial Operation Year shall be prorated to reflect

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the number of Days by which the first Commercial Operation Year exceeds three hundred sixty-five (365) Days.

4.6 Pre-COD Testing.

(A) Seller shall provide Company and Transmission Authority with the information necessary to have the Facility registered with the Transmission Authority for inclusion in any generation and energy storage modeling maintained by the Transmission Authority, sufficiently in advance to allow the Facility to be registered in such model at least **four (4) months [six (6) months if Transmission Owner is not NSP]** prior to dispatching any Pre-COD Test Energy. Company shall cooperate reasonably to assist in the registration of the Facility to allow dispatch of Test Energy.

(B) Seller shall coordinate the receipt and delivery of Test Energy with Company, with not less than seven (7) Business Days' prior written notice, or such other Commercially Reasonable prior written notice as Company may reasonably request. Company shall provide all Test Energy required to charge the Battery Storage System, and Discharging Energy from the Facility derived from such Test Energy shall be treated as dispatched by the Company hereunder. Company shall reasonably cooperate with Seller to provide such Test Energy at a time that will mitigate the costs of such Energy (including, if requested by Seller, by providing Seller with projections of the Charging Energy Price), and Seller shall reimburse Company for the cost of the Test Energy (based on the Charging Energy Price at the time of charging) to the extent that it exceeds the cost of the Discharging Energy discharged by the Battery Storage System derived from such Test Energy (based on the Discharging Energy Price at the time of discharging).

(C) For purposes hereof, "Test Energy" means all Charging Energy stored by the Facility prior to COD that is required to satisfy the COD Conditions, or as otherwise determined by the Company in the exercise of its reasonable discretion.

Article 5 - Delivery and Testing

5.1 Arrangements.

(A) Seller shall be responsible for arranging, maintaining and paying the costs associated with the interconnection of the Facility to the Transmission Authority's System. Seller shall comply with the Transmission Authority's requirements for interconnection and shall comply with all requirements set forth in the applicable Transmission Tariff.

(B) Seller's interconnection application shall request that the Transmission Authority study the Facility for Network Resource Interconnection Service under the Transmission Tariff. The resulting Interconnection Agreement must be Network Resource Interconnection Service.

(C) Seller hereby authorizes Company to contact, discuss and obtain information concerning the Facility and the Interconnection Facilities directly with/from the

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Transmission Authority. Promptly upon request by Company, Seller shall confirm such authorization in writing to the Transmission Authority and any applicable transmission owners in such form as may be requested by Company or the Transmission Authority.

(D) To the extent required, Company shall arrange and be responsible for scheduling and transmission services beyond the Point of Delivery with respect to the output of the Facility. To the extent applicable, Company shall be the market participant with respect to the output of the Facility, as defined by the Transmission Authority.

(E) Seller shall be responsible for all interconnection, electric losses, transmission and ancillary service arrangements and costs required to deliver Discharging Energy. Company shall be responsible for all electrical losses, transmission and ancillary service arrangements and costs required to transmit and deliver Discharging Energy beyond the Point of Delivery.

5.2 Charging Requirements

(A) Company shall be responsible for arranging, managing, purchasing, and scheduling all of the Charging Energy for the Battery Storage System in accordance with the terms of Sections 7.2 and 7.3 and Exhibit O - Battery Storage System Operating Procedures. Company will be responsible for delivering Charging Energy at the Point of Delivery, and Seller shall be responsible for accepting and transferring Charging Energy from the Point of Delivery to the Battery Storage System. Seller shall be responsible for delivering all Discharging Energy up to the Point of Delivery. Company shall be responsible for accepting and transferring all Discharging Energy at and from the Point of Delivery.

(B) Seller shall take any and all action necessary to allow the delivery of Charging Energy to the Battery Storage System in accordance with the terms of this PPA, including maintenance, repair or replacement of equipment in Seller's possession or control used to deliver the Charging Energy from the Point of Delivery to the Battery Storage System and receive any such Charging Energy at the Point of Delivery.

(C) Except with respect to the establishment of the ability to deliver Charging Energy to the Battery Storage System, Company shall be responsible for the costs required to supply any Charging Energy to the Point of Delivery; provided, that Seller shall be responsible for certain costs arising out of a Seller Initiated Test as set forth in Section 5.6.

(D) The Battery Storage System may not be, and Company shall not issue any instruction, order, Dispatch Notice or other communication requesting or requiring the Battery Storage System to be charged, discharged or operated in any manner which results in an amount of Energy discharged by the Battery Storage System in any given Commercial Operation Year which exceeds the Annual Throughput Limit, except to the extent provided in accordance with Section 8.5 and Section 8.6.

5.3 Market Changes

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(A) If at any time during the Term, the Transmission Authority changes or the facilities at the Point of Delivery cease to be subject to the Transmission Tariff, the Parties shall cooperate in good faith to facilitate the delivery of Energy, at the least possible cost to the Parties, consistent with this PPA to the extent possible.

(B) If and to the extent that changes to the rules of the Market Operator require Company to change the manner in which Company schedules and dispatches the Facility, the Parties shall cooperate in good faith to change their protocols for operation of the Facility accordingly, at the least possible cost to the Parties, consistent with this PPA to the extent possible.

(C) In addition, if as a result of any change in Applicable Law, the Company is not able to realize the capacity and Ancillary Services products that the Facility is able to provide to the Company as of the Effective Date and such capacity and Ancillary Services products can be provided by the Facility subject to the Seller making capital expenditures to comply with such change in Applicable Law, then Seller agrees that it shall make all such required capital expenditures so that the Facility is able to provide such capacity and Ancillary Services products to the Company.

5.4 Communication Protocols. To facilitate the exchange of information between the Parties, the Parties shall follow the communication protocols set forth in Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection.

5.5 Electric Metering Devices.

(A) All Electric Metering Devices used to measure Energy located and installed at the Point of Delivery shall be owned, and maintained by Company or the Transmission Authority, unless otherwise agreed to by Company, and all Electric Metering Devices located at or within the Facility shall be owned and maintained by Seller, at no cost to Company, unless the Company requests otherwise. All Electric Metering Devices shall meet the requirements of Exhibit R - Meter and Communications Requirements.

1. Seller shall configure Electric Metering Devices via electronic remote communications and via physical access in a manner that enables separate, bi-directional (as applicable) meter readings for all Energy transmitted at the Point of Delivery as set forth in Exhibit C - Facility Description and Site Maps.

2. Seller shall configure Electric Metering Devices, installed in accordance with and conforming to the Local Provider's electrical service and tariff requirements, as necessary, to separately account for all House Power.

3. Seller shall arrange any necessary authorization to provide Company access to all Electric Metering Devices for purposes related to this PPA and shall provide Company the opportunity to be present at any time when any such Electric Metering Devices is to be inspected, tested or adjusted.

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(B) Either Party may elect to install and maintain, at its own expense, backup Electric Metering Devices ("Back-Up Metering"), *provided, however*, that the specifications, installation and testing of any such Back-Up Metering shall be consistent with the requirements for the Electric Metering Devices. Upon written request from the other Party, the installing Party shall test the Back-Up Metering. The actual cost of any such test shall be borne by the Party requesting the test, unless, upon such test, Back-Up Metering is inaccurate by more than one percent (1%), in which case the cost of the retest shall be borne by the installing Party. If requested in writing, the installing Party shall provide copies of any inspection or testing reports to the requesting Party.

(C) If an Electric Metering Device or Back-Up Metering fails to register, or if the measurement is inaccurate by more than one percent (1%), if requested by Company an adjustment shall be made correcting all measurements as follows:

1. If the Electric Metering Device is found to be defective or inaccurate, the Parties shall use Back-Up Metering, if installed, to determine the amount of such inaccuracy, *provided, however*, that Back-Up Metering has been tested and maintained and adjusted for losses on the same basis as the Electric Metering Device. If Back-Up Metering is not installed, or Back-Up Metering is also found to be inaccurate by more than one percent (1%), the Parties shall use the best available information for the period of inaccuracy, adjusted for losses to the Point of Delivery in accordance with applicable manufacturers' parameters or as otherwise agreed by the Parties.

2. If the Parties cannot agree on the actual period during which inaccurate measurements were made, the period shall be the shorter of (i) the last one-half of the period from the last previous test of the Electric Metering Device to the test that found the Electric Metering Device to be defective or inaccurate, or (ii) one hundred eighty (180) Days immediately preceding the test that found the Electric Metering Device to be defective or inaccurate.

3. To the extent that an adjustment period covers a period of deliveries for which payment has already been made by Company, Company shall use the corrected measurements as determined in accordance with this Article 5 - to re-compute the amount due for the period of the inaccuracy and shall subtract or add the previous payments made by Company for this period from such re-computed amount. The net difference shall be reflected as an adjustment on the next regular invoice in accordance with Article 9 -.

5.6 Battery Storage System Testing.

(A) Prior to the Commercial Operation Date, Seller shall schedule and successfully complete a "Commercial Operation Test" during which Company shall have exclusive dispatch rights to the Facility to demonstrate the Facility's ability to meet the Guaranteed Performance listed in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels when responding to Company's Dispatch Notice.

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(B) On an annual basis, no earlier than one hundred eighty (180) Days and no later than thirty (30) Days prior to each Commercial Operation Year during the Delivery Period, upon seven (7) Days prior written notice to Company, Seller shall schedule and complete a “Periodic Test” to demonstrate that the Facility is capable of meeting the Guaranteed Performance listed in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels. Company has the right to not permit a Periodic Test if it conflicts with the requirement of the ERO. In addition, either Party shall have the right to require a retest at any time if such Party reasonably believes that the actual Performance Criteria have varied materially from the results of the most recent Tests. Such retest shall be scheduled as soon as is reasonably practicable for the Parties consistent with Good Utility Practices. Any such retest shall be deemed a Seller Initiated Test, as defined in Section 5.6(D), except to the extent that such discretionary testing can be conducted during a period in which Company is already charging or discharging the Battery Storage System in a manner which can allow accommodation of such testing, in which case such Test may be deemed to be a Company Dispatched Test, as defined in Section 5.6(D).

(C) If Seller fails any Periodic Test, then Seller shall be required to commence repairs in accordance with Section 10.4.

(D) Seller may also conduct other discretionary tests, at times and for durations agreed to by Company, that Seller deems necessary for purposes of reliably operating the Facility or for re-performing a required Test. If such discretionary testing is conducted during a period in which Company is already charging or discharging the Battery Storage System in a manner which can allow accommodation of such testing (“Company Dispatched Test”), Seller shall not be obligated to pay for the electricity required to charge the Battery Storage System relating to such Company Dispatched Test of the Battery Storage System, and Discharging Energy from the Facility shall be treated as dispatched by Company hereunder. If discretionary testing is conducted during a period in which Company is not charging or discharging the Battery Storage System in a manner which can allow accommodation of such testing (“Seller Initiated Test”), then Company shall provide all electricity required to charge the Battery Storage System; provided that Company shall reasonably cooperate with Seller in its efforts to perform the Seller Initiated Test at a time that will mitigate the costs of such Energy (including, if requested by Seller, by providing Seller with projections of the Charging Energy Price), and Seller shall reimburse Company for the cost of such Charging Energy used to charge the Battery Storage System to the extent that it exceeds the cost of the Discharging Energy discharged by the Battery Storage System during such Seller Initiated Test (based on the Charging Energy Price at the time of charging and the Discharging Energy Price at the time of discharging). Company shall reasonably cooperate with Seller to schedule testing during periods when Company is dispatching the Facility so that such testing will be deemed to be a Company Dispatched Test; provided that Company is not required to use or change its utilization of its owned or controlled assets or market positions to facilitate the characterization of such testing as a Company Dispatched Test.

Article 6 - Conditions Precedent

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6.1 PUC Approval.

(A) No later than forty-five (45) Days after the Effective Date, Company may apply to the MPUC/NDPSC for PUC Approval. If Company fails to apply for PUC Approval within forty-five (45) Days following the Effective Date, Company shall be deemed to have waived its right to obtain PUC Approval and to terminate this PPA under this Section 6.1, and this PPA shall remain in full force and effect thereafter.

(B) If Company applies for PUC Approval, Company shall use Commercially Reasonable Efforts to obtain PUC Approval as soon as reasonably practicable. Seller shall cooperate with Company's efforts to obtain PUC Approval.

(C) If Company applies for PUC Approval, Company shall have the right to terminate this PPA, without any further financial or other obligation to Seller as a result of such termination, by notice to Seller:

1. at any time within thirty (30) Days following issuance of a written order by the MPUC or the NDPSC (as applicable) rejecting PUC Approval, or granting PUC Approval with conditions unacceptable to Company in its sole discretion;

2. at any time between the one hundred eightieth (180th) and two hundred fifteenth (215th) Day following Company's application for PUC Approval, if prior to the date of such termination the MPUC or the NDPSC (as applicable) has not issued a written order granting or rejecting PUC Approval [if applicable as specified in the RFP];

3. at any time within thirty (30) Days following timely request for reconsideration (in whole or in any material part) by any third party with standing, of a written order of the MPUC or the NDPSC (as applicable) granting PUC Approval; and/or

4. at any time within thirty (30) Days following timely appeal by any party with standing, of a written order of the MPUC or the NDPSC (as applicable) granting PUC Approval.

If Company is eligible but fails to terminate this PPA by the applicable date, Company shall be deemed to have waived its right to terminate this PPA under this Section 6.1(C), and this PPA shall remain in full force and effect thereafter.

(D) For purposes of this PPA, "PUC Approval" means a written order of the MPUC and/or an Advance Determination of Prudency from the NDPSC, which alone or in combination make(s) an affirmative determination that all costs incurred under this PPA are recoverable from Company's retail customers pursuant to Applicable Law, subject only to the requirement that the MPUC/NDPSC (as applicable) retain ongoing prudency review of Company's performance and administration of this PPA, as determined by Company in its sole discretion.

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6.2 Other Company CPs. *[if any]*.

6.3 Seller CPs. *[if any - bid specific]*.

6.4 Return of Security Fund. Following a termination pursuant to Section 6.1 [or Section 6.22/Section 6.23], the Company will return to Seller the undisputed amount of the remaining initial Security Fund within five (5) Business Days of such termination.

Article 7 - Sale and Purchase

7.1 General Obligation.

(A) Subject to the provisions of this PPA, beginning on the Commercial Operation Date, Seller shall receive at the Point of Delivery, store in the Battery Storage System, and deliver to the Point of Delivery, and Company shall receive at the Point of Delivery, the Energy, Ancillary Services and other products and services required by this PPA. Seller shall not curtail or interrupt deliveries of Energy to Company for economic reasons of any type.

(B) Seller shall not sell any products or services required by this PPA to any third party.

(C) Title and risk of loss of the products and services transacted by this PPA shall transfer from Seller to Company at the Point of Delivery.

7.2 Dispatch. Beginning on the Commercial Operation Date, Company shall dispatch the Facility through the EMCC AGC system in accordance with Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection. Seller shall ensure that, throughout the Term, the SCADA System signal is capable of functioning on all AGC Set-Points within the margin of error specified in the manufacturer's energy set point margin of error.

7.3 Battery Storage System Dispatch.

(A) During each Operating Day, Company's EMCC will have the exclusive right to dispatch the Battery Storage System, seven (7) Days per week and twenty-four (24) hours per Day (including holidays), by providing Dispatch Notices to Seller in accordance with the Battery Storage System Operating Procedures and subject to the requirements and limitations set forth in this PPA. Seller shall abide with all directives from Company's EMCC, subject only to Good Utility Practices.

(B) For each Operating Day, Seller shall provide to Company (in accordance with the protocols outlined in Exhibit O - Battery Storage System Operating Procedures and as may be updated by written agreement of the Operating Committee pursuant to Section 10.9) an hourly schedule of the expected availability of the Battery Storage System for such Operating Day, no later than two (2) Business Days before such Operating Day (the "Availability Notice"). Seller must update Company immediately, unless an event or circumstance makes it unsafe to do so, then as soon as practicable,

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in accordance with the protocols outlined in Exhibit O - Battery Storage System Operating Procedures if the availability of the Battery Storage System for dispatch by Company changes or is likely to change after the Availability Notice is submitted. Seller shall accommodate Company's reasonable requests for changes in the time or form of delivery of the Availability Notices.

7.4 Environmental Attributes. The Parties acknowledge that existing and future Applicable Laws create significant value in the ownership, use and allocation of Environmental Attributes. To the full extent allowed by Applicable Law, Seller hereby assigns to Company (and Company shall own and be entitled to claim) all Environmental Attributes existing or created during the Term associated with the Facility, at no additional charge to Company under this PPA.

(A) Seller hereby irrevocably assigns to Company all rights, title and authority for Company to register the Facility and own, hold and manage the Environmental Attributes associated with the Facility in Company's own name and to Company's account, including any rights associated with any energy information or tracking system that exists or may be established with regard to monitoring, registering, tracking, certifying, and/or trading such Environmental Attributes. Seller hereby authorizes Company to act as its agent for the purposes of registering the Facility and tracking, certifying, registering and reporting such Environmental Attributes. Seller grants to Company full authority to hold, use, sell and/or trade such Environmental Attributes for Company's own account in all applicable energy information or tracking systems. Upon the request of Company, at no cost to Company, (i) Seller shall deliver or cause to be delivered to Company appropriate attestations/certifications of such Environmental Attributes, and (ii) Seller shall cooperate with Company's tracking, registration, reporting and certification of such Environmental Attributes.

(B) For purposes hereof, "Environmental Attributes" includes but is not limited to existing and future, (i) environmental credits, benefits or attributes, (ii) emissions reductions, (iii) avoided emissions and reporting rights for avoided emissions of pollutants to the air, soils or waters, such as sulfur oxides (SO_x), nitrogen oxides (NO_x), carbon monoxide (CO), greenhouse gases (such as carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆) that have been or may in the future be determined by the United Nations Intergovernmental Panel on Climate Change or by Applicable Law to contribute to the threat of climate change; (iv) avoidances (including emission rate credits), offsets, allowances and green tags, and (v) zero-emission electricity credits, that are attributable to the Facility during the Term, recognized by Applicable Law, including any rights to compensation therefor.

(C) Prior to the Commercial Operation Date, Seller shall complete and return to Company all applications and forms and provide all supporting documentation required by Applicable Law for accreditation and assignment of all Environmental Attributes.

7.5 Ancillary Services.

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(A) During the Term, Seller shall make available to Company and Company shall own, all Ancillary Services associated with the Facility, including but not limited to the sole right to sell Ancillary Services associated with the Facility and to retain all revenues therefrom. Seller shall use Commercially Reasonable Efforts to maximize the Ancillary Services available from the Facility.

(B) Any compensation Seller receives under the Interconnection Agreement or otherwise from third parties for Ancillary Services shall be provided to Company at no additional cost to Company under this PPA. To implement the foregoing, Seller shall credit Company, as a reduction to Seller's monthly invoice or other mutually-agreed mechanism, for any compensation that Seller receives from third parties for Ancillary Services; *provided*, that if a Governmental Authority or Transmission Authority implements new or revised requirements for generators and/or energy storage resources to create, modify, or supply Ancillary Services, requiring Seller to install additional equipment after the Effective Date to meet such requirements, then Seller, after consultation with Company, shall, if requested to do so by Company, install any such additional equipment and shall be allowed to reduce the amount to be credited to Company for Ancillary Services by an amount sufficient to recover the cost of such additional equipment (up to the amount of any cap agreed to by the Parties for such work). Any cost not so recovered by Seller in any billing period shall be carried forward as a reduction of the amount of the credit in subsequent billing periods. The invoice for the final billing period of the Term shall include any costs not yet recovered by Seller pursuant to this Section 7.5(B).

(C) For purposes hereof, "Ancillary Services" mean any service associated, directly or indirectly, with the reliable storage and/or transmission of energy from the Facility from time to time, including but not limited to: operating reserves, ramp capability, reactive supply, reactive supply capability, voltage control, voltage control capability, and any rights to compensation for any of these services. "Ancillary Services" also includes any other service identified as an "ancillary service" or "other ancillary service" in the Transmission Tariff. For the avoidance of doubt, "Ancillary Services" includes any service associated, directly or indirectly, with the reliable generation and/or transmission of energy from the Facility, regardless of whether the Facility, the Transmission Authority or the Company is deemed to be the service provider for the service.

Article 8 - Payment Calculations

8.1 Payment for Capacity.

(A) Company shall pay Seller a monthly payment for capacity (the "Monthly Capacity Payment") based upon the following formula:

Monthly Capacity Payment = (C x CP x CAF), where:

C = (the "Capacity") for the applicable month is the lesser of the Maximum Charging Rate or Maximum Discharging Rate, in each case as determined by the

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most recently completed Test and stated in kW. For avoidance of doubt, the Capacity shall not be greater than the Battery Storage System Nameplate Capacity.

CP = Capacity Payment Rate, as set forth in Exhibit J - Capacity Payment Rate.

CAF (the “Capacity Availability Factor”) = $(AC + SME) \div PE$, where:

AC = Available Capacity for any period, stated in MWh, means the maximum amount of Storage Capacity that is available from the Facility as reported by the Facility’s SCADA System in accordance with Exhibit O – Battery Storage System Operating Procedures for such period. For purposes of calculating Available Capacity:

1. Storage Capacity that is unavailable for dispatch by Company shall be considered to be available for the purposes of determining Available Capacity when (and only when):

a. the Facility is disconnected from the Transmission Authority’s System pursuant to the Interconnection Agreement, and the disconnection is not caused by actions of Seller or problems with the Facility; and/or

b. the Discharging Energy cannot be delivered by Seller or received by Company due to an Emergency or an event of Force Majeure affecting the Transmission Authority’s System at or beyond the Point of Delivery; and/or

c. Company has contracted for non-firm transmission service, and the Discharging Energy cannot be received at the Point of Delivery due to transmission constraints affecting the Transmission Authority’s System.

2. By way of example only, Available Capacity shall be deemed unavailable for purposes of this Section 8.1 if:

a. to the extent and for so long as the Facility is subject to a Forced Outage, including an Outage caused by Force Majeure at the Site or prior to the Point of Delivery;

b. Company has contracted for firm transmission service, but the Discharging Energy cannot be received by Company at the Point of Delivery due to transmission constraints affecting the Transmission Authority’s System.

SME = “Scheduled Maintenance Energy” for any period, stated in MWh and set forth on an approved Maintenance Schedule in accordance with Section 10.2(A), means the amount of energy that is not available from the Facility

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during such period due to planned outages/deratings that meet the definition of Battery Storage System Planned Outages and were included on an approved Maintenance Schedule in accordance with Section 10.2(A); *provided, however*, if the actual number of Battery Storage System Planned Outages during the measurement period is less than as set forth in an approved Maintenance Schedule for such period, then the Scheduled Maintenance Energy shall be adjusted to reflect the actual number of Battery Storage System Planned Outages and calculated in the same manner as set forth in Section 10.2(A).

PE = Period Energy for any period, stated in MWh, means the product of the Storage Capacity, as determined by the most recently completed Test, and the total number of hours in such period.

For the avoidance of doubt, the calculated CAF cannot be greater than 1.

For the avoidance of doubt, a GSU Transformer Failure shall not be considered in the calculation of the Capacity Availability Factor set forth in this Section 8.1(A).

(B) The Capacity Payment Rate shall be deemed Confidential Information for purposes of Section 20.18 below.

(C) For the avoidance of doubt, monthly payments to Seller may be subject to reduction in accordance with Section 8.3.

8.2 Reserved.

8.3 Monthly Payment Reduction.

(A) For each month of the Delivery Period, the monthly payments to Seller may be reduced by (i) the Round Trip Efficiency Adjustment as set forth in Section 8.3(B) and/or (ii) the adjustment set forth in Section 8.3(C).

(B) If the Round Trip Efficiency as determined by the most recently completed Test is less than the then-applicable Guaranteed Round Trip Efficiency, then the Monthly Capacity Payment shall be reduced by the Round Trip Efficiency Adjustment, based upon the following formula:

1. The "Round Trip Efficiency Adjustment" or "RTE_{Adj}" for each month is given by:

If $[RTE_{test} < RTE_G]$ then $RTE_{Adj} =$

$[1 - (RTE_{test} / RTE_G)] \times (\text{Discharging } MWh_{Actual} * \text{Discharging LMP})$

where:

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RTE_{test} = the Round Trip Efficiency as determined by the most recently completed Test.

RTE_G = the then-applicable Guaranteed Round Trip Efficiency, as identified in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

$Discharging\ MWh_{Actual}$ = the Discharging Energy delivered to Company at the Point of Delivery for the affected hour expressed in MWh.

$Discharging\ LMP$ = the Discharging Energy Price for each $Discharging\ MWh_{Actual}$ for the affected hour expressed in Dollars per MWh; *provided*, that the Discharging LMP may not, in any event, be less than \$0.00 for any given hour.

In no event shall the Round Trip Efficiency Adjustment be less than \$0.00.

Sample calculations for the Round Trip Efficiency Adjustment are set forth in Exhibit Q - Example Adjustment Calculation.

(C) If Seller fails to accurately or timely respond to a Company Dispatch Notice, then unless such failure is expressly permitted under this PPA (including due to a Force Majeure or Excused Outage), if the Market Operator assesses a penalty or similar charge (including as applicable, an excessive or deficient energy charge referenced in the protocols of the Market Operator) on the Company due to or arising out of such failure and Company provides documentation of the same to Seller along with any other details and documentation as reasonably requested by Seller, then Company shall provide and pass through to Seller such penalty or charge. Company shall reduce Seller's next monthly invoice payment by an amount equal to such Market Operator charges, in accordance with Section 8.3(A).

8.4 Excess Throughput Payment. Company shall pay Seller a payment equal to [REDACTED] for each MWh of Energy discharged by the Battery Storage System above the Annual Throughput Limit in any given Commercial Operation Year as adjusted pursuant to Section 8.5 below. The total Discharging Energy shall not exceed one-hundred ten percent (110%) of the Annual Throughput Limit in any given Commercial Operation Year. For purposes of determining the amount of Energy discharged by the Battery Storage System in any given Commercial Operation Year, any Energy discharged by the Battery Storage System during a Seller Initiated Test or a Periodic Test shall be excluded.

8.5 Annual Throughput Limit Banking and Borrowing.

(A) If, in any Commercial Operation Year, Company has not used all of the Annual Throughput Limit for such Commercial Operation Year, then [insert five percent (5%) of Annual Throughput Limit] MWh of the unused Annual Throughput Limit

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for such Commercial Operation Year shall be added to the Annual Throughput Limit for the subsequent Commercial Operation Year.

(B) If, in any Commercial Operation Year, Company has used all of the Annual Throughput Limit for such Commercial Operation Year, then, for such Commercial Operation year, Company may add up to [insert five percent (5%) of Annual Throughput Limit] MWh of the Annual Throughput Limit allocated to the subsequent Commercial Operation Year, which use shall reduce the Annual Throughput Limit for the subsequent Commercial Operation Year.

8.6 Excess Annual State of Charge Payment. If applicable, no later than thirty (30) Days after the end of each Commercial Operation Year, Company shall pay Seller a payment equal to one-thousand Dollars (\$1,000) for every one-tenth of one percent (0.1%) the average State of Charge for a Commercial Operation Year exceeds the Annual State of Charge Limit as defined in this PPA.

Article 9 - Billing and Payment

9.1 Billing.

(A) The billing period under this PPA shall be the calendar month.

(B) As soon as practicable and in any event within twenty (20) Days after the end of each month, or (ii) ten (10) Days after receipt by Company of the monthly report required from Seller under Section 10.5(B), Company shall provide to Seller a statement containing Company's calculation of the amount due to Seller for such month, including the applicable billing parameters based upon Company's reading of the Electric Metering Devices consistent with Section 5.5.

(C) No later than fifteen (15) Business Days following receipt of Company's billing statement, Seller shall submit an invoice to Company in a form and by a method to be agreed by the Parties, showing the amount due to Seller for the relevant month, specifying the products and services provided, billing meter register reads for relevant measurement quantities, total usage in kWh being billed, date and time at which accumulated and billed production was read by the Electric Metering Devices, all billing parameters, rates and factors, and any other data relevant to the calculation of payments due to Seller. Such invoice shall include an explanation of any items in dispute, as well as all supporting documentation upon which Seller relies.

9.2 Payment. All payments shall be remitted via check or electronic funds transfer, as designated by the owed Party, on or before the fifteenth (15th) Business Day following receipt of the invoice described in Section 9.1(C). Remittances received by mail will be considered to have been paid when due if the postmark indicates the payment was mailed on or before the fifteenth (15th) Business Day following receipt of the billing invoice.

(A) If a payment is late, a late payment charge shall be applied to the unpaid balance for the number of Days the payment was late and shall be added to the next billing statement. Late payment charges shall include interest calculated using the

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prime rate of interest as published on the date of the invoice in *The Wall Street Journal* (or, if unavailable, an equivalent publication on or about that date).

(B) Company at any time may offset against amounts owed to Seller, any liquidated amounts, accrued damages and other payments, and undisputed billing errors and adjustments, which are owed by Seller to Company.

(C) Seller and Company may net their obligations to each other under this PPA, and payment of the net amount shall discharge all mutual undisputed obligations between the Parties.

9.3 Billing Disputes. Either Party may dispute invoiced amounts pursuant to Section 13.1 and shall pay to the other Party at least the portion of invoiced amounts that is not disputed, on or before the invoice due date. When the billing dispute is resolved, the amount owed shall be netted in the monthly billing period's invoice following the date of such resolution, with late payment interest charges calculated on the amount owed in accordance with Section 9.2(A).

Article 10 - Operations and Maintenance

10.1 Operation and Administration.

(A) Seller shall staff, control, and operate the Facility consistent with Good Utility Practices, Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection, Exhibit O - Battery Storage System Operating Procedures, and this PPA. Personnel of Seller shall be available 24x7 via telephone or other electronic means with (i) the capability of remotely starting, operating and stopping the Facility within ten (10) minutes, and (ii) the ability to be present at the Site within thirty (30) minutes, or sooner, to the extent required in accordance with Good Utility Practices and subject to the Safety Requirements.

(B) Seller shall comply with Good Utility Practices, its obligations under this PPA, the Interconnection Agreement, and the requirements of all Governmental Authorities and all reasonable requirements of Company in the operation of the Facility. By way of example only, Seller shall perform all capacity testing of the Facility and related reporting, as and when required by Governmental Authorities. Any such testing shall be deemed to be a Seller Initiated Test.

(C) Seller shall provide to Company a day-ahead availability schedule in accordance with Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection, Exhibit O - Battery Storage System Operating Procedures, and any other reporting requirements required for compliance with NERC reliability standards. Company shall forward Seller's forecast to the applicable local reliability coordinator on Seller's behalf, *provided, however*, that Seller shall remain responsible to ensure the timeliness and accuracy of forecasts and any changes to the real-time or forecast availability of the Facility. If and to the extent that the ERO modifies the forecasting or other reporting requirements imposed on Company or the Facility, Seller shall timely provide required data to Company or the ERO, as applicable.

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(D) Seller shall, and shall cause its Affiliates and contractors to, operate and maintain the Facility and conduct all work or cause all work in connection therewith to be conducted in accordance with Exhibit P - Safety Requirements. Seller shall, and shall cause its Affiliates and contractors to, take all actions to comply with Exhibit P - Safety Requirements.

10.2 Facility Maintenance.

(A) Seller shall maintain the Facility in accordance with Good Utility Practices. Seller shall coordinate its regular maintenance requirements for the Facility with Company ("Maintenance Schedules"). Seller shall provide Maintenance Schedules, including planned Outages of the Facility (including any Battery Storage System Planned Outages) and a calculation of the expected Scheduled Maintenance Energy for such planned Outage based on the Storage Capacity as determined by the most recently completed Test to Company in writing and sufficiently in advance for Commercially Reasonable review, which Outages shall be subject to Company's Commercially Reasonable approval. Seller shall coordinate with Company and the Transmission Authority on the timing and duration of planned Outages. Company has the right to not permit a planned Outage if it conflicts with the requirements of the ERO or if the ERO rejects the planned Outage request.

(B) Seller shall minimize the amount of scheduled maintenance during the months of January, February, June, July, August, September and December to the maximum extent consistent with Good Utility Practices. Seller shall coordinate with Company and the Transmission Authority on the timing and duration of planned Outages of the Facility (including any Battery Storage System Planned Outages).

10.3 Outages and Reporting.

(A) When any Forced Outage occurs, Seller shall notify Company's EMCC of the existence, nature, start time, and expected duration of the Forced Outage as soon as practical, but in no event later than one (1) hour after the Forced Outage occurs. Seller shall immediately inform Company's EMCC of changes in the expected duration of the Forced Outage except to the extent relieved of this obligation by Company's EMCC with respect thereto.

(B) Seller shall develop and provide Company with a copy of its Facility cold weather policy. In the event of a Facility Forced Outage or derate of more than ten percent (10%) of the Battery Storage System Nameplate Capacity, Company may request that Seller shall conduct a root cause analysis, take corrective action(s) as are reasonable under the circumstances to prevent reoccurrences and provide a copy of such analyses and corrective action(s) to Company.

10.4 Repair Obligations.

(A) In the event that:

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1. operating performance demonstrates that (i) the Minimum Charging Time is in excess of one-hundred two percent (102%) of the Guaranteed Minimum Charging Time, (ii) the Maximum Charging Rate is less than ninety-eight percent (98%) of the Guaranteed Maximum Charging Rate, (iii) the Minimum Discharging Time is in excess of one-hundred two percent (102%) of the Guaranteed Minimum Discharging Time, (iv) the Maximum Discharging Rate is less than ninety-eight (98%) of the Guaranteed Maximum Discharging Rate, (v) the Response Time is in excess of one-hundred two percent (102%) of the Guaranteed Response Time, or (vi) the Storage Capacity is less than ninety-eight percent (98%) of the Guaranteed Storage Capacity; or

2. a Test demonstrates that any of the Performance Criteria does not meet the levels required to pass such Test in accordance with the standards set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels;

3. then Seller shall repair the Battery Storage System in accordance with Good Utility Practices and the procedures set forth in this Section 10.4.

(B) Within fourteen (14) Days of any failure set forth in Section 10.4(A), Seller shall demonstrate such remedy to the reasonable satisfaction of Company (a "Successful Repair") or present to Company a description of the reason for the failure and a plan and schedule for completing a Successful Repair (the "Repair Plan").

10.5 Books and Records.

(A) Seller shall maintain an accurate and up-to-date hourly operating log for the Facility, in electronic format, with records of production for each clock hour; changes in operating status; Forced Outages; information required by Governmental Authorities in the prescribed format; and other information reasonably requested by Company. Seller shall deliver the operating log to Company electronically for each month within five (5) Business Days of the end of such month, if requested by Company.

(B) Seller shall deliver to Company information on Facility performance during each calendar month within five (5) Business Days after the end of each month using definitions provided by (or consistent with) the NERC Generation Availability Data System Manual, or any successor document. The data delivered to Company shall include planned and unplanned derated hours, average derated kW during the derated hours, scheduled maintenance hours, average derated kW during scheduled maintenance hours, the operating log referenced in Section 10.5(A) above, and any other additional supporting documentation as reasonably requested by Company.

(C) Seller and Company shall each keep complete and accurate records and all other data required by each of them for the purposes of proper administration of this PPA, including metering, billing and payment records, and such records as may be required by Governmental Authorities. Originals or copies of all Operating Records shall

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be maintained at the Site or such other [Minnesota or Wisconsin] location as may be specified by Seller from time to time. Company may examine and make copies of such Operating Records from time to time upon request, during normal business hours.

10.6 Access to Facility. Representatives of Company shall have access to the Facility from time to time, on Commercially Reasonable prior written notice, to read meters, perform inspections and take such other actions as may be appropriate to facilitate Company's performance of this PPA. While at the Facility, such representatives shall observe Seller's standard safety precautions and shall conduct themselves in a manner that will not interfere with operation of the Facility.

10.7 Real Time Data.

(A) Seller shall communicate all data necessary for Company to integrate the Facility into Company's EMCC in real time ("Real Time Data") through the Facility's SCADA System in accordance with Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection, and subject to Exhibit O - Battery Storage System Operating Procedures. Seller shall maintain the Facility's SCADA System and communications system so that they are capable of interfacing with and reacting to Company's AGC Set-Point and responding to signals from Company's EMCC in accordance with the AGC Protocols, subject to Exhibit I – AGC Protocols; Dispatch and Availability Reporting; Data Collection and Exhibit O - Battery Storage System Operating Procedures.

(B) From and after the Commercial Operation Date, Seller shall provide Company, at Seller's expense, real time performance data in accordance with Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection for the Term of this PPA. Seller shall maintain Seller-owned data collection systems that are compatible with Company's PI System. Seller shall ensure that real time communications capabilities are available and maintained for transmission to Company's PI System. Company shall have the right to disclose data gathered through Company's PI System publicly; *provided, however*, that such data is (i) masked to obscure the origin of the data and (ii) aggregated so that the data cannot be correlated and used by competitors of Seller, except as otherwise provided in Section 20.18.

10.8 Accreditation. Seller shall perform from time to time, at its expense, any reporting and testing (including capacity testing) of the Facility required by Governmental Authorities.

10.9 Operating Committee and Operating Procedures.

(A) Company and Seller shall each appoint one representative and one alternate representative to act as the Operating Committee in matters relating to the Parties' performance obligations under this PPA and to develop operating arrangements for the charging, discharging, delivery, dispatch, and receipt of Energy from the Facility. The Parties' initial representatives on the Operating Committee are set forth in Exhibit D - Notices and Contact Information.

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(B) If requested by Company, the Operating Committee shall develop mutually agreeable written Battery Storage System Operating Procedures for the Battery Storage System that are consistent with the requirements of this PPA, including Section 5.2 and Exhibit O - Battery Storage System Operating Procedures in order to address administrative matters such as: day-to-day communications; key personnel; operations-center interface; metering, telemetering, telecommunications, and data acquisition procedures; operations and maintenance scheduling and reporting; reports; operations log; testing procedures; and such other matters as may be mutually agreed upon by the Operating Committee. For the avoidance of doubt, Company (or its representative on the Operating Committee) shall have no obligation to agree to operational limitations except for those set forth in Part I of Exhibit O - Battery Storage System Operating Procedures.

(C) The Operating Committee shall review the requirements for AGC and data collection from time to time after the Effective Date and may agree on modifications thereto to the extent necessary or convenient for operation of the Facility in accordance with this PPA.

(D) The Operating Committee shall have authority to act in all technical and day-to-day operational matters relating to performance of this PPA and to attempt to resolve potential disputes, provided, however, that except as explicitly provided herein, the Operating Committee shall have no authority to amend or waive any provision of this PPA, including any provision included within Exhibit O - Battery Storage System Operating Procedures.

Article 11 - Security for Performance

11.1 Security Fund.

(A) During the Term of this PPA, Seller shall fund and maintain security in favor of Company, at Seller's expense, to secure Seller's obligations to Company under this PPA (the "Security Fund"), in accordance with this Article 11 -.

(B) Seller shall establish and fund the Security Fund in the amount of [insert \$[200]/kW x Battery Storage System Nameplate Capacity kW], no later than thirty (30) Days following the Effective Date. Within five (5) Business Days following COD, the amount of the Security Fund shall be reduced to [insert \$[75]/kW x Battery Storage System Nameplate Capacity kW].

(C) Without notice to Seller, Company may draw from the Security Fund such amounts as are necessary to recover amounts owing to Company pursuant to this PPA, including any Liquidated Delay Damages, Actual Damages, liquidated damages for failure to achieve COD, and any amounts for which Company is entitled to indemnification under this PPA. Company may, in its sole discretion, draw all or any part of such amounts from any form of security to the extent available pursuant to this Article 11 - and in any sequence Company may select. Company's failure or delay to draw any amount from the Security Fund in any instance shall not prejudice Company's rights to subsequently recover such amount from the Security Fund or in any other manner.

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(D) Company shall notify Seller within five (5) Business Days following any draw on the Security Fund by Company, including the amount thereof and the basis therefor.

11.2 Replenishment. Seller shall replenish the Security Fund to the applicable levels set forth in Section 11.1(B) within fifteen (15) Business Days after Company makes a draw on the Security Fund; *provided however*, following COD such replenishment shall not exceed the amount remaining under the Damage Cap (as provided in Section 12.4(A)). Notwithstanding the foregoing, within fifteen (15) Business Days after Company makes a draw on the Security Fund associated with the damages described in Section 12.4(B), Seller shall replenish all amounts drawn from the Security Fund.

11.3 Form.

(A) The Security Fund may be in the form of an irrevocable standby letter of credit substantially in the form of Exhibit G - Form of Letter of Credit (a "Letter of Credit") from a financial institution acceptable to Company ("Issuer").

1. The Letter of Credit must be issued by a bank or other financial institution that is acceptable to Company, with a minimum rating of A- by Standard & Poor's and A3 from Moody's (unenhanced by third-party support). No letters of credit will be accepted from banks which are rated below A-/A3 by one or more rating agencies. (If there are split ratings amongst rating agencies, the Company will use the lowest of the different ratings within the same rating agency and amongst different rating agencies). The Letter of Credit must be issued by a U.S. branch/office and such branch/office must have an acceptable minimum rating of A-/A3 on its own by at least one of the rating agencies. If such rating is equivalent to A-/A3, the Issuer must not be on credit watch or have a negative outlook by any rating agency. The above ratings are defined as follows (if available): Long term issuer rating, Long Term Senior Unsecured rating or Long Term Counterparty Risk Assessment/Rating (for Moody's).

2. The Letter of Credit must be for a minimum term of three hundred sixty (360) Days. Seller shall give Company at least thirty (30) Days advance notice prior to any expiration or earlier termination of the Letter of Credit. Seller shall cause the renewal or extension of the Letter of Credit for additional consecutive terms of three hundred sixty (360) Days or more (or, if shorter, through the end of the period required under Section 11.5 below) more than thirty (30) Days prior to each expiration date of the security. If the Letter of Credit is not renewed or extended at least thirty (30) Days prior to its expiration date or otherwise is terminated early, Company shall have the right to draw immediately upon the Letter of Credit and to place the amounts so drawn, in Company's account until such time as Seller provides a substitute form of security meeting the requirements of this Section 11.3.

(B) The Security Fund may be in the form of U.S. currency deposited into an escrow account with a state or federally chartered commercial bank with an office

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in the State of [Minnesota or Wisconsin] with net assets of at least \$1 billion (the "Escrow Account").

1. The Escrow Account shall be governed by an escrow and account control agreement in a form mutually satisfactory to Seller, Company and the escrow agent, provided that (a) Company shall hold a first and exclusive perfected security interest in the funds in the Escrow Account, (b) Company shall be permitted unilaterally to draw down any amount therein, regardless of any protest by Seller or any other party liable thereon (*provided* that nothing in the escrow agreement shall preclude any protest against Company by Seller, following any draw, that such draw did not comply with this PPA), and (c) Seller shall pay all fees and expenses of the escrow agent.

2. Funds held in the Escrow Account may be invested as Seller may direct in any of the following:

- a. a money-market fund sponsored by the escrow agent;
- b. U.S. treasury obligations with a maturity of ninety (90) Days or less;
- c. commercial paper rated "A" or better, with a maturity of ninety (90) Days or less; and
- d. other liquid investment-grade investments with maturities of three months or less, approved by Company in advance (such approval not to be unreasonably withheld or delayed).

3. All investment income on the Escrow Account shall be taxable to, and accrue for the benefit of, Seller. After the Commercial Operation Date, periodic sweeps by Seller for recovery of interest earned by the escrowed funds shall be allowed, and, at any time the balance in the Escrow Account exceeds the required amount of security, the escrow agent may remit the excess to Seller.

(C) Following COD, the Security Fund may consist of a guaranty substantially in the form of Exhibit H - Form of Guaranty, from a parent or other guarantor ("Guarantor") acceptable to Company in its sole and absolute discretion, and up to an amount within Company's sole and absolute discretion. Subject to Company's sole and absolute discretion, to be eligible to provide a guaranty, the proposed Guarantor must have a minimum tangible net worth of at least \$250,000,000 and an Investment Grade Credit Rating (and if such Credit Rating is exactly equivalent to BBB- (S&P) / Baa3 (Moody's), the Guarantor must not be on credit watch by any rating agency). If the Credit Rating of the Guarantor is downgraded below Investment Grade, put on credit watch, or an event occurs that (in the reasonable determination of Company) portends a Material Adverse Effect in the creditworthiness of the Guarantor, then Company may require Seller to convert the guaranty to a Security Fund instrument meeting the criteria set forth in either paragraph (A) or paragraph (B) above no later than ten (10) Days after notice from Company.

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(D) Upon request by Seller, Company shall negotiate in good faith any immaterial changes to Exhibit G - Form of Letter of Credit and/or Exhibit H - Form of Guaranty, provided that Seller shall pay or reimburse Company for the incremental direct expenses (including the fees and expenses of counsel) incurred by Company in connection therewith.

(E) Seller may change the form of the Security Fund at any time and from time to time upon Commercially Reasonable prior written notice to Company, *provided, however*, that the Security Fund must at all times satisfy the requirements of this Article 11 -.

11.4 Replacement. In the event that the Security Fund ever fails to comply with the requirements of this Article 11 - or Company determines in a Commercially Reasonable manner that an event has occurred or circumstances have developed that threaten to cause the Security Fund to fail to comply with the requirements of this Article 11 - (e.g. a Guarantor is placed on negative credit watch by a rating agency), Seller shall be required to replace the Security Fund with security in compliance with Article 11 - within five (5) Days following notice thereof from Company.

11.5 Survival. The Security Fund shall survive termination of this PPA to be available to pay any amounts owed to Company arising prior to or upon termination. Promptly following (i) the end of the Term and the completion of all of Seller's obligations under this PPA, or (ii) termination of this PPA for any reason prior to the Scheduled Termination Date, Company shall determine the amount, if any, owed by Seller for any obligations or damages arising out of this PPA. Company may draw such amount and shall release the balance of the Security Fund (including any accumulated interest, if applicable) to Seller.

11.6 Expenses. Seller shall reimburse Company for its direct expenses (including the fees and expenses of counsel) incurred by Company in connection with the preparation, negotiation, execution and/or release (including making a draw of funds) of the Security Fund under this Article 11 -.

Article 12 - Default and Remedies

12.1 Default by Seller: General.

(A) Events. Any of the following events shall constitute a default by Seller under this PPA. If no cure period is provided below, such default shall be deemed an Event of Default by Seller immediately upon its occurrence. If a cure period is provided below, such default shall mature into an Event of Default if not cured within the indicated cure period, subject to Section 13.3 below.

1. Seller's application for, or consent (by admission of material allegations of a petition or otherwise) to, the appointment of a receiver, trustee or liquidator for Seller or for all or substantially all of its assets, or its authorization of such application or consent, or the commencement of any proceedings seeking such appointment without such authorization, consent or application, which

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proceedings continue undismissed or unstayed for a period of sixty (60) Days from inception.

Cure Period: None.

2. Seller's authorization or filing of a voluntary petition in bankruptcy or application for or consent (by admission of material allegations of a petition or otherwise) to the application of any bankruptcy, reorganization, readjustment of debt, insolvency, dissolution, liquidation or other similar law of any jurisdiction or the institution of such proceedings against Seller without such authorization, application or consent, which proceedings remain undismissed or unstayed for sixty (60) Days from its inception or which result in adjudication of bankruptcy or insolvency within such time.

Cure Period: None.

3. Seller's assignment of this PPA or the Facility or any Change of Control, not permitted by Section 19.1.

Cure Period: None.

4. Any representation or warranty by Seller that materially affects its ability to perform this PPA: (a) is proven to have been false in any material respect when made; or (b) ceases to remain true in all material respects during the Term, *provided however*, that a representation or warranty that ceases to remain true due to a change in Applicable Law shall not be considered an Event of Default.

Cure Period: Thirty (30) Days after Company provides notice of such breach.

5. Seller's failure to establish and, once established, maintain the Security Fund as and in the amounts required under Article 11 -.

Cure Period: Five (5) Business Days after Company provides notice of Seller's failure.

6. Seller's failure to obtain and maintain insurance in scope and amounts required under Article 16 -.

Cure Period: Five (5) Business Days after Company provides notice of Seller's failure.

7. Seller's failure to make any payment to Company as and when required by this PPA, including Liquidated Delay Damages, Actual Damages, and any required indemnification.

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Cure Period: Ten (10) Business Days after Company provides notice that the amount is overdue.

8. The breach by Seller of the Interconnection Agreement, which breach (i) materially interferes with Seller's production and/or delivery of any product or service to be produced or delivered pursuant to this PPA or Company's ability to accept or receive such product or service, (ii) Company's ability to transmit Energy beyond the Point of Delivery, and/or (iii) otherwise has a Material Adverse Effect on Company.

Cure Period: Thirty (30) Days from the breach or the cure period allowed by the Interconnection Agreement (whichever is longer).

9. Seller starts-up, operates, charges, or discharges or permits or causes any third party (including Seller's designated operator) to start-up, operate, charge or discharge any Battery Storage System other than as specifically permitted under this PPA.

Cure Period: None.

10. Seller intentionally or knowingly delivers, or attempts to deliver, Energy for sale under this PPA that was not associated with or stored by the Facility.

Cure Period: None.

11. The monthly Capacity Availability Factor of the Battery Storage System is less than ninety percent (90%) on average for a Commercial Operation Year, provided however, that for purposes of this Event of Default only, if Seller's failure to meet the Capacity Availability Factor during a Commercial Operation Year(s) is directly attributable to a GSU Transformer Failure, such GSU Transformer Failure not to exceed in the aggregate eighteen (18) months in duration during the Term, the number of Days in which such GSU Transformer Failure occurred shall be deducted from the calculation of the Capacity Availability Factor of the Battery Storage System for the Commercial Operation Year(s) in which the GSU Transformer Failure occurred. Seller may only claim one (1) GSU Transformer Failure during the Term.

Cure Period: Seller shall be deemed to have cured this default if the average Capacity Availability Factor of the Battery Storage System is at least ninety percent (90%) for the subsequent Commercial Operation Year.

12. Any failure set forth in Section 10.4(A)1 or Section 10.4(A)2.

Cure Period: Seller shall be deemed to have cured this default if a subsequent Test performed within a one hundred eighty (180) Day period demonstrates that, all of the Performance Criteria meet the

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levels required to pass such Test in accordance with the standards set forth in Exhibit M-1 – Battery Storage System Guaranteed Performance Levels, *provided however*, that the cure period may be extended to a total of three hundred sixty-five (365) Days if Seller provides a written opinion from a mutually-agreeable Independent Engineer that a cure can reasonably be achieved within such additional period.

13. The failure by Seller to perform or observe any other material obligation to Company under this PPA, unexcused by Force Majeure (other than failure to achieve COD, which is addressed in Section 12.2 below).

Cure Period: Thirty (30) Days after Company provides notice thereof; *provided*, that if such default is not reasonably capable of cure within such thirty (30) Day period, Seller shall have such additional period of time (not to exceed ninety (90) Days in any event) as is reasonably necessary for cure, so long as Seller initiates cure within such thirty (30) Day period and diligently prosecutes the cure to conclusion thereafter.

14. Seller removes from the Site equipment upon which the Commercial Operation Test has been based, except for the purposes of replacement, refurbishment, repair or maintenance, and the equipment is not returned within five (5) Days after notice from Company.

Cure Period: Equipment returned five (5) Days after Company provides notice.

15. Seller makes any material misrepresentation or omission in any report (including any status report, logs, and reports required under Section 4.1, Section 5.5, Section 5.6, Section 10.5, and Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection required to be made or furnished by Seller pursuant to this PPA.

Cure Period: Five (5) Days after Company provides notice.

16. Subject to Section 7.3, Seller makes any material misrepresentation or omission in any Availability Notice.

Cure Period: Such Event of Default may be cured if (i) the default was caused solely by an inadvertent error or omission of an administrative or clerical nature and (ii) such default is cured within one (1) Business Day after knowledge of such inadvertent error or omission in the Availability Notice.

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(B) Remedies for Default. In connection with any default by Seller under this Section 12.1 (whether or not cured by Seller), Company may:

1. Seek Actual Damages in such amounts and on such basis for the default as authorized by this PPA;
2. Offset against any payments due to Seller, any Actual Damages and other amounts due from Seller; and/or
3. Draw any Actual Damages and other amounts due from Seller, from the Security Fund.

(C) Termination for Event of Default. Upon and at any time following an Event of Default by Seller under this Section 12.1, in addition to its rights under Section 12.1(B) above, Company may terminate this PPA effective immediately upon notice to Seller, without penalty or further obligation to Seller. In connection with any such termination, Company may collect from Seller (subject to the Damage Cap) all Actual Damages arising from such Event of Default through the Scheduled Termination Date.

(D) Specific Performance. In addition to the other remedies specified herein, upon any Event of Default of Seller under this Section 12.1, Company may elect to treat this PPA as being in full force and effect and Company shall have the right to specific performance.

(E) Option to Acquire Facility upon Termination due to Seller Default. If Company terminates this PPA under this Section 12.1 following COD, then, at any time within ninety (90) Days following such termination, Company may give notice to Seller of Company's intent to purchase the Facility from Seller (a "Default Option Preliminary Exercise Notice").

1. As soon as practicable following delivery of a Default Option Preliminary Exercise Notice, the Parties shall appoint an independent appraiser experienced in appraising utility-scale battery storage facilities to determine the fair market value ("Default FMV") of the Facility. If the Parties cannot agree on the identity of the appraiser, the appraiser shall be selected by the Arbitration Service. Seller shall provide to the appraiser full access to the Facility and the Site, to Seller's contracts, books and records, and to relevant personnel of Seller, during normal business hours. Such access shall include the right to conduct inspections and tests (including environmental testing of the Site and operating tests on the Facility) necessary or appropriate for the determination of the Default FMV of the Facility. Company shall pay all fees and costs of the appraiser. The Parties shall direct the appraiser to use his/her best efforts to complete and deliver his/her appraisal to the Parties within forty-five (45) Days following his/her appointment and to keep all information obtained by appraiser from any investigations as Confidential Information subject to the provisions of Section 20.18.

2. Following delivery of a Default Option Preliminary Exercise Notice, Seller shall provide to Company full access to the Facility and the Site, to

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Seller's contracts, books and records, and to relevant personnel of Seller, during normal business hours. Such access shall include the right to conduct lien searches, surveys, inspections and tests (including environmental testing of the Site and operating tests on the Facility) necessary or appropriate for due diligence review of the Facility. All information obtained by Company from such investigations shall be deemed Confidential Information subject to Section 20.18. All inspections, testing and access to the Facility and the Site by Company and the appraiser shall comport with all of Seller's policies governing the use, operation, and maintenance of the Facility, including health, safety and environmental requirements.

3. Within sixty (60) Days following receipt of an appraisal under this Section 12.1(E), Company may elect to purchase the Facility from Seller (a "Default Option"). If Company fails to notify Seller of Company's election within such sixty (60)-Day period, Company shall be deemed to have elected not to exercise the Default Option. If Company exercises the Default Option, the purchase price to be paid by Company for the Facility in connection with any exercise of the Default Option shall be the Default FMV of the Facility, as determined by the appraiser. Seller shall cooperate in all respects reasonably necessary for Company to exercise its Default Option rights.

4. If Company exercises the Default Option, the Parties shall negotiate and execute a PSA, subject to clause (iv) below. The PSA shall include the terms and conditions set forth in Exhibit L-2 - PSA Provisions. In the event that the Parties cannot agree on the final form of PSA, (i) the issue shall be submitted to "baseball" arbitration in [Minneapolis, MN or Eau Claire, WI] before one arbitrator appointed by the Arbitration Service, i.e. each Party shall submit to the arbitrator a form of proposed PSA, and the arbitrator shall be required to select one of the two forms to be used as the PSA in the transaction, without compromise, as the arbitral award, (ii) the period for closing of the transaction shall be extended for the period required to complete arbitration, (iii) the Party whose form PSA is rejected shall pay the fees and costs of the Arbitration Service, and (iv) if Company's form of PSA is rejected, Company shall have thirty (30) Days following such rejection to decide whether to execute and deliver Seller's form of PSA or abandon the transaction.

5. This Section 12.1(E) shall be specifically enforceable by Company, without bond and without the need to prove irreparable harm.

12.2 Default by Seller: Failure to Achieve Critical Path Development Milestone or COD.

(A) Delay. Seller shall be in default under this PPA if the Facility fails to achieve any Critical Path Development Milestone by the date set forth in Section 4.1(B) ("CPD Delay") or COD by the Target COD ("COD Delay").

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1. Seller shall be liable to pay *[insert \$[250]/MW x Battery Storage System Nameplate Capacity MW]* (“CPD Liquidated Delay Damages”) to Company as a liquidated damage and not a penalty, in lieu of Actual Damages, for each Day of each CPD Delay. CPD Liquidated Delay Damages shall begin to accrue on the Day after the applicable missed Critical Path Development Milestone (in each case, as it may be extended due to Force Majeure) until the first to occur of the satisfaction of the applicable Critical Path Development Milestone or termination of this PPA pursuant to Section 12.2(C) below. CPD Liquidated Delay Damages shall apply if any Critical Path Development Milestone is missed, and the payment of CPD Liquidated Delay Damages with respect to any given Critical Path Development Milestone shall extend each subsequent Critical Path Development Milestone on a day-for-day basis. In the event Seller incurs CPD Liquidated Delay Damages but subsequently achieves the Target COD, Company shall reimburse Seller all such CPD Liquidated Delay Damages.

2. Seller shall be liable to pay *[insert \$[250]/MW Battery Storage System Nameplate Capacity MW]* (“COD Liquidated Delay Damages” and, together with CPD Liquidated Delay Damages, the “Liquidated Delay Damages”) to Company as a liquidated damage and not a penalty, in lieu of Actual Damages, for each Day of a COD Delay. COD Liquidated Delay Damages shall begin to accrue on the Day after the Target COD (in each case, as it may be extended due to Force Majeure), until the first to occur of the COD or termination of this PPA pursuant to Section 12.2(C) below. The payment of CPD Liquidated Delay Damages shall not cure Seller’s failure to achieve COD by the Target COD. For the avoidance of doubt, if Seller is delayed in reaching one or more Critical Path Development Milestones and the Target COD, then Seller may incur both CPD Liquidated Delay Damages and COD Liquidated Delay Damages.

3. Except as provided in Section 12.2(C) below, the payment of Liquidated Delay Damages shall be Company’s sole and exclusive remedy for a CPD Delay or COD Delay.

(B) Cure. Subject to the obligations in Section 12.2(B), Seller shall have a cure period of up to ninety (90) Days for its failure to achieve any Critical Path Development Milestone by the date set forth in Section 4.1(B) (subject to compliance with Seller’s obligations in Section 4.1(B) or Commercial Operation by the Target COD, as applicable so long as the following conditions are satisfied:

1. Seller’s payment of accrued Liquidated Delay Damages shall be a condition to any such cure. In order to utilize the cure period set forth in this Section 12.2(B), Seller must, at any time prior to, but no later than, 6:00 a.m. on the third (3rd) Business Day immediately prior to the Critical Path Development Milestone date set forth in Section 4.1(B) or the Target COD, as applicable (as such dates may have been previously extended pursuant to this Section 12.2(B)), provide Company with (a) Notice of its election to extend such Critical Path Development Milestone date or the Target COD, (b) Seller’s reasonable estimate of the required duration of the full estimated extension period, and (c) its payment

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of the applicable Liquidated Delay Damages for each Day of the full estimated extension period; provided, that if the actual delay is less than the full estimated extension period, then Company shall refund to Seller any unused portion of the applicable Liquidated Delay Damages. For the avoidance of doubt, (i) the Security Fund may not be utilized by Seller for the payment of Liquidated Delay Damages and (ii) the payment of CPD Liquidated Delay Damages shall only extend the Critical Path Development Milestones and not the Target COD, and payment of the COD Liquidated Delay Damages shall only extend the Target COD and not the Critical Path Development Milestones. To the extent Seller achieves the Commercial Operation Date prior to the Target COD as extended pursuant to this Section 12.2(B), Company shall refund Seller any estimated COD Liquidated Delay Damages corresponding to the number of Days by which the extended Target COD Date exceeded the Commercial Operation Date.

2. In addition, for any extensions pursuant to Section 12.2(B) of more than an aggregate total of forty-five (45) Days, Seller must, at any time prior to, but no later than, 6:00 a.m. on the third (3rd) Business Day immediately prior to the Critical Path Development Milestone date set forth in Section 4.1(B) or the Target COD, as applicable (as such dates may have been previously extended pursuant to this Section 12.2(B)), provide a written opinion from a mutually-agreeable Independent Engineer that such Critical Path Development Milestone or COD, as applicable, can reasonably be achieved within such additional period.

(C) Termination. Failure to cure a CPD Delay or COD Delay within the applicable cure period set forth in Section 12.2(B) shall be an Event of Default by Seller. Upon such an Event of Default, Company may (i) terminate this PPA immediately upon notice to Seller, without penalty or further obligation to Seller except as to costs and balances incurred prior to the effective date of such termination, and (ii) in connection therewith, in addition to accrued Liquidated Delay Damages but in lieu of Actual Damages for the balance of the Term, collect from Seller liquidated damages therefor in the amount of [insert \$100/kW x Battery Storage System Nameplate Capacity kW)].

12.3 Default by Company.

(A) Events. Any of the following events shall constitute a default by Company under this PPA. If no cure period is provided below, such default shall be deemed an Event of Default by Company immediately upon its occurrence. If a cure period is provided below, such default shall mature into an Event of Default if not cured within the indicated cure period, subject to Section 13.3 below.

1. Company's application for, or consent (by admission of material allegations of a petition or otherwise) to, the appointment of a receiver, trustee or liquidator for Company or for all or substantially all of its assets, or its authorization of such application or consent, or the commencement of any proceedings seeking such appointment without such authorization, consent or application, which proceedings continue undismissed or unstayed for a period of sixty (60) Days from inception.

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Cure Period: None.

2. Company's authorization or filing of a voluntary petition in bankruptcy or application for or consent (by admission of material allegations of a petition or otherwise) to the application of any bankruptcy, reorganization, readjustment of debt, insolvency, dissolution, liquidation or other similar law of any jurisdiction or the institution of such proceedings against Company without such authorization, application or consent, which proceedings remain undismissed or unstayed for sixty (60) Days from its inception or which result in adjudication of bankruptcy or insolvency within such time.

Cure Period: None.

3. Company's assignment of this PPA, not permitted by Section 19.2.

Cure Period: None.

4. Any representation or warranty by Company that materially affects its ability to perform this PPA; (a) is proven to have been false in any material respect when made; or (b) ceases to remain true in all material respects during the Term, provided however, that a representation or warranty that ceases to remain true due to a change in Applicable Law shall not be considered an Event of Default.

Cure Period: Thirty (30) Days after Seller provides notice of such breach.

5. Company's failure to make any payment to Seller as and when required by this PPA, including invoiced amounts, Actual Damages and any required indemnification.

Cure Period: Ten (10) Business Days after Seller provides notice that the amount is overdue.

6. The failure by Company to perform or observe any other material obligation to Seller under this PPA, unexcused by Force Majeure.

Cure Period: Thirty (30) Days after Seller provides notice; *provided*, that if such default is not reasonably capable of cure within such thirty (30) Day period, Company shall have such additional period of time (not to exceed ninety (90) Days in any event) as is reasonably necessary for cure, so long as Company initiates cure within such thirty (30) Day period and diligently prosecutes the cure to conclusion thereafter.

(B) Remedies for Default. In connection with any default by Company (whether or not cured by Company), Seller may:

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1. Seek Actual Damages in such amounts and on such basis for the default as authorized by this PPA; and/or

2. Offset against any payments due to Company, any Actual Damages and other amounts due from Company.

(C) Termination for Event of Default. Upon an Event of Default by Company, in addition to its rights under Section 12.3(B) above, Seller may terminate this PPA immediately upon notice to Company, without penalty or further obligation to Company, and in connection therewith, collect from Company all Actual Damages arising from such Event of Default through the Scheduled Termination Date.

12.4 Limitations on Damages.

(A) Except as otherwise provided in Section 12.4(B), following COD Seller's aggregate financial liability to Company for Actual Damages shall not exceed [insert \$[75]/kW x Battery Storage System Nameplate Capacity kW] (the "Damage Cap"). If at any time following COD, Company incurs damages in excess of the Damage Cap that Seller does not pay when billed by Company, Company shall have the right to terminate this PPA upon notice to Seller, without further obligation by either Party except as to costs and balances incurred prior to the effective date of such termination.

(B) Actual Damages payable by Seller arising out of any of the following events shall not be subject to the Damage Cap and shall not be credited against the Damage Cap:

1. damage to Company-owned facilities proximately caused by negligence, breach of this PPA or misconduct by Seller, its directors, officers, employees and agents;

2. Seller's intentional misrepresentation or intentional misconduct in connection with this PPA or the operation of the Facility;

3. the sale or diversion by Seller to a third party of any Energy, capacity, or Ancillary Services from the Facility, excluding any sales in mitigation of damages;

4. Seller's failure (i) to maintain insurance coverages in the types and amounts required by this PPA or (ii) to apply any insurance proceeds as required by Section 16.5;

5. any indemnification claim under this PPA;

6. any Environmental Contamination caused or exacerbated by Seller; or

7. damages incurred by Company in connection with any bankruptcy or insolvency proceeding involving Seller, including Company's loss of

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the benefit of its bargain due to rejection or other termination of this PPA in such proceeding.

(C) The Parties confirm that the express remedies and measures of damages provided in this PPA satisfy the essential purposes hereof. If no remedy or measure of damages is expressly herein provided, the obligor's liability shall be limited to all direct damages proximately caused by such default ("Actual Damages") incurred by the non-defaulting Party, provided that if Seller is the defaulting Party, Actual Damages recoverable by Company hereunder may include Replacement Power Costs. **Neither Party shall be liable to the other Party for consequential, incidental, punitive, exemplary, special, treble, equitable or indirect damages, lost profits or other business interruption damages regardless of whether the relevant cause of action arises from statute, in tort or contract** (except to the extent expressly provided herein); *provided, however*, that if either Party is held liable to a third party for such damages and the Party held liable for such damages is entitled to indemnification from the other Party hereto, the Indemnifying Party shall be liable for, and obligated to reimburse the Indemnified Party for all such damages.

(D) To the extent damages required to be paid hereunder are liquidated, the Parties acknowledge that Actual Damages would be substantial but difficult or impossible to determine, that otherwise obtaining an adequate remedy is inconvenient, and that the liquidated damages constitute a reasonable approximation of the harm or loss.

12.5 Bankruptcy. This PPA grants each Party the contractual right to "cause the liquidation, termination or acceleration" of the transactions within the meaning of Sections §556, §560 and §561 of the U.S. Bankruptcy Code, as they may be amended superseded or replaced from time to time. Upon a bankruptcy, a non-defaulting Party shall be entitled to exercise its rights and remedies under this PPA in accordance with the safe harbor provisions of the U.S. Bankruptcy Code set forth in, *inter alia*, Sections §362(b)(6), §362(b)(17), §362(b)(27), §362(o), § 546(e), §548(d)(2), §556, §560 and §561, as they may be amended, superseded or replaced from time to time.

12.6 Cumulative Remedies. Except as explicitly provided to the contrary in this PPA, each right or remedy of the Parties provided for in this PPA shall be cumulative of and shall be in addition to every other right or remedy provided for in this PPA, and the exercise of one or more of the rights or remedies provided for herein shall not preclude the simultaneous or later exercise by such Party of any other rights or remedies provided for herein.

12.7 Duty to Mitigate. Each Party shall use Commercially Reasonable Efforts to mitigate any damages it may incur as a result of a default by the other Party under this PPA.

Article 13 - Dispute Resolution

13.1 Negotiation.

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(A) In the event of any dispute arising under or associated with the Parties' performance of this PPA (a "Dispute"), within ten (10) Business Days following notice by either Party (a "Dispute Notice"), (i) each Party shall appoint a representative, and (ii) the representatives shall meet, negotiate and attempt in good faith to resolve the Dispute quickly, informally and inexpensively. Any Dispute that is mutually agreed by the Parties (each acting in its sole and complete discretion) to involve engineering, construction or technical matters as the sole or primary area of disagreement between the Parties shall be deemed to be a "Technical Dispute" (each, a "Technical Dispute"). The Parties agree that the technical expert for purposes of resolving any Technical Disputes shall be a mutually agreeable Independent Engineer, the costs and expenses for which will be shared equally by the Parties. The Independent Engineer may, if he or she deems it appropriate, hold a hearing on the subject of the Technical Dispute and shall, upon the request of either Party, meet with the Parties or their representatives with respect to such Technical Dispute within three (3) Business Days of the request for such meeting. The Independent Engineer shall render a decision solely resolving the Technical Dispute within five (5) Business Days of the meeting with the Parties or their representatives or hearing (if any), or such longer period as the Parties and the Independent Engineer may agree. The decision of the Independent Engineer shall be advisory rather than final and binding on the Parties.

(B) In the event the Parties' representatives cannot resolve the Dispute, or if either Party is not satisfied with the resolution of the Technical Dispute by the Independent Engineer, within thirty (30) Days after the first meeting, either Party may request that consideration and resolution of the Dispute be transferred to senior management. Within ten (10) Days following such a request, each Party shall submit a written summary of the Dispute describing the issues and claims to a senior officer of each Party designated to address the Dispute. Within ten (10) Business Days after receipt of each Party's Dispute summaries, the designated senior managers for both Parties shall negotiate in good faith to resolve the Dispute. If such senior managers are unable to resolve the Dispute thereafter, either Party may seek available legal remedies, subject to Sections 13.3, 19.3 and 19.5.

13.2 Time Bar. If no Dispute Notice has been issued within eighteen (18) months following the occurrence of events or circumstances giving rise to the Dispute (regardless of the actual knowledge of either Party of such events and circumstances), all claims related to such Dispute (including any allegations of billing errors) shall be deemed waived and the aggrieved Party shall thereafter be barred from proceeding thereon.

13.3 No Termination Pending Dispute Resolution. Notwithstanding Section 12.1 or Section 12.3 to the contrary:

(A) An Event of Default shall not be deemed to have occurred (and hence neither Party may terminate this PPA) for failure by the other Party to pay any amount(s) allegedly due totaling less than one hundred thousand Dollars (\$100,000), if (1) such amount(s) are disputed in good faith, (2) the Party alleged to owe such amount(s) promptly commences and diligently pursues resolution of the Dispute pursuant to Section

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13.1, and (3) the owed amount (if any) is paid within ten (10) Business Days after all dispute resolution mechanisms are completed with respect thereto.

(B) An Event of Default by Seller shall not be deemed to have occurred (and hence Company may not terminate this PPA) for failure by Seller to pay any amount(s) allegedly due totaling one hundred thousand Dollars (\$100,000) or more, if:

1. such amount(s) are disputed by Seller in good faith;
2. Seller promptly commences and diligently pursues resolution of the Dispute pursuant to Section 13.1;
3. Seller either holds an Investment Grade Credit Rating, or posts cash collateral to secure its obligations (if any) with respect to the disputed amount(s), in an amount equal to the amount(s) in dispute, under a mutually agreeable third-party escrow and account control agreement, in addition to the Security Fund; and
4. the owed amount (if any) is paid by Seller within ten (10) Business Days after all dispute resolution mechanisms are completed with respect thereto.

(C) An Event of Default by Company shall not be deemed to have occurred (and hence Seller may not terminate this PPA) for failure by Company to pay any amount(s) allegedly due totaling one hundred thousand Dollars (\$100,000) or more, if

1. such amount(s) are disputed by Company in good faith;
2. Company promptly commences and diligently pursues resolution of the Dispute pursuant to Section 13.1;
3. Company either holds an Investment Grade Credit Rating, or posts cash collateral to secure its obligations (if any) with respect to the disputed amount(s), in an amount equal to the amount(s) in dispute, under a mutually agreeable third-party escrow and account control agreement; and
4. the owed amount (if any) is paid by Company within ten (10) Business Days after all dispute resolution mechanisms are completed with respect thereto.

13.4 Governing Law. The interpretation and performance of this PPA and all actions related hereto (whether sounding in contract, tort or otherwise), shall be governed and construed in accordance with the laws of the State of [Minnesota or Wisconsin], exclusive of conflict of laws principles.

13.5 Venue. The Parties submit to the exclusive jurisdiction of the state courts of the State of [Minnesota or Wisconsin] for purposes of resolving any Dispute hereunder,

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except as provided Sections 12.1(E), 19.3 and 19.5. Venue for any court proceedings shall lie exclusively in

[NSPM:] the Minnesota District Court for the Fourth District or, if jurisdictionally available, the U.S. District Court for the District of Minnesota.

[NSPW] [update as applicable] [the Wisconsin District Court for the [District] or, if jurisdictionally available, the U.S. District Court for the District of Wisconsin.]

13.6 Waiver of Jury Trial. **Seller and Company each hereby knowingly, voluntarily and intentionally waive any rights they may have to a trial by jury** in respect of any litigation based hereon, or arising out of, under, or in connection with, this PPA or any course of conduct, course of dealing, statements (whether oral or written) or actions of Seller and Company related hereto and expressly agree to have any Disputes be adjudicated by a judge of the court having jurisdiction, without a jury, subject only to Sections 12.1(E) and 19.3 and 19.5.

Article 14 - Force Majeure

14.1 Definition. For purposes hereof, “Force Majeure” means an event or circumstance that prevents a Party from performing its obligations under this PPA, which event or circumstance (i) was not anticipated as of the Effective Date, (ii) is not within the control of or the result of the fault or negligence or failure to follow Good Utility Practices of the Party claiming excuse, and (iii) which by exercise of due diligence and foresight could not reasonably have been avoided; Force Majeure shall not include:

(A) any failure, inability, delay or excess cost, to procure any equipment or component to perform this PPA for any reason (the risk of which is assumed by Seller), including as a result of the imposition of tariffs or any other changes in Applicable Law or supply chain disruptions;

(B) acts or omissions of a third party (including vendors and contractors to Seller), unless such acts or omissions are themselves excused by reason of Force Majeure as defined in this Section 14.1;

(C) failure to obtain any Permits required for the Facility, including the Permits set forth on Exhibit F - Seller's Needed Permits hereto;

(D) mechanical or equipment breakdown or failure to operate, under circumstances that are within the design criteria and/or normal operating tolerances of similar equipment;

(E) Environmental Contamination at the Site;

(F) changes in market conditions;

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(G) any delay or failure by the Transmission Authority to perform its obligations under the Interconnection Agreement or any Curtailment or reduction in deliveries by the Transmission Authority;

(H) any delay or nonperformance by suppliers, vendors or other third parties with whom Seller has contracted, including the failure of such third party to deliver any required components to Seller, except to the extent such delay or nonperformance is directly caused by circumstances that would themselves constitute Force Majeure as defined in this Section 14.1 as applied to such third party;

(I) the delay or effects of the COVID epidemic or pandemic (or any variant of COVID), except to the extent there occurs after the Effective Date: (A) the adoption or taking effect of any Applicable Law in respect of such COVID epidemic or pandemic (or any variant thereof), or (B) a change in any Applicable Law or any health or safety recommendation or guideline of a Governmental Authority in respect of such COVID epidemic or pandemic (or variant thereof);

(J) changes of Applicable Law, except to the extent the change (i) occurs after the Effective Date; and (ii) renders performance under the Agreement by the Party claiming Force Majeure illegal or impossible; or

(K) labor strikes, slowdowns, work stoppages, or other labor disruptions.

14.2 Applicability of Force Majeure. A Party shall be relieved of its obligations to perform this PPA and shall not be considered to be in default with respect to any obligation under this PPA if and to the extent such Party is prevented from fulfilling such obligation by Force Majeure, *provided, however*, that: (i) such Party gives notice describing the circumstances and impact of the Force Majeure no later than ten (10) Business Days after the occurrence of the Force Majeure; (ii) the relief from its obligations sought by such Party is of no greater scope and of no longer duration than is required by the Force Majeure; (iii) such Party proceeds with due diligence to overcome the Force Majeure and resumes performance of its obligations under this PPA as soon as practicable thereafter; and (iv) such Party provides notice upon conclusion of the Force Majeure. Failure to provide such notice within the required time period shall be deemed conclusive evidence that the claimed Force Majeure event either did not occur or did not impact Seller's ability to perform its obligations under this PPA in any fashion and thus Seller shall not be entitled to relief under this Article 14 -.

14.3 Limitations on Effect of Force Majeure.

(A) Force Majeure shall only relieve a Party of such obligations as are actually precluded by the Force Majeure.

(B) In no event will the existence of Force Majeure extend this PPA beyond its stated Term.

(C) If, (i) prior to COD, Force Majeure affecting Seller continues for a period of ninety (90) consecutive Days or any one-hundred fifty (150) non-consecutive

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Days, or (ii) after COD Force Majeure affecting Seller continues for a period of one-hundred eighty (180) consecutive Days or any two-hundred seventy (270) non-consecutive Days in any three consecutive Commercial Operation Years, Company may, at any time following the end of such period, terminate this PPA upon notice to Seller, without further obligation by either Party except as to costs and balances incurred prior to the effective date of such termination.

Article 15 - Representations, Warranties and Covenants

15.1 Each Party hereby represents and warrants to the other as follows, which representations and warranties shall be deemed to be repeated, if applicable, by each Party throughout the Term:

(A) Such Party is a valid separate legal entity, duly organized, validly existing and in good standing under Applicable Law. It is qualified to do business in the State in which the Facility is located and each other jurisdiction where the failure to so qualify would have a Material Adverse Effect on the business or financial condition of the other Party. It has all requisite power and authority to conduct its business, to own its properties, and to execute, deliver, and perform its obligations under this PPA.

(B) The Party's execution, delivery, and performance of all of its obligations under this PPA have been duly authorized by all necessary organizational action, and do not and will not:

1. require any consent or approval by any governing corporate or management body, other than that which has been obtained and is in full force and effect (evidence of which shall be delivered to the other Party upon its request);
2. violate any Applicable Law, the violation of which could have a Material Adverse Effect on the representing Party's ability to perform its obligations under this PPA;
3. result in a breach or constitute a default under the representing Party's formation documents, bylaws or equivalent, or under any agreement relating to its management or affairs, any indenture or loan or credit agreement, or any other agreement, lease, or instrument to which it is a party or by which it or its properties or assets may be bound or affected, the breach or default of which could reasonably be expected to have a Material Adverse Effect on the representing Party's ability to perform its obligations under this PPA; or
4. result in, or require the creation or imposition of any mortgage, deed of trust, pledge, lien, security interest, or other charge or encumbrance of any nature (other than as may be contemplated by this PPA) upon or with respect to any of the assets or properties of the representing Party now owned or hereafter acquired, the creation or imposition of which could reasonably be expected to have a Material Adverse Effect on the representing Party's ability to perform its obligations under this PPA.

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(C) This PPA is a valid and binding obligation of the representing Party.

(D) The execution and performance of this PPA will not conflict with or constitute a breach or default under any contract or agreement of any kind to which the representing Party is a party or any judgment, order, or Applicable Law, applicable to it or its business.

(E) Within the meaning of the U.S. Bankruptcy Code, (i) this PPA constitutes a “master netting agreement,” (ii) all transactions pursuant to this PPA constitute “forward contracts” or a “swap agreement,” (iii) the representing Party is a “forward contract merchant” and “master netting agreement participant,” and (iv) all payments made or to be made pursuant to this PPA constitute “settlement payments.”

(F) Such Party is (i) a producer, processor, or commercial user of, or a merchant handling, the commodity which is the subject of this PPA, or the products or by products thereof; and (ii) entering into this PPA solely for purposes related to its business as such.

15.2 Seller further hereby covenants to Company throughout the Term that, in connection with its obligations under this PPA:

(A) Seller shall deliver to Company the products and services required by this PPA free and clear of all liens, security interests, claims and encumbrances or any interest therein or thereto by any person.

(B) No portion of the Facility (including any of its components and materials) will be extracted, mined, produced, manufactured, assembled or processed using any form of convict, indentured or forced labor, including indentured or forced child labor (“Forced Labor”). Seller represents and warrants that it shall at a minimum comply with all Forced Labor Laws, including but not limited to the UFLPA, Section 307 of the Tariff Act of 1930, 19 U.S.C. §1307, when performing the work under this Agreement. Without limiting any other obligation of Seller hereunder, Seller shall not, and shall ensure that its Affiliates, suppliers, subcontractors, and other business partners involved in any tier of the extraction, mining, production, processing, assembly or manufacturing of the materials and components used in the Project, within the United States or globally, do not (i) use any form of Forced Labor at any stage of extraction, mining, production, manufacturing, assembly or processing of any components or materials or (ii) cause or permit the Facility (including any of its components and materials) to originate from, or be extracted, mined, produced, manufactured, assembled or processed in any place or region known or suspected to use Forced Labor. Seller shall maintain adequate procedures, internal controls and audit procedures necessary to ensure compliance with this Section.

Article 16 - Insurance

16.1 Evidence of Insurance. No later than commencement of construction and thereafter no later than five (5) Business Days after each applicable expiration date, Seller shall provide to Company via email, a copy of insurance certificates acceptable to

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Company evidencing that insurance coverages for the Facility are in force and in compliance with the specifications for insurance coverage set forth in Exhibit E - Insurance Coverage to this PPA. Such certificates shall

(A) name Company as an additional insured (except workers' compensation);

(B) provide that Company shall receive thirty (30) Days prior written notice of non-renewal, cancellation of, or significant modification to any of the corresponding policies (except that such notice may be ten (10) Days for non-payment of premiums);

(C) provide a waiver of any rights of subrogation against Company, its Affiliates and their officers, directors, agents, subcontractors, and employees; and

(D) indicate that the "Commercial General Liability" policy has been endorsed as described above.

16.2 Policy Requirements. All policies shall be written with insurers with an AM Best rating of at least A-VII or a Standard & Poor's rating of at least A. All policies shall be written on an occurrence basis, except as provided in Section 16.4. All policies shall contain an endorsement that Seller's policy shall be primary in all instances regardless of like coverages, if any, carried by Company. Seller may satisfy its insurance requirements using any reasonable combination of primary and secondary coverage.

16.3 No Implied Limitation. Seller's liability under this PPA is not limited to the amount of insurance coverage required herein.

16.4 Term and Modification of Insurance.

(A) All insurance required under this PPA shall cover occurrences during the Term and for a period of two (2) years after the Term. In the event that any insurance as required herein is commercially available only on a "claims-made" basis, such insurance shall provide for a retroactive date not later than the Effective Date and such insurance shall be maintained by Seller for a minimum of six (6) years after the Term.

(B) Company shall have the right, at times deemed appropriate to Company during the Term, to request Seller to modify the insurance minimum limits specified in Exhibit E - Insurance Coverage in order to maintain Commercially Reasonable coverage amounts. Seller shall make Commercially Reasonable Efforts to comply with any such request.

(C) If any insurance required to be maintained by Seller hereunder ceases to be reasonably available and commercially feasible in the commercial insurance market, Seller shall provide notice to Company, accompanied by a certificate from an independent insurance advisor of recognized national standing, certifying that such insurance is not reasonably available and commercially feasible in the commercial insurance market for electric energy storage plants of similar type, geographic location

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and capacity (or, if not enough data is available for energy storage plants, such advisor may use utilize data regarding electric generation projects as a proxy for energy storage). Upon receipt of such notice, Seller shall use Commercially Reasonable Efforts to obtain other insurance that would provide comparable protection against the risk to be insured.

16.5 Application of Proceeds. Except to the extent otherwise required by the Financing Documents, Seller shall apply any insurance proceeds first to reconstruction of the Facility following any material casualty to the Facility that occurs more than eighteen (18) months prior to the Scheduled Termination Date.

Article 17 - Indemnity

17.1 Indemnification: General. Each Party (the "Indemnifying Party") shall indemnify, defend and hold the other Party (the "Indemnified Party") harmless from and against all third-party claims, demands, lawsuits (including citizen suits), losses, liabilities, fines, penalties, and expenses (including attorneys' fees) (generally, "Losses"), to the extent proximately caused by:

- (A) a default under this PPA by the Indemnifying Party;
- (B) a violation or alleged violation of Applicable Laws by the Indemnifying Party; and
- (C) the negligence, intentional acts and other misconduct of the directors, officers, employees, or agents of the Indemnifying Party.

17.2 Indemnification: Environmental. Seller shall indemnify, defend and hold Company harmless from and against all Losses arising out of any claim by any Governmental Authority or other third party alleging Environmental Contamination at the Site and/or illegal disposal of Hazardous Materials off-site, regardless of merit and regardless of Seller's responsibility therefor.

17.3 Indemnification: House Power. If Seller obtains House Power from the Facility and/or a self-generation source other than the Facility, Seller shall: (i) at Company's discretion, provide evidence reasonably satisfactory to Company that it is permitted to do so under Applicable Law, and (ii) shall indemnify, defend and hold Company harmless from and against all Losses that may result therefrom.

17.4 Indemnification: Company Remote Start of Facility. Should Company remotely start the Facility, Seller shall indemnify, defend and hold Company harmless from and against all Losses that may result therefrom.

17.5 Limitations.

(A) The foregoing indemnification obligations shall apply notwithstanding any contributory misconduct of the Indemnified Party, but the Indemnifying Party's liability to indemnify the Indemnified Party shall be reduced in proportion to the percentage by which the Indemnified Party's misconduct caused the damages.

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(B) Neither Party shall be indemnified for Losses resulting from the sole negligence or willful misconduct of the directors, officers, employees, or agents of such Party.

(C) These indemnity provisions shall not be construed to relieve any insurer of its obligation to pay claims consistent with the provisions of a valid insurance policy. Nothing in this Article 17 - shall enlarge or relieve Seller or Company of any liability to the other for any breach of this PPA.

17.6 Procedures.

(A) Promptly after receipt by a Party of any claim or notice of the commencement of any action, administrative, or legal proceeding, or investigation as to which the indemnity provided for in this Article 17 - may apply, the Indemnified Party shall provide notice thereof to the Indemnifying Party; *provided* that a delay in providing such notice shall limit the obligations of the Indemnifying Party only to the extent that such delay actually prejudices the ability of the Indemnifying Party to contest the claim or defend the proceeding.

(B) The Indemnifying Party shall assume the defense thereof with counsel designated by such Party and satisfactory to the Indemnified Party, *provided, however*, if the defendants in any such action include both the Indemnified Party and the Indemnifying Party, and the Indemnified Party shall reasonably conclude that there may be legal defenses available to it which are different from or additional to, or inconsistent with, those available to the Indemnifying Party, the Indemnified Party shall have the right to select and be represented by separate counsel, at the Indemnifying Party's expense.

(C) If an Indemnifying Party fails to assume the defense of a claim meriting indemnification, the Indemnified Party may contest, settle, or pay such claim at the expense of the Indemnifying Party, *provided, however, that* settlement or full payment of any such claim may be made only following consent of the Indemnifying Party or, absent such consent, written opinion of the Indemnified Party's counsel that such claim is meritorious or otherwise warrants settlement.

17.7 Amounts Owed. In the event that a Party is obligated for indemnification under this Article 17 -, the amount owing to the Indemnified Party will be the amount of the Indemnified Party's actual Losses net of any insurance proceeds received by the Indemnified Party following Commercially Reasonable Efforts by the Indemnified Party to obtain such insurance proceeds.

Article 18 - Lender Provisions

18.1 Accommodation of Facility Lender.

(A) Company shall provide such consents to collateral assignment, certifications, representations, estoppels, information or other documents, as may be reasonably requested by Seller in connection with the financing of the Facility consistent with the terms set forth in Exhibit K - Lender Consent Provisions (generally, a "Lender

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Consent”), *provided, however*, that in providing a Lender Consent, Company shall have no obligation to:

1. modify the terms of this PPA;
2. provide any consent or enter into any agreement that has a Material Adverse Effect on any of Company’s rights, benefits, risks, or obligations under this PPA;
3. transfer or release any property or property interests of Company;
4. release or subordinate (or cause the release or subordination of) any lien on any property of Company for the benefit of Seller or the Facility Lender; or
5. permit any lien to be placed on property of Company.

(B) Seller shall reimburse, or shall cause the Facility Lender to reimburse, Company for the direct expenses (including the fees and expenses of counsel) incurred by Company in the preparation, negotiation, execution and/or delivery of each Lender Consent and any documents requested by Seller or the Facility Lender pursuant to this Section 18.1.

18.2 Lender Notices.

(A) Seller shall provide Company with a notice identifying the Facility Lender (“Lender Notice”) and providing appropriate contact information for the Facility Lender. Following receipt of such notice, Company shall provide to the Facility Lender a copy of each notice of alleged default delivered to Seller under Section 12.1 or Section 12.2, and Company will accept a cure thereof performed by the Facility Lender, so long as the cure is accomplished within the applicable cure period set forth in this PPA or the relevant Lender Consent.

(B) Within ten (10) Days following Seller’s receipt of each notice of default or Facility Lender’s intent to exercise any remedies under the Financing Documents, Seller shall deliver a copy of such notice to Company.

Article 19 - Assignment

19.1 Assignment by Seller.

(A) Seller shall not sell, exchange or otherwise transfer the Facility or any material portion thereof to any third party, nor shall Seller undergo any Change of Control (whether voluntary or by operation of law), absent the prior written consent of Company, which shall not be unreasonably withheld or delayed. Company shall have no obligation to provide any consent under this Article 19 - unless:

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1. Seller has complied with Sections 19.3, 19.4, and 19.5 if and as applicable;
2. Seller has provided to Company such information concerning the transferee's direct and indirect ownership as Company reasonably requests;
3. the transferee has substantial experience in the operation of power energy storage facilities akin to the Facility, either directly, through its Affiliates or through a Qualified Operator;
4. the transferee (together with its parents and Affiliates) possesses an Investment Grade Credit Rating or other creditworthiness satisfactory to Company;
5. Seller has provided to Company at least thirty (30) Days' prior written notice of the transaction; and
6. Seller pays or reimburses Company for the direct expenses (including the fees and expenses of counsel) incurred by Company in connection with the transaction.

(B) Any Change of Control or sale, transfer, or assignment of any interest in the Facility completed without fulfilling the requirements of this PPA shall be null, void and a breach of this PPA.

(C) Seller shall assign this PPA to any successor owner of the Facility and shall cause such successor to assume all obligations of Seller (accrued and prospective) hereunder via a writing reasonably satisfactory to Company. Seller also may assign this PPA for collateral purposes to any Facility Lender and may subcontract some or all of its duties under this PPA, upon notice to but without the consent of Company.

(D) Except as permitted in this Section 19.1, Seller may not assign this PPA or any portion hereof. No assignment shall relieve Seller of its obligations under this PPA, nor impair any security posted by Seller unless such security is replaced in accordance with Article 11 -. Before this PPA is assigned by Seller, the assignee must first obtain such approvals as may be required by all applicable Governmental Authorities.

19.2 Assignment by Company.

(A) Company may assign this PPA to any Affiliate, or to any successor that provides retail electric service in all or substantially all of Company's service territory and is subject to rate and quality service regulation under the jurisdiction of the MPUC and/or NDPSC. Any other assignment of this PPA by Company shall require the prior written consent of Seller, not to be unreasonably withheld or delayed.

(B) If an assignee of Company possesses a Credit Rating equal to or better than Investment Grade or Company's Credit Rating as of the date of assignment (whichever is higher), Seller shall release Company from its obligations hereunder if so

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requested by Company. Except for the foregoing, no assignment shall relieve Company of its obligations under this PPA.

(C) Any assignee of Company shall assume all obligations of Company (accrued and prospective) hereunder via a writing reasonably satisfactory to Seller. Before this PPA is assigned by Company, the assignee must first obtain such approvals as may be required by all applicable Governmental Authorities.

19.3 Right of First Offer ("ROFO").

(A) At any time after the Commercial Operation Date, but before the end of the Term,

1. if Seller proposes to sell the Facility to an unaffiliated third party, Seller shall first offer to sell the Facility to Company via notice to Company,

2. if Seller's parent proposes to sell a majority of any class of voting and/or non-voting equity interests in Seller (excluding interests owned by tax equity investors) to an unaffiliated third party, Seller shall cause its parent first to offer to sell such equity interests to Company via notice to Company, and

3. if Seller's parent owns no assets other than its equity interests in Seller and the parent of Seller's parent proposes to sell a majority of any class of voting and/or non-voting equity interests in Seller's parent (excluding interests owned by tax equity investors) to an unaffiliated third party, Seller shall cause its parent's parent first to offer to sell such equity interests to Company via notice to Company.

in each case (1) through (3) above, a "ROFO Notice". Any ROFO Notice shall describe the proposed transaction, including the minimum price, status of title to the Site, liabilities to be assumed and other terms which Seller or its relevant parent (as applicable) is willing to accept to proceed with the contemplated transaction. The contents of a ROFO Notice shall be deemed Confidential Information for purposes of Section 20.18 below.

(B) Following issuance of a ROFO Notice, Seller shall allow Company sixty (60) Days to investigate the proposed transaction and conduct due diligence. Due diligence shall include such physical inspections, surveys and operating tests of the Facility and the Site, such reviews of Seller's contracts, books and records, and interviews of such personnel, as Company may reasonably request. All information obtained by Company from such investigations shall be deemed Confidential Information subject to Section 20.18 below. Within such sixty (60)-Day period, Company may elect to purchase the Facility or the relevant equity interests (as applicable) on substantially the same terms as set forth in the ROFO Notice. If Company fails to notify Seller of Company's election within such sixty (60)-Day period, Company shall be deemed to have rejected the transaction.

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(C) If Company elects to purchase the Facility or the specified equity interests (as applicable), the Parties shall negotiate and execute a PSA. If Company elects to purchase the Facility the PSA shall include the price and other terms set forth in the ROFO Notice and such other terms as are set forth in Exhibit L-2 - PSA Provisions. If Company elects to purchase the specified equity interests, the PSA shall include the price and other terms set forth in the ROFO Notice and such other terms as are set forth in EXHIBIT L-3 - MIPS A PROVISIONS.

(D) If Company rejects the transaction described in a ROFO Notice, Seller shall have the right to sell the Facility (or Seller's relevant parent shall have the right to sell the specified equity interests, as applicable) on terms that a reasonable person would determine are not more favorable to such buyer than the terms offered to the Company in the ROFO Notice, at any time within the twelve (12)-month period following issuance of the ROFO Notice. If Seller or its relevant parent fails to close a transaction on such terms within such twelve (12)-month period, any sale of the Facility or equity interests in Seller shall again be subject to this Section 19.3.

(E) This Section 19.3 shall be specifically enforceable by Company, without bond and without the need to prove irreparable harm.

(F) Seller shall cooperate in all respects reasonably necessary for Company to exercise its ROFO rights, and shall operate the Facility in the ordinary course of business following the date of issuance of a ROFO Notice.

19.4 PFT.

(A) Seller shall give Company at least ninety (90) Days' prior written notice (a "PFT Notice") of any Pending Facility Transaction that does not otherwise trigger Company's ROFO rights under Section 19.3, in order to provide Company with an opportunity to discuss and negotiate with Seller the possible sale of the Facility to Company. Any PFT Notice shall include a fair summary of Seller's plans with respect to the Facility in connection with the proposed Pending Facility Transaction, to the extent then known by Seller. The contents of a PFT Notice shall be deemed Confidential Information for purposes of Section 20.18 below.

(B) Seller shall have no obligation to sell nor shall Company have any obligation to purchase the Facility, following any PFT Notice. Issuance of a PFT Notice shall not relieve Seller of its obligation to offer a ROFO to Company if and when applicable pursuant to Section 19.3. In the event that the transaction giving rise to the PFT Notice has not been completed within twelve (12) months following a PFT Notice, Seller shall be required to resubmit a PFT Notice for such transaction.

(C) Any breach of this Section 19.4 shall entitle Company to liquidated damages from Seller in the amount of [insert \$[5]/kW x Battery Storage System Nameplate Capacity kW].

(D) For purposes hereof, a "Pending Facility Transaction" or "PFT" means:

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1. any Change of Control of Seller;
2. the issuance by Seller or any of its Affiliates of a request for proposals or the response by Seller or any of its Affiliates to a request for proposal or similar process (e.g., auction) for the purchase or sale to any unaffiliated third party of any equity interests in Seller or the Facility, or any group(s) of assets or equity interests that includes the Facility;
3. the transmission by Seller or any of its Affiliates of a draft letter of intent, memorandum of understanding, term sheet or similar document (or a revised version thereof) to an unaffiliated third party with respect to the sale of any equity interests in Seller or the Facility, or any group(s) of assets or equity interests that includes the Facility; or
4. the execution by Seller or any of its Affiliates of any letter of intent, memorandum of understanding, term sheet or similar document, whether or not legally binding, which contemplates the sale or lease to an unaffiliated third party of any equity interests in Seller or the Facility or any group(s) of assets or equity interests that includes the Facility; *provided, however*, that a PFT does not include (i) any financing or refinancing of the Facility Debt, (ii) any transaction among Affiliates of Seller, and/or (iii) any transaction for which Seller offers ROFO rights to Company under Section 19.3.

19.5 Option.

(A) At any time during each of the periods that is within one hundred eighty (180) Days following any of (i) the sixth (6th) anniversary of COD, (ii) the tenth (10th) anniversary of COD, (iii) the fourteenth (14th) anniversary of COD and (iv) Scheduled Termination Date, Company (or an Affiliate) may give notice to Seller of Company's (or such Affiliate) intent to purchase (i) the Facility from Seller (a "Facility Acquisition") or (ii) all, but not less than all, of Ultimate Parent's direct and indirect right, title and interest in the equity interests of Seller, and including, if applicable, Ultimate Parent's direct and indirect right, title and interest in the tax equity partnership (the "TE Partnership") that owns, directly or indirectly, equity interests in Seller (together, the "Equity Interest") (an "Equity Interest Acquisition") with such notice in either case referred to as an "Option Preliminary Exercise Notice".

(B) As soon as practicable following delivery of an Option Preliminary Exercise Notice for a Facility Acquisition, the Parties shall appoint an independent appraiser experienced in appraising utility-scale battery storage facilities (as may be applicable to the bid) to determine the fair market value ("FMV") of the Facility. If the Parties cannot agree on the identity of the appraiser, the appraiser shall be selected by the Arbitration Service.

1. Seller shall provide to the appraiser full access to the Facility and the Site, to Seller's contracts, books and records, and to relevant personnel of Seller, during normal business hours. Such access shall include the right to

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conduct inspections, surveys and tests (including environmental testing of the Site and operating tests on the Facility) necessary or appropriate for the determination of FMV of the Facility.

2. Unless otherwise agreed to by Parties, Company shall engage and pay all fees and costs of the appraiser.

3. The Parties shall direct the appraiser to use his/her/its best efforts to complete and deliver his/her/its appraisal to the Parties within two (2) months following his/her/its appointment and to keep all information obtained by appraiser from any investigations as Confidential Information subject to the provisions of Section 20.18.

(C) In the case of an Option Preliminary Exercise Notice for an Equity Interest Acquisition, Company will deliver, together with the Option Preliminary Exercise Notice, its calculation of the purchase price for the Equity Interest Acquisition utilizing the formula for such determination set forth in Exhibit L-1 – Equity Purchase Price Formula. The Parties reasonably believe, based on all facts and circumstances at the time of executing this PPA, that the purchase price for the Equity Interest Acquisition so determined by such formula will not be less than the fair market value of the Equity Interest on the relevant date. All information obtained by Company from such investigations shall be deemed Confidential Information subject to Section 20.18.

(D) Following delivery of an Option Preliminary Exercise Notice, Seller shall provide to Company full access to the Facility and the Site, to Seller's contracts, books and records, and to relevant personnel of Seller, during normal business hours. Such access shall include the right to conduct lien searches, surveys, inspections and tests (including environmental testing of the Site and operating tests on the Facility) necessary or appropriate for due diligence review of the Facility. All information obtained by Company from such investigations shall be deemed Confidential Information subject to Section 20.18.

(E) All inspections, testing and access to the Facility and the Site by Company and the appraiser shall comport with all of Seller's policies governing the use, operation, and maintenance of the Facility, including health, safety and environmental requirements, and shall be conducted in a manner so as to minimize disruption in the operation of the Facility and to avoid any adverse economic impacts to Seller under this PPA.

(F) In the case of a Facility Acquisition, within sixty (60) Days following the determination of FMV as described above, Company may elect to purchase the Facility from Seller (an "Option"). If Company fails to notify Seller of Company's election within such sixty (60)-Day period, Company shall be deemed to have elected not to exercise the Option.

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(G) In the case of a Facility Acquisition, the "Purchase Price" to be paid by Company for the Facility in connection with exercise of the First Option shall be the greater of:

1. the sum of:

a. (x) amount of Facility Debt (if any) as of the date of issuance of the Option Preliminary Exercise Notice, and

b. (y) if the relevant tax equity agreements allow the other members of the TE Partnership the option to purchase, at "fair market value" (as determined in those tax equity agreements) or a pre-determined price, the interest of the tax equity investor that has invested directly or indirectly in the Facility or Seller, then the amount of such purchase option price or, in any other case, the amount necessary to cause the after-tax internal rate of return of such tax equity investor's investment to equal the targeted rate of return under its tax equity agreements, or

2. the FMV of the Facility, as determined by the appraiser.

(H) If Company exercises the Option, the Parties shall use Commercially Reasonable Efforts to negotiate and sign either:

(I) A PSA for the Facility. The PSA shall include the terms and conditions set forth in Exhibit L-2 - PSA Provisions.

(J) A PSA for the Equity Interest. The PSA shall include the terms and conditions set forth in Exhibit L-3 - MIPSAs Provisions.

(K) This Section 19.5 shall be specifically enforceable by Company, without bond and without the need to prove irreparable harm.

Seller shall cooperate, and cause its Affiliates to cooperate, in all respects reasonably necessary for Company to exercise its rights under this Section 19.5, and shall operate the Facility in the ordinary course of business following the date of issuance of an Option Preliminary Exercise Notice.

19.6 Memo of Option. In connection with the Parties' execution and delivery of this PPA, the Parties are executing and Company is recording a "Memorandum of Option" memorializing its Default Option rights under Section 12.1(E), its ROFO rights under Section 19.3 and its Option rights under Section 19.5.

Article 20 - Miscellaneous

20.1 Notices.

(A) Notices required by this PPA shall be in writing addressed to the other Party at the addresses noted in Exhibit D - Notices and Contact Information, as

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either Party updates such addresses from time to time by notice to the other Party. A notice shall be deemed to have been received as follows: (1) if it is delivered by email, when the recipient, by an email sent to the email address for the sender stated in Exhibit D - Notices and Contact Information or by a notice delivered by another method in accordance with this Section 20.1(A), acknowledges having received that email, with an automatic "read receipt" not constituting acknowledgment of an email for purposes of this Section 20.1(A); and, (2) If it is delivered in writing, when receipt is acknowledged in writing by the counterparty (or absent such acknowledgement, when delivered via third-party messenger or via FedEx or other reputable overnight courier service). Any notice shall be deemed to have been received by the close of the Business Day on which it was delivered. Real-time or routine communications concerning Facility operations shall be exempt from this Section 20.1(A).

(B) The Parties recognize the need for accurate communications between them. Each Party consents to the recording of telephone conversations between their employees and representatives, related to the performance and administration of this PPA.

20.2 Taxes.

(A) Company shall purchase all Energy on a wholesale basis, for resale to Company's wholesale and retail customers. Company shall obtain and provide Seller with any certificates required by any Governmental Authority or otherwise reasonably requested by Seller to evidence that the deliveries of Energy hereunder are sales for resale.

(B) As between the Parties, Company shall be solely responsible for the payment of (1) any sales, use or equivalent taxes imposed by Governmental Authorities, whether now in existence or hereafter enacted, on the purchase of Energy and any other products and services purchased by Company hereunder at or beyond the Point of Delivery, and (2) any taxes imposed by Governmental Authorities, whether now in existence or hereafter enacted, on the transmission of Energy beyond the Point of Delivery.

(C) Subject to Section 20.2(B), Seller shall be solely responsible for any and all present and future taxes and other impositions of Governmental Authorities relating to the construction, ownership or leasing, operation or maintenance of the Facility and the Site (including *ad valorem* taxes on the Facility and the Site), and any taxes imposed prior to the Point of Delivery with respect to the products and services to be sold and delivered to Company hereunder, whether calculated based upon cost, value, labor, capital, production, savings, green attributes or other parameters. Seller's prices under Article 8 - are inclusive of such taxes and impositions during the Term, and Seller assumes the risk of changes in such taxes after the Effective Date.

(D) The Parties shall cooperate to minimize tax exposure, *provided, however*, that neither Party shall be obligated to incur any financial burden to reduce taxes for which the other Party is responsible hereunder.

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20.3 Applicable Laws. Each Party shall comply with all Applicable Laws (including the Transmission Authority Tariff), except for any non-compliance that (individually or in the aggregate) could not reasonably be expected to have a Material Adverse Effect on the other Party or on such Party's ability to perform this PPA.

(A) As applicable, each Party shall give all required notices, shall procure and maintain all Permits necessary for performance of this PPA, and shall pay its respective charges and fees in connection therewith.

(B) Each Party shall promptly disclose to the other Party, any violation of any Applicable Laws arising out of their performance of this PPA.

(C) Upon permanent cessation of operation of the Facility, Seller shall decommission and remove the Facility and remediate the Site as, if and when required by Applicable Laws.

(D) Seller acknowledges that as a government contractor Company is subject to Applicable Laws regarding equal employment opportunity and affirmative action, including 41 C.F.R. § 601.4(a) (1-7). Such Applicable Laws may also be applicable to Seller as a subcontractor to Company. All such Applicable Laws shall be deemed to be incorporated herein as required by Applicable Law.

(E) Except as specifically set forth in this Section 20.3 and elsewhere in this PPA, each Party assumes the risk of changes in Applicable Laws following the Effective Date, that affect such Party's costs of ownership and operation of its assets, and its performance of this PPA, except as otherwise specifically set forth herein.

20.4 Fines and Penalties. Seller shall pay when due all fees, fines, penalties and costs incurred by Company, Seller and/or their agents, employees or contractors arising from noncompliance by Seller, its employees, or subcontractors with any provision of this PPA, or any contractual obligation, Permit or requirements of Applicable Law, except for such fines, penalties and costs that are being actively contested in good faith and with due diligence by Seller and for which adequate financial reserves have been set aside to pay such fines, penalties or costs in the event of an adverse determination.

20.5 Rate Changes.

(A) The terms and conditions and the rates for service specified in this PPA shall remain in effect for the Term hereof. Neither Party shall seek (nor support any third party seeking) any prospective or retroactive change to the rates or terms of service under this PPA pursuant to Sections 205, 206 or 306 of the Federal Power Act.

(B) The standard of review for changes to this PPA whether proposed by a Party, a non-party, or FERC acting *sua sponte* shall be the "public interest" standard of review set forth in *United Gas Pipe Line v. Mobile Gas Service Corp.*, 350 U.S. 332 (1956) and *Federal Power Commission v. Sierra Pacific Power Co.*, 350 U.S. 348 (1956) (aka the "Mobile-Sierra doctrine"), as interpreted in *Morgan Stanley Capital Group, Inc. v. Public Util. Dist. No. 1*, 128 S. Ct. 2733 (2008).

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20.6 Certifications. Each Party shall deliver or cause to be delivered to the other Party certificates of its officers, accountants, engineers or agents as to matters as may be reasonably requested, and shall make available personnel and records relating to the Facility to the extent that the requesting Party requires the same in order to fulfill any regulatory reporting requirements, or to assist the requesting Party in litigation, including administrative proceedings before the MPUC/NDPSC.

20.7 Disclaimer of Third-Party Beneficiaries. In executing this PPA, Company does not and does not intend to extend its credit or financial support for the benefit of any Facility Lender or any other third-party transacting with Seller. Nothing in this PPA shall be construed to create any duty to, or standard of care with reference to, or any liability to, any person not a party to this PPA.

20.8 Relationship of the Parties.

(A) This PPA shall not be interpreted to create an association, joint venture, or partnership between the Parties, nor to impose any partnership obligation or liability upon either Party. Except as specifically provided for in this PPA to the contrary, neither Party shall have any right, power, or authority to enter into any agreement or undertaking for, or act on behalf of, or to act as an agent or representative of, the other Party.

(B) Seller shall be solely liable for the payment of all wages, taxes, and other costs related to the employment of persons to perform such services, including all federal, state, and local income, social security, payroll, and employment taxes and statutorily mandated workers' compensation coverage. None of the persons employed by Seller shall be considered employees of Company for any purpose; nor shall Seller represent to any person that he or she is or shall become a Company employee.

20.9 Survival of Obligations. Cancellation, expiration, or earlier termination of this PPA shall not relieve the Parties of obligations, including warranties, remedies, or indemnities, that by their nature should survive such cancellation, expiration, or termination, which obligations shall survive for the period of the applicable statute(s) of limitation.

20.10 Severability. In the event any of the terms, covenants, or conditions of this PPA, its Exhibits, or the application of any such terms, covenants, or conditions, shall be held invalid, illegal, or unenforceable by any court or administrative body having jurisdiction, all other terms, covenants, and conditions of this PPA and their application not adversely affected thereby shall remain in force and effect; *provided, however, that* Company and Seller shall negotiate in good faith to attempt to implement an equitable adjustment in the provisions of this PPA with a view toward effecting the purposes of this PPA by replacing the provision that is held invalid, illegal, or unenforceable with a valid provision the economic effect of which comes as close as possible to that of the provision that has been found to be invalid, illegal or unenforceable.

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20.11 Complete Agreement; Amendments. The terms and provisions contained in this PPA constitute the entire agreement between Company and Seller with respect to the Facility and shall supersede all previous communications, representations, or agreements, either verbal or written, between Company and Seller with respect to the sale and delivery of the products and services required by this PPA. Any amendment of this PPA, or any waiver of any provision hereof, shall be evidenced by a writing signed by the Parties to be bound thereby.

20.12 Waiver. The failure of either Party to enforce or insist upon compliance with or strict performance of any of the terms or conditions of this PPA, or to take advantage of any of its rights hereunder, shall not constitute a waiver or relinquishment of any such terms, conditions, or rights, but the same shall be and remain at all times in full force and effect.

20.13 Binding Effect. This PPA is binding upon and shall inure to the benefit of the Parties hereto and their respective successors, legal representatives, and assigns.

20.14 Headings. Captions and headings used in this PPA are for ease of reference only and do not constitute a part of this PPA.

20.15 Counterparts and Electronic Signatures. This PPA may be executed in counterparts, and each executed counterpart shall have the same force and effect as an original instrument. A manually signed copy of this PPA, or a copy of this PPA signed with an electronic or digital signature, delivered by e-mail shall be deemed to have the same legal effect as delivery of an original signed copy of this PPA. No legally binding obligation shall be created with respect to a Party until such Party has delivered or caused to be delivered a signed copy of this PPA.

20.16 Press Release. Upon the request of either Party, the Parties shall develop a mutually agreed joint press release to be issued describing the location, size and nature of the Facility, the Term, and other relevant factual information about the relationship.

20.17 Exhibits. Either Party may change the information in Exhibit D - Notices and Contact Information at any time by notice without the approval of the other Party. All other Exhibits may be changed to the extent allowed by specific provisions of this PPA or with the mutual consent of both Parties.

20.18 Confidentiality.

(A) For purposes hereof, "Confidential Information" means:

1. information specifically designated as Confidential Information in this PPA; and
2. written information delivered by one Party to the other from time to time during the Term, which information is labeled prominently as "Confidential," "Proprietary" or the like and specifically references this PPA;

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provided, however, that "Confidential Information" shall not include information that:

- a. is publicly available as of the Effective Date, or becomes publicly available during the Term through no fault of the recipient Party;
- b. can be documented was independently developed by the recipient Party; and/or
- c. is disclosed to the recipient Party from an ultimate source other than the protected Party, without breach of this PPA by the recipient Party.

(B) The recipient Party shall (i) maintain the confidentiality of all Confidential Information of the protected Party, using the same degree of care used by the recipient Party to protect its own Confidential Information (and in any event not less than a reasonable degree of care), and (ii) shall use Confidential Information only in connection with its performance of this PPA. Confidential Information may be disclosed by the recipient Party to its agents, employees, directors, officers, consultants, auditors, lenders and equity investors, subject to their acceptance of the obligations of confidentiality imposed hereby and for whose violations of this Section 20.18 the recipient Party shall be responsible.

(C) In the event that Confidential Information is disclosed to the MPUC/NDPSC, their staff, parties, intervenors, participants or consumer counsel in any regulatory or administrative proceedings before the MPUC/NDPSC, or Confidential Information is disclosed to the MPUC/NDPSC, their staff, or consumer counsel outside of any regulatory or administrative proceedings before the MPUC/NDPSC, the disclosing Party shall submit such Confidential Information in accordance with applicable MPUC/NDPSC confidentiality rules and procedures, the MPUC/NDPSC protective order or signed non-disclosure agreement.

(D) In the event that Confidential Information must otherwise be disclosed by Applicable Law (e.g., pursuant to subpoena or civil discovery), the Party required to make disclosure shall notify the protected Party sufficiently in advance to allow the protected Party a reasonable opportunity to obtain a protective order or seek other remedies, prior to disclosure by the recipient Party.

20.19 Accounting Treatment.

(A) If and when Company reasonably determines that Company must consolidate financial information of Seller into Company's financial statements under FASB ASC 810 or other accounting standard applicable to Company:

- 1. the Parties shall use Commercially Reasonable Efforts to amend this PPA and/or the Parties' protocols for operation of the Facility to avoid

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such treatment, at the least possible cost to the Parties, consistent with the intent of this PPA to the extent possible; or

2. if such avoidance is not reasonably feasible, Seller shall provide to Company from time to time upon request such quarterly and annual financial information as may be needed for Company to comply with such standard, in such format and within such time frames as Company may reasonably request.

(B) If and when Company reasonably determines that Company must treat this PPA as a “finance lease” under FASB ASC 842 or other accounting standard applicable to Company, the Parties shall use Commercially Reasonable Efforts to amend this PPA and/or the Parties’ protocols for operation of the Facility to avoid such treatment, at the least possible cost to the Parties, consistent with the intent of this PPA to the extent possible, if so requested by Company.

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IN WITNESS WHEREOF, the Parties have executed this PPA as of the date first set forth above.

Seller:

_____ [LLC]

By: _____

[NAME]

[TITLE]

Company:

**Xcel Energy Services, Inc., authorized signatory for
Northern States Power Company, a [Minnesota or
Wisconsin] corporation,**

By: _____

[NAME]

[TITLE]

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EXHIBIT A - DEFINITIONS

The following terms shall have the meanings set forth herein:

"AC" shall have the meaning set forth in Section 1.1(D).

"Actual Damages" shall have the meaning set forth in Section 12.4(C).

"Affiliate" of any designated person or entity means any person or entity that directly or indirectly controls, is under the control of, or is under common control with, the designated person or entity by the power to direct or cause the direction of the management of the policies of designated person or entity, whether through ownership interest, by contract or otherwise.

"AGC" or "Automatic Generation Control" means the equipment and capability of an electric energy storage facility automatically to adjust the charging and discharging quantity within the applicable Balancing Authority with the purpose of interchange balancing and specifically, the Facility's capability of accepting an AGC Set-Point electronically, and the automatic adjustment and regulation of the Facility's Energy production via the SCADA System.

"AGC Protocols" means the protocols for AGC included in Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection, as such protocols may be modified from time to time in accordance with Section 10.9.

"AGC Set-Point" means the Company-generated analog or digital signal sent by the SCADA System to the Facility, representing the quantity of Energy to be stored by the Battery Storage System. The AGC Set-Point is calculated by the EMCC AGC system and communicated electronically to the Facility via the SCADA System.

"Ancillary Services" shall have the meaning set forth in Section 7.5(C).

"Annual Throughput Limit" means [as-bid, shall be no less than 260 equivalent cycles] MWh.

"Annual State of Charge Limit" means fifty-one percent (51%) as calculated as a simple average of the State of Charge in each hour for the applicable Commercial Operation Year.

"Applicable Law" means all laws, statutes, treaties, codes, ordinances, regulations, standards, certificates, orders, licenses and permits of any Governmental Authority that are applicable to a Party, the business of a Party or the Facility, now in effect or hereafter enacted, including amendments to or interpretations of any of the foregoing by a Governmental Authority having jurisdiction, and all applicable judicial, administrative, arbitration and regulatory decrees, judgments, injunctions, writs, orders, awards and/or like actions, including, for the avoidance of doubt, electrical, building, fire, zoning, environmental, and occupational health and Safety Requirements.

"Arbitration Service" means Judicial Arbitration and Mediation Services, Inc. (aka JAMS).

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“Availability Notice” shall have the meaning set forth in Section 7.3(B).

“Back-Up Metering” shall have the meaning set forth in Section 5.5(B).

“Balancing Authority” means the system of electrical generation, distribution and transmission facilities within which generation is regulated in order to maintain interchange schedules with other such systems.

“Battery Storage System” means that portion of the Facility that is required to store energy using the Battery Units, including, step-up transformers, output breakers, facilities necessary to connect to the Interconnection Point, protective and associated equipment, improvements, and other tangible and intangible assets, contract rights, Permits, easements, rights of way, surface use agreements and other interests or rights in real estate, owned or used for construction, operation, maintenance and delivery of the foregoing.

“Battery Storage System Nameplate Capacity” shall have the meaning set forth in Section 3.2.

“Battery Storage System Operating Procedures” means those procedures applicable to the operation of the Battery Storage System, as developed by the Operating Committee in accordance with the procedure, and subject to the requirements, set forth in Exhibit O - Battery Storage System Operating Procedures.

“Battery Storage System Planned Outages” means a planned removal from service of the Battery Storage System, or some part thereof constituting not less than ten percent (10%) of the Battery Storage System Nameplate Capacity, that is required for inspection, or routine, preventive or corrective maintenance; provided that Battery Storage System Planned Outages during any Commercial Operation Year may not exceed ninety-six (96) hours; provided that to the extent the total Battery Storage System Planned Outages in a Commercial Operation Year are less than ninety-six (96) hours, Seller shall be permitted to increase the number of permitted Battery Storage System Planned Outages in a subsequent Commercial Operation Year by such amount; *provided, further*, in no case during any Commercial Operation Year may the Battery Storage System Planned Outages exceed one hundred ninety-two (192) hours.

“Battery Units” means the batteries, power electronic systems, enclosures and other equipment necessary for the Battery Storage System to store electricity at the Site and transmit such electricity upon command. The manufacturer and model number of the Battery Units will be identified on Exhibit C - Facility Description and Site Maps.

“Building Trades CBA” shall have the meaning set forth in Section 4.5(C)1.m.

“Business Day” means any Day that is not a Saturday, a Sunday, or a NERC recognized holiday.

“Capacity” shall have the meaning set forth in Section 8.1(A).

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“Capacity Availability Factor” or “CAF” shall have the meaning set forth in Section 8.1(A).

“Capacity Payment Rate” shall have the meaning set forth in Exhibit J - Capacity Payment Rate.

“Change of Control” means the occurrence of any one of the following events with respect to Seller or any direct or indirect owner of a majority of the ownership interests in Seller: (a) a transfer of a majority of the ownership interests in Seller or such owner; (b) any consolidation or merger of Seller or such owner in which Seller or such owner, as the case may be, is not the continuing or surviving entity; or (c) a sale or conveyance of any direct or indirect ownership interest in Seller following which [REDACTED] (“Ultimate Parent”) is no longer the direct or indirect owner of at least fifty percent (50%) of the ownership interests of Seller, *provided, however*, that a Change of Control shall not be deemed to have occurred solely as a result of:

- (i) transactions exclusively among Affiliates of Seller;
- (ii) any exercise by the Facility Lender of its rights and remedies under the Financing Documents, with respect to any Facility Debt secured only by the Facility;
- (iii) a change of control of Ultimate Parent; or
- (iv) any change of economic and/or voting rights triggered in Seller’s organizational documents arising from (a) a tax-equity financing of the Facility, or (b) a transaction in which interests in Seller or any direct or indirect owner are sold to or by a tax equity investor.

“Charging Energy” means energy withdrawn from the Transmission Authority’s electrical system and delivered at the Point of Delivery used to charge the Battery Storage System and discharged at a later time.

“Charging Energy Price” means, if Company has joined a regional transmission organization or is participating in an organized market for which nodal prices can be determined, then the applicable market settlement price per MWh as determined by Company in its sole discretion, or, if not, then the applicable price per MWh as determined by Company in its sole discretion pursuant to its cost calculator.

“COD Conditions” means all of the requirements that must be satisfied by Seller as a prerequisite to achieving Commercial Operation. The COD Conditions are set forth in Section 4.5.

“COD Delay” shall have the meaning set forth in Section 12.2(A).

“COD Liquidated Delay Damages” shall have the meaning set forth in Section 12.2(A).

“COD Notice” shall have the meaning set forth in Section 4.5.

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“Commercial Operation” means the period beginning on the Commercial Operation Date and continuing through the balance of the Term of this PPA.

“Commercial Operation Date” or “COD” shall have the meaning set forth in Section 4.5.

“Commercial Operation Test” shall have the meaning set forth in Section 5.6(A).

“Commercial Operation Year” shall have the meaning set forth in Section 4.5(E).

“Commercially Reasonable” or “Commercially Reasonable Efforts” means, with respect to any action to be taken or attempted by a Party under this PPA, the level of effort in light of the facts known to such Party at the time a decision is made that: (a) can reasonably be expected to accomplish the desired action at a reasonable cost; (b) is consistent with Good Utility Practices; (c) is consistent with the terms in this PPA; and (d) takes into consideration the amount of advance notice required to take such action, the duration and type of action, and the competitive environment in which such action occurs.

“Company” shall have the meaning set forth in the introductory paragraph.

“Company Dispatched Test” shall have the meaning set forth in Section 5.6(D).

“Confidential Information” shall have the meaning set forth in Section 20.18(A).

“Construction Contracts” shall have the meaning set forth in Section 4.1(A).

“Construction Craft Employees” means employees engaged in on-Site construction and commencement of operations of the Facility, excluding (i) Specialty Vendors, (ii) management and supervisory employees, (iii) employees engaged in non-construction support services (including messengers, guards, safety personnel, medical and first-aid technicians, community relations or public affairs, etc.), and (iv) employees engaged in on-Site maintenance of installed equipment or systems but which maintenance occurs after installation of such equipment or system and is not directly related to construction services.

“Construction Milestones” means the dates set forth in Exhibit B - Construction Milestones.

“COVID” means SARS-CoV-2 or COVID-19, and any evolutions or mutations thereof or related or associated epidemics, pandemic or disease outbreaks.

“CPD Delay” shall have the meaning set forth in Section 12.2(A).

“CPD Liquidated Delay Damages” shall have the meaning set forth in Section 12.2(A).

“Credit Rating” of any person or entity means the lowest rating assigned to such person or entity’s long-term debt or deposit obligations (unenanced by third-party

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support) by Standard & Poor's and Moody's. If such person or entity has no outstanding long-term debt or deposit obligations, or if no rating is assigned to such obligations, "Credit Rating" shall mean the lowest general corporate credit rating or long-term issuer rating assigned to such person or entity by Standard & Poor's or Moody's.

"Critical Path Development Milestone" shall have the meaning set forth in Section 4.1(B).

"Damage Cap" shall have the meaning set forth in Section 12.4.

"Day" means a calendar day.

"DC" shall have the meaning set forth in Section 1.1(D).

"Default FMV" shall have the meaning set forth in Section 12.1(E)1.

"Default Option" shall have the meaning set forth in Section 12.1(E)3

"Default Option Preliminary Exercise Notice" shall have the meaning set forth in Section 12.1(E).

"Delivery Period" shall be the period during which the Facility is available to receive Charging Energy from, or deliver Discharging Energy to, Company, commencing at 12:01 am on the Commercial Operation Date and continuing until midnight on the Scheduled Termination Date, subject to early termination as provided in this PPA.

"Discharging Energy" means all Energy discharged by the Battery Storage System and delivered to the Point of Delivery.

"Discharging Energy Price" means, if Company has joined a regional transmission organization or is participating in an organized market for which nodal prices can be determined, then the applicable real-time market settlement price per MWh as determined by Company in its Commercially Reasonable discretion, or, if not, then the applicable incremental system price per MWh as determined by Company in its Commercially Reasonable discretion.

"Dispatch Notice" means the operating instruction, and any subsequent updates, given by Company to Seller, directing the Battery Storage System to (i) charge at a specified megawatt input or discharge at a specified megawatt output, and (ii) at a specified Ramp Rate. Dispatch Notices may be communicated electronically, via SCADA System signal, facsimile, telephonically or other verbal means. Telephonic or other verbal communications shall be documented (either recorded by tape, electronically or in writing) and such recordings shall be made available to both Company and Seller upon request. For the avoidance of doubt, Company shall be subject to the scheduling limitations of the Market Operator when updating any Dispatch Notice.

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“Dispute” shall have the meaning set forth in Section 13.1(A).

“Dispute Notice” shall have the meaning set forth in Section 13.1(A).

“Distributed Network Protocol” means a set of communications protocols used between components in process automation systems.

“Dollar”, “\$”, or “US\$” means the lawful currency of the United States of America.

“Effective Date” shall have the meaning set forth in the introductory paragraph.

“Electric Metering Devices” means revenue quality meters, metering equipment and/or data processing equipment used to measure, record and transmit data with respect to the to the Charging Energy delivered to and the Discharging Energy delivered from the Battery Storage System, including metering current transformers and metering voltage transformers. The Electric Metering Devices must transmit to Company five-minute revenue quality meter data.

“Emergency” means any event or occurrence during the Term that results in the declaration of an Emergency Condition under and as defined in the Interconnection Agreement.

“Energy” means all electrical energy stored and discharged by the Battery Storage System during the Term.

“Energy Markets Control Center” or “EMCC” means Company's merchant representatives responsible for dispatch of the Facility.

“Energy Resource Interconnection Service” means the type of interconnection service which allows Seller to connect the Facility to the transmission or distribution system, as applicable, as an “Energy Resource” as defined by the Transmission Tariff and be eligible to deliver the Facility's output using the existing firm or non-firm capacity on the transmission system on an as-available basis. **[if needed]**

“Environmental Attributes” shall have the meaning set forth in Section 7.4(B).

“Environmental Contamination” shall have the meaning set forth in Section 4.2.

“Equity Interest” shall have the meaning set forth in Section 19.5(A).

“Equity Interest Acquisition” shall have the meaning set forth in Section 19.5(A).

“Equity Purchase Price” shall have the meaning set forth in Exhibit L-1 – Equity Purchase Price Formula.

“ERO” means the Electric Reliability Organization certified by FERC pursuant to Section 215 of the Federal Power Act, which as of the Effective Date is NERC, or any

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successor organization. For purposes of this PPA, ERO also includes the Midwest Reliability Organization (MRO).

"Escrow Account" shall have the meaning set forth in Section 11.3(B).

"Event of Default" shall have the meaning set forth in Article 12 -.

"Excused Outage" means any Outage of the Battery Storage System resulting from: (i) a Battery Storage System Planned Outage; (ii) Force Majeure or Emergency; (iii) a breach of this PPA by Company; (iv) insufficient stored energy not caused by any act or omission of Seller; (v) an Outage resulting from a request by Company; (vii) any Outage where Seller failed to comply with a dispatch that was not in accordance with the Battery Storage System Operating Procedures.

"Facility" means the Battery Storage System, and all equipment necessary to interconnect to the Transmission Authority's System, all as further described in Exhibit C - Facility Description and Site Maps, including Seller's rights to the Site and all of the following: the Battery Units, buildings, step-up transformers, output breakers, facilities necessary to connect to the Interconnection Point, protective and associated equipment, improvements, and other tangible and intangible assets, contract rights, Permits, easements, rights of way, surface use agreements and other interests or rights in real estate, owned or used for construction, operation, maintenance and delivery of the capacity and Energy subject to this PPA.

"Facility Acquisition" shall have the meaning set forth in Section 19.5(A).

"Facility Debt" means the obligations of Seller or its Affiliates to any lender or tax equity or other investor pursuant to the Financing Documents, including principal of, premium and interest on indebtedness, fees, expenses or penalties, amounts due upon acceleration, prepayment or restructuring, swap or interest rate hedging breakage costs and any fees or interest due with respect to any of the foregoing.

"Facility Lender" means, collectively, any lenders or tax equity investors or other investor providing Facility Debt, including any successors or assigns thereof.

"Federal Power Act" means the provisions of 16 U.S.C. §791(A) *et seq.* and amendments or supplements thereto.

"FERC" means the Federal Energy Regulatory Commission or any successor agency.

"Financing Documents" means the loan and credit agreements, notes, bonds, indentures, security agreements, lease financing agreements, equity contribution agreements, mortgages, deeds of trust, interest rate exchanges, swap agreements and other documents relating to the development, bridge, construction, back-leverage or permanent debt financing and/or tax equity financing for the Facility, including any credit enhancement, credit support, working capital financing, or refinancing documents, and any and all amendments, modifications, or supplements to the foregoing that may be

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entered into from time to time at the discretion of Seller in connection with development, construction, ownership, leasing, operation or maintenance of the Facility.

“FMV” means the “fair market value.”

“Force Majeure” shall have the meaning set forth in Section 14.1.

“Forced Labor Laws” shall have the meaning set forth in Section 15.2(B).

“Forced Outage” means any condition at the Facility that requires the immediate and unplanned removal of at least ten percent (10%) or five (5) MW whichever is less, of the capacity of the Battery Storage System from service, or that results in a material deviation from the Guaranteed Performance identified in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels, another outage state, or a reserve shutdown state, resulting from immediate mechanical/electrical/hydraulic control system trips and operator-initiated trips in response to abnormal Facility conditions or alarms.

“Good Utility Practices” means the practices, methods, standards and acts engaged in or approved by a significant portion of the applicable segment of the electric power generation and storage industry pertaining to facilities of the type, similar size and location to the Facility that, at a particular time, in the exercise of Commercially Reasonable judgment, in light of the facts that are known (or reasonably should have been known) at the time a decision was made, would have been expected to accomplish the desired result in a manner consistent with Applicable Law, Permits, codes, standards, equipment manufacturer’s recommendations, reliability, safety, environmental protection, economy, and expedition. Good Utility Practices is not limited to the optimum practice, method, standard or act to the exclusion of all others, but rather to those practices, methods, standards and acts generally acceptable or approved by a significant portion of the applicable segment of the electric power generation and storage industry in the relevant region, during the relevant period.

“Governmental Authority” means any federal, state, local or municipal governmental body; any governmental, quasi-governmental, regulatory or administrative agency, commission, body or other authority exercising or entitled to exercise any administrative, executive, judicial, legislative, policy, regulatory or taxing authority or power; and/or any court or governmental tribunal. By way of example only, “Governmental Authorities” include but are not limited to NERC, the ERO, the Market Operator (if any), an applicable PUC, the Transmission Authority, FERC, and successor organizations. For the avoidance of doubt, Company is not a Governmental Authority for purposes of this PPA.

“Grid Charging Capability” means the ability for the Battery Storage System to charge and store Charging Energy delivered from an offsite source by the Transmission Authority’s electrical system.

“GSU Transformer” means a power transformer that is contained within the Facility and that increases the AC voltage of the electrical energy produced by the

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Facility to the AC voltage at which such electrical energy is delivered to Company at the Interconnection Point.

“GSU Transformer Failure” means the failure of a GSU Transformer; provided, however, that such failure requires the replacement or substantial remanufacturing of such GSU Transformer to return to service.

“Guaranteed Maximum Charging Rate” shall have the meaning set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

“Guaranteed Maximum Discharging Rate” shall have the meaning set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

“Guaranteed Minimum Charging Time” shall have the meaning set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

“Guaranteed Minimum Discharging Time” shall have the meaning set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

“Guaranteed Performance” shall have the meaning set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

“Guaranteed Response Time” shall have the meaning set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

“Guaranteed Round Trip Efficiency” shall have the meaning set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

“Guaranteed Storage Capacity” shall have the meaning set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

“Guarantor” shall have the meaning set forth in Section 11.3(C).

“Hazardous Materials” shall have the meaning set forth in Section 4.2.

“House Power” shall have the meaning set forth in Section 1.2(B).

“Indemnified Party” shall have the meaning set forth in Section 17.1.

“Indemnifying Party” shall have the meaning set forth in Section 17.1.

“Independent Engineer” means a qualified and independent third party engineering firm.

“Interconnection Agreement” means the separate contract for interconnection of the Facility to the Transmission Authority’s System, as such agreement may be amended from time to time. For purposes of this PPA, the Interconnection Agreement shall be interpreted to include any third party facility construction agreement or other agreement required by the Transmission Authority to interconnect the Facility in

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accordance with the Transmission Tariff. For the avoidance of doubt, “Interconnection Agreement” excludes any temporary or provisional interconnection agreement or any agreement where the Transmission Provider may limit the operational output of the Facility.

“Interconnection Facilities” means those facilities designated in the Interconnection Agreement for the direct purpose of interconnecting the Facility at the Interconnection Point, along with any easements, rights of way, surface use agreements and other interests or rights in real estate reasonably necessary for the construction, operation and maintenance of such facilities, whether owned by Seller, the Transmission Authority or another entity. This equipment is conceptually depicted in Exhibit C - Facility Description and Site Maps to this PPA.

“Interconnection Point” means the physical point within the operational authority of the Transmission Authority as specified in the Interconnection Agreement as project [REDACTED], at which electrical interconnection is made between the Facility and the Transmission Authority’s System in accordance with the Transmission Tariff and the Interconnection Agreement.

“Investment Grade” means a Credit Rating of both (a) Baa3 or higher by Moody’s, and (b) BBB- or higher by Standard & Poor’s.

“Issuer” shall have the meaning set forth in Section 11.3(A).

“kW” means kilowatt.

“kWh” means kilowatt hour.

“Lender Consent” shall have the meaning set forth in Section 18.1.

“Lender Notice” shall have the meaning set forth in Section 18.2(A).

“Letter of Credit” shall have the meaning set forth in Section 11.3(A).

“Liquidated Delay Damages” shall have the meaning set forth in Section 12.2.

“Local Provider” shall have the meaning set forth in Section 1.2(B).

“Losses” shall have the meaning set forth in Section 17.1.

“Maintenance Schedules” shall have the meaning set forth in Section 10.2.

“Market Operator” means the entity that instructs market participants and/or generators to regulate generation and energy storage assets (including the Facility) within any energy market in which Company participates, based on price-based offer curves for the purpose of matching generation output to system load demand while maintaining bulk electric system reliability. If such entity is the Transmission Authority, then “Market Operator” shall mean such entity acting in its capacity as such.

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“Material Adverse Effect” means any effect (or effects taken together) that is materially adverse to the present or future business, operations, assets, liabilities, properties, results in operations or condition (financial or otherwise), prospects, or property of a Party, its business, or this PPA.

“Maximum Charging Rate” means the maximum rate of charging (expressed in MW).

“Maximum Discharging Rate” means the maximum rate of discharging (expressed in MW).

“Minimum Charging Time” means the minimum amount of time to charge the Battery Storage System Nameplate Capacity measured in MWh divided by the Round Trip Efficiency (expressed in units of time).

“Minimum Discharging Time” means the minimum amount of time to discharge the Battery Storage System Nameplate Capacity measured in MWh (expressed in units of time).

“MIPSA” means “member interest purchase and sale agreement.”

“MPUC” means the Minnesota Public Utilities Commission or any successor agency.

“Monthly Capacity Payment” “shall have the meaning set forth in Section 8.1(A).”

“MW” means megawatt or one thousand kW, and “MWh” means megawatt hours.

“NDPSC” means the North Dakota Public Service Commission or any successor agency.

“NERC” means the North American Electric Reliability Corporation or any successor organization.

[if applicable] “Network Resource Interconnection Service” means the type of interconnection service which allows Seller to connect the Facility to the transmission or distribution system, as applicable, as a Network Resource as defined by the Transmission Tariff, and be eligible to deliver the Facility’s output in a manner comparable to that in which the Transmission Authority integrates its generating facilities to serve native load customers.

“Operating Committee” means representative(s) each from Company and Seller, pursuant to Section 10.9.

“Operating Day” means a day within the Delivery Period on which the Battery Storage System operates.

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“Operating Records” means all agreements associated with the Facility, operating logs, blueprints for construction, operating manuals, all warranties on equipment, and all documents, whether in printed or electronic format, that Seller uses or maintains for the operation of the Facility.

“Option” means Company’s rights to purchase the Facility on the terms and conditions set forth in Section 19.5.

“Option Preliminary Exercise Notice” shall have the meaning set forth in Section 19.5(A).

“Outage” means any period during which the capacity of the Battery Storage System is unavailable for any reason as reported by the SCADA System in accordance with Exhibit O - Battery Storage System Operating Procedures.

“Party” and “Parties” shall have the meanings set forth in the introductory paragraph.

“Pending Facility Transaction” or “PFT” shall have the meaning set forth in Section 19.4.

“Performance Criteria” means the performance elements set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

“Permits” shall have the meaning set forth in Section 4.3.

“Periodic Test” shall have the meaning set forth in Section 5.6(B).

“PFT Notice” shall have the meaning set forth in Section 19.4.

“PI System” means the “plant information” system for the Facility or other data collection systems, as described and implemented in Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection.

“Point of Delivery” means the physical point within the operational authority of Transmission Authority at which (i) Seller makes available and delivers to Company the Energy being provided by Seller to Company under this PPA and (ii) Company makes available and delivers to Seller the Charging Energy being provided by Company to Seller under this PPA. The Point of Delivery is specified in Exhibit C - Facility Description and Site Maps to this PPA.

“PPA” shall have the meaning set forth in the introductory paragraph.

“PSA” means purchase and sale agreement.

“PUC Approval” shall have the meaning set forth in Section 6.1(D).

“Purchase Price” shall have the meaning set forth in Section 19.5(G).

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“Qualified Operator” means an operator of battery energy storage systems that has sufficient experience to successfully operate the Facility, including a minimum of one (1) year of experience in the battery energy storage business, and owns, controls or operates a minimum of 20 MW and 40 MWh of battery energy storage capacity in aggregate with at least one facility that has at least 5 MW and 10 MWh of battery energy storage capacity.

“Ramp Rate” shall have the meaning set forth in the Transmission Tariff.

“Real Time Data” shall have the meaning set for in Section 10.7(A).

“Recovery Plan” means, with respect to Seller’s failure to achieve a Critical Path Development Milestone under Section 4.1(B), a recovery plan (confirmed by a qualified consultant, vendor or expert reasonably acceptable to Company) indicating in sufficient detail, to Company’s reasonable satisfaction, the steps to be taken by Seller to achieve the missed Critical Path Development Milestone by a date certain, which date shall be the earliest reasonable date for achievement of the Critical Path Development Milestone, but shall not exceed ninety (90) days following the completion deadline set forth in Section 4.1(B) for such Critical Path Development Milestone. If the date certain identified in a Recovery Plan is later than the completion deadline(s) for any other Critical Path Development Milestone(s) (as those deadlines are set forth in Section 4.1(B)), then such Recovery Plan shall also describe the impacts, if any, to such other Critical Path Development Milestone(s); *provided, however*, that Seller shall remain responsible for achieving such other Critical Path Development Milestone(s), as set forth in Section 4.1(B), Section 12.2(A), and Section 12.2(B).

“Remote/Local” means a handshake electronic signal sent from the Facility to the EMCC AGC system, and from the EMCC AGC system to the Facility, indicating the Facility is receiving AGC Set-Point locally (from the Facility) or remotely (EMCC AGC system) and is following that AGC Set-Point.

“Repair Plan” shall have the meaning set forth in Section 10.4(B).

“Replacement Power Costs” for any period mean the costs incurred by Company to replace the products and services which Seller was required to provide under this PPA (but failed to so provide) during such period, less the sum of any payments from Company to Seller under this PPA that were eliminated with respect to such period as a result of such failure. Replacement Power Costs shall be determined on an hourly basis and shall equal the sum of the following for each hour where the following calculation achieves a positive number:

Hourly Replacement Power Costs = (A + B + C) – D, where

“A” = the product of (x) the number of MW of lost capacity, derived by subtracting the number of MW of capacity of the Facility that qualifies for capacity credit actually made available to Company from the amount of qualifying capacity associated with the entire Facility, and

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(y) the applicable market price for capacity made available to Company's system, for such hour;

"B" = the price paid by Company for the MWh of energy purchased by Company to replace the Energy that was not delivered under this PPA during such hour;

"C" = the actual cost of transmission, Ancillary Services, fuel and fuel transportation, other incremental costs, and any related penalties that could not be avoided or mitigated, and transaction charges to deliver reasonably available energy to Company in amounts equal to the number of MWh for which Replacement Power Costs are owed; and

"D" = the sum of all payments avoided by Company as a result of Seller's breach, for such hour, including avoided payments under Article 8 -.

For the avoidance of doubt, Replacement Power Costs shall never be less than zero.

"Response Time" means the amount of time for the Battery Storage System to respond to Company's Dispatch Notice.

"ROFO" means "Right of First Offer".

"ROFO Notice" shall have the meaning set forth in Section 19.3.

"Round Trip Efficiency" or "RTE" means the amount of energy discharged by the Battery Storage System relative to the amount of energy charged as measured at the Point of Delivery, calculated as shown below:

Round Trip Efficiency (RTE) = Discharging Energy / Charging Energy.

"Round Trip Efficiency Adjustment" shall have the meaning set forth in Section 8.3(B).

"Safety Requirements" means those requirements set forth in Exhibit P - Safety Requirements, in addition to any other safety-related practices required by Applicable Law and Good Utility Practices.

"SCADA System" or "SCADA" means supervisory control and data acquisition.

"Scheduled Termination Date" shall have the meaning set forth in Article 2 -.

"Security Fund" shall have the meaning set forth in Section 11.1.

"Self-Discharge Rate" is defined as the loss of State of Charge within the Battery Storage System while idle.

"Seller" shall have the meaning set forth in the introductory paragraph.

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“Seller Initiated Test” shall have the meaning set forth in Section 5.6(D).

“Site” means the parcel of real property on which the Facility will be located, including any easements, rights of way, surface use agreements and other interests or rights in real estate necessary for the construction, operation and maintenance of the Facility. The Site is more specifically described in Exhibit C - Facility Description and Site Maps to this PPA.

“SME” shall mean “Scheduled Maintenance Energy.”

“State of Charge” or “SOC” means the amount of electric energy in a Battery Unit expressed as a percent of the Storage Capacity.

“Storage Capacity” means the amount of energy that the Battery Storage System can hold, measured in MWh or MW, as applicable and measured at the Point of Delivery.

“Successful Repair” shall have the meaning set forth in Section 10.4(B).

“Target COD” shall have the meaning set forth in Section 4.5(A).

“TE Partnership” shall have the meaning set forth in Section 19.5(A).

“Technical Dispute” shall have the meaning set forth in Section 13.1(A).

“Term” means the period of time during which this PPA remains in full force and effect, as further defined in Article 2 -.

“Test” means the Commercial Operation Test, Periodic Test, and other discretionary testing identified in Section 5.6 referred to individually as a “Test” and jointly as the “Tests.”.

“Test Energy” shall have the meaning set forth in Section 4.6(C).

“Transmission Authority” means collectively those entities owning and/or operating the interconnected transmission system applicable to Seller and the Facility pursuant to a Transmission Tariff, including (i) Company operating under and in accordance with its Transmission Tariff, and (ii) all entity(ies) responsible under the Interconnection Agreement for providing the transmission lines, any Interconnection Facilities and other equipment and facilities with which the Facility interconnects at the Interconnection Point and transmission system.

“Transmission Authority’s System” means the contiguously interconnected electric transmission and sub-transmission facilities, over which the Transmission Authority has rights (by ownership or contract) to provide bulk transmission of capacity and Energy from the Interconnection Point.

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“Transmission Tariff” means the applicable Open Access Transmission Tariff of the Transmission Authority, as amended from time to time.

“UFLPA” means the Uyghur Forced Labor Prevention Act, Pub. L. 117-78 (2021).

“Ultimate Parent” shall have the meaning set forth in the definition of Change of Control.

* * * * *

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EXHIBIT B - CONSTRUCTION MILESTONES

Construction

<u>Milestone</u>	<u>Outcome</u>
[Date]	Seller and all required counterparties shall have executed such Construction Contracts as are needed to construct the Facility.
[Date]	Seller and the Transmission Authority shall have executed the Interconnection Agreement.
[Date]	Seller shall have achieved closing on financing for the Facility or provided Company with proof of financial capability to construct the Facility.
[Date]	Commencement of construction of the Facility.
[Date]	Procurement of Battery Units.
[Date]	Seller shall have laid the foundation for all Facility buildings, energy storage facilities and step-up transformation facilities.
[Date]	Seller has submitted to Company and obtained Company approval of serialized information for all Electric Metering Devices and Back-Up Metering. [Date] Seller has demonstrated to Company's reasonable satisfaction that all Electric Metering Devices and Back-Up Metering and communications equipment are functional and provide data integrity.
[Date]	The step-up transformer and Battery Units shall have been delivered and installed at the Site.
[Date]	Seller's Interconnection Facilities shall have been constructed, and such facilities are capable of being energized.
[Date]	Start-up testing of the Facility commences.
[Date]	Seller shall make all applications and/or filings required by Applicable Law for REC accreditation and for the assignment of such RECs to Company.

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EXHIBIT C - FACILITY DESCRIPTION AND SITE MAPS

[This Exhibit shall include a description of the Facility and all material components thereof, including map, aerial pictures, AC one-line diagram showing metering point(s), Point of Delivery and (if different) the Interconnection Point as well as the manufacturer and model numbers of the Battery Units.]

The Facility shall be located on the Site and shall be identified as Seller's [REDACTED] Energy Storage Facility. Maps and one-line diagrams of the Facility and associated equipment are included as part of this Exhibit, as may be updated from time to time.

The address of the Facility is [REDACTED].

The Facility and the Battery Storage System must include the following specific components:

- * Major equipment including batteries and grid forming (GFM) inverters² without any inherent limitations for alignment and conformance with IEEE Std. 2800-2022³.
- * Communication circuits from the Facility to the EMCC for the purpose of telemetering, supervisory control/data acquisition, and voice communications as required by Company.
- * Equipment and software necessary to receive, accept and react to an AGC signal from the Company's SCADA System and to comply with the AGC Protocols as further specified on Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection.
- * Ramping capability, reactive power - voltage control capability and active power - frequency response capability pursuant to NERC guidelines/requirements and applicable sections of IEEE Std. 2800-2022, including but not limited to, Section 5

² Grid Forming (GFM) Control of Inverter-Based Resources (IBRs) refers to their ability to set up and control (i.e. "form") the grid voltage and frequency. GFM control sets an internal voltage waveform reference such that an IBR with GFM control shall be able to synchronize with the grid and regulate active and reactive power generation appropriately, regardless of the grid's strength. An IBR with GFM control shall immediately respond to grid disturbances to support stability of the grid and maintain its own control stability during the system disturbance.

³ "IEEE Standard for Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power Systems," IEEE STD.2022.9762253

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“Reactive power-voltage control requirements within the continuous operation region”,
and Section 6 ““Active-power – frequency response requirements”.

*Capability of sending real time data and OPC interface to Company’s PI System.

*AC Capacity of the Facility (from Seller’s bid) [AC].

*a Point of Delivery⁴ located at [].

The proposed Facility includes the components that are equivalent to, or better than,
the following:

- [Additional Bid Specific information to be added]

⁴ Referred to as Point of Interconnection (POI) in Transmission Tariff and as Reference Point of Applicability (RPA) in IEEE Std. 2800-2022

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EXHIBIT D - NOTICES AND CONTACT INFORMATION

<u>Company</u>	<u>Seller</u>
Notices: Director, Purchased Power Xcel Energy Services Inc. 1800 Larimer Street, Suite 1000 Denver, CO 80202 Email: purchasedpowernotices@xcelenergy.com <i>with a cc to:</i> Purchased Power Consultant Xcel Energy Services Inc. 1800 Larimer Street, Suite 1000 Denver, CO 80202 Email: purchasedpowernotices@xcelenergy.com	Notices: _____ _____ _____ Phone: _____ E-mail: _____@_____.com <i>with a cc to:</i> _____ _____ _____ Phone: _____ E-mail: _____@_____.com
Operating Committee Representative: Director, Purchased Power Xcel Energy Services Inc. 1800 Larimer Street, Suite 1000 Denver, CO 80202 Email: purchasedpowernotices@xcelenergy.com Alternate: Purchased Power Consultant Xcel Energy Services Inc. 1800 Larimer Street, Suite 1000 Denver, CO 80202 Email: purchasedpowernotices@xcelenergy.com	Operating Committee Representative: _____ _____ _____ Phone: _____ E-mail: _____@_____.com Alternate: _____ _____ _____ Phone: _____ E-mail: _____@_____.com
Real-Time Contact Information <u>EMCC</u> (24-hour coverage): Phone: 303-571-7426	Real-Time Contact Information <u>[Operations Command Center]</u> (24-hour coverage): Phone: _____ E-mail: _____@_____.com

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E-mail: dlrtelectricmarketersnsp@xcelenergy.com <u>Transmission Ops:</u> Phone: 303-273-4811 E-mail: AGCOpr@xcelenergy.com	

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EXHIBIT E - INSURANCE COVERAGE

Type of Insurance	Minimum Limits of Coverage

Commercial General Liability (CGL) and commercial umbrella	\$11,000,000 combined single limit each occurrence and the aggregate, where applicable. If CGL insurance contains a general aggregate limit, it shall apply separately to the Facility.

CGL insurance shall be written on ISO occurrence form CG 00 01 01 96 (or a substitute form providing equivalent coverage) and shall cover liability arising from premises, operations, independent contractors, products/completed operations, contracts, property damage, personal injury and advertising injury, and liability assumed under an insured contract (including the tort liability of another assumed in a business contract), all with limits as specified above. CGL insurance shall include ISO endorsement CG 24 17 (or an equivalent endorsement) which modifies the definition of "Insured contract" to eliminate the exclusion of easement or license agreements in connection with construction or demolition operations on or within 50 feet of a railroad. There shall be no endorsement or modification of the CGL insurance limiting the scope of coverage for liability arising from explosion, collapse, or underground property damage.

Company shall be included as an insured under the CGL policy, using ISO additional insured endorsement CG 20 10 (or a substitute providing equivalent coverage), and under the commercial umbrella insurance. The commercial umbrella insurance shall provide coverage over the top of the CGL insurance, the Business Automobile Liability insurance, and the Employers Liability insurance. The CGL and commercial umbrella insurance to be obtained by or on behalf of Seller shall be endorsed as follows:

Such insurance as afforded by this policy for the benefit of Company shall be primary as respects any claims, losses, damages, expenses, or liabilities arising out of this PPA, and insured hereunder, and any insurance carried by Company shall be excess of and noncontributing with insurance afforded by this policy.

Business Automobile Liability	\$2,000,000 combined single limit (each accident), including all Owned, Non-Owned, Hired and Leased Autos.

Business Automobile Liability insurance shall be written on ISO form CA 00 01, CA 00 05, CA 00 12, CA 00 20, or a substitute form providing equivalent liability coverage. If necessary, the policy shall be endorsed to provide contractual liability coverage equivalent to that provided in the 1990 and later editions of CA 00 01.

Workers Compensation	Statutory Requirements. Seller may comply

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	with these requirements through the use of a qualified self-insurance plan.

Type of Insurance	Minimum Limits of Coverage

Employers Liability	\$2,000,000 each accident for bodily injury by accident, or \$2,000,000 each employee for bodily injury by disease.

Builder's Risk	Replacement value of the Facility.

Builder's Risk insurance, or an installation floater, shall include coverage for earthquake and flood, collapse, faulty workmanship, materials and design, testing of machinery or equipment, freezing or changes in temperature, debris removal, and partial occupancy.

Environmental Liability	Impairment \$5,000,000 each occurrence.

All-Risk Property insurance covering physical loss or damage to the Facility	Full replacement value of the Facility. A deductible may be carried which deductible shall be the absolute responsibility of Seller.

All-Risk Property insurance shall include: (i) coverage for fire, flood, wind and storm, tornado and earthquake with respect to facilities similar in construction, location and occupancy to the Facility, with sublimits of no less than \$10,000,000 each for flood and earthquake; and (ii) Boiler and Machinery insurance covering all objects customarily subject to such insurance, including boilers and turbines, in an amount equal to their full replacement value.

Business Interruption insurance	Amount required to cover Seller's continuing or increased expenses, resulting from full interruption, for a period of 12 calendar months.

Business Interruption insurance shall cover loss of revenues or the increased expense to resume operations attributable to the Facility by reason of total or partial suspension or delay of, or interruption in, the operation of the Facility as a result of an insured peril covered under Property insurance as set forth above, to the extent available on Commercially Reasonable terms as determined by Company, subject to a Commercially Reasonable deductible that shall be the responsibility of Seller. Notwithstanding any other provision of this PPA, Seller shall not be required to have Business Interruption insurance until the Commercial Operation Date.

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EXHIBIT F - SELLER'S NEEDED PERMITS

[Bid Specific]

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EXHIBIT G - FORM OF LETTER OF CREDIT

[LETTERHEAD OF ISSUING BANK]

Irrevocable Standby Letter of Credit No: _____ Date of Issuance: _____

Beneficiary: Northern States Power Company, a [Minnesota or Wisconsin] corporation
Initial Expiration Date: [Must be at least one year after date of issuance]
Applicant:

As the Issuing Bank ("Issuer"), we, [Name of Issuing Bank], hereby establish this irrevocable Standby Letter of Credit No. _____ (this "Letter of Credit") in favor of the above-named beneficiary ("Beneficiary") for the account of the above-named applicant ("Applicant") in the amount of US\$ _____ (_____ Million U.S. Dollars).

Beneficiary may draw all or any portion of this Letter of Credit at any time and from time to time, and Issuer will make funds immediately available to Beneficiary upon presentation of Beneficiary's draft(s) at sight in substantially the form attached hereto as Exhibit "A" ("Sight Draft"), drawn on Issuer and accompanied by this Letter of Credit. All Sight Drafts must be signed on behalf of Beneficiary, and the signator must indicate his or her title or other official capacity. No other documents will be required to be presented. Issuer will effect payment under this Letter of Credit within twenty-four (24) hours after presentment of any Sight Draft. Payment shall be made in U.S. Dollars with Issuer's own funds in immediately available funds.

Issuer will honor any Sight Draft presented in substantial compliance with the terms of this Letter of Credit at the Issuer's letterhead office, the office located at _____ or any other full service office of the Issuer on or before the above-stated expiration date, as such expiration date may be extended hereunder. Partial and multiple draws and presentations are permitted on any number of occasions. Following any partial draw, Issuer will endorse this Letter of Credit and return the original to Beneficiary.

This Letter of Credit is issued pursuant to the provisions of that certain Battery Storage Energy Purchase Agreement between Beneficiary and Applicant dated as of _____, 20__ (as the same may have been or may be amended from time to time, the "PPA"). Notwithstanding any reference in this Letter of Credit to this PPA or any other documents, instruments or agreements, or references in this PPA or any other documents, instruments or agreements to this Letter of Credit, this Letter of Credit contains the entire agreement between Beneficiary and Issuer relating to the obligations of Issuer hereunder.

This Letter of Credit will be automatically extended each year without amendment for a period of one (1) year from the expiration Effective Date, as extended, unless at least thirty (30) days prior to the expiration date, Issuer notifies Beneficiary by registered mail that it elects not to extend this Letter of Credit for such additional period. Notice of non-

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extension will be given by Issuer to Beneficiary at Beneficiary's address set forth herein or at such other address as Beneficiary may designate to Issuer in writing at Issuer's letterhead address.

This Letter of Credit is freely transferable by Beneficiary in whole or in part, and the number of transfers is unlimited. Issuer shall effect any transfers immediately upon presentation to Issuer of this Letter of Credit and a completed written transfer request substantially in the form attached hereto as Exhibit "B." Such transfer will be effected at no cost to Beneficiary. Any transfer fees assessed by Issuer will be payable solely by Applicant, and the payment of any transfer fees will not be a condition to the validity or effectiveness of the transfer of this Letter of Credit.

Issuer waives any rights it may have, at law or otherwise, to subrogate to any claims which Beneficiary may have against Applicant or Applicant may have against Beneficiary.

This Letter of Credit is subject to the uniform customs and practice for documentary credits (2007 Revision), International Chamber of Commerce publication No. 600 (the "UCP"), except to the extent that the terms hereof are inconsistent with the provisions of the UCP, including but not limited to Articles 14(b) and 36 of the UCP, in which case the terms of this Letter of Credit shall govern. With respect to Article 14(b) of the UCP, Issuer shall have a reasonable amount of time, not to exceed three (3) banking days following the date of Issuer's receipt of documents from Beneficiary (to the extent required herein), to examine the documents and determine whether to take up or refuse the documents and to inform Beneficiary accordingly.

In the event of an act of God, riot, civil commotion, insurrection, war or any other cause beyond Issuer's control that interrupts Issuer's business and causes the place for presentation of this Letter of Credit to be closed for business on the last day for presentation, the expiry date of this Letter of Credit will be automatically extended without amendment to a date thirty (30) calendar days after the place for presentation reopens for business.

ISSUER:

By: _____
Authorized Signature

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EXHIBIT "A"
TO LETTER OF CREDIT

SIGHT DRAFT

Draft Number _____
\$ _____

At sight, pay to the order of [Name of Beneficiary to be inserted], the amount of
USD \$ _____ (_____ and 00/100ths U.S. Dollars).

Value received and charged to the account of: [Name of Issuer and address].
Drawn under [Name of Issuer to be inserted] Standby Letter of Credit No.
_____.

Dated: _____

Northern States Power Company, a
[Minnesota or Wisconsin] corporation

By: _____
[name and title]

Account: [Applicant to be inserted]

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EXHIBIT "B"
TO LETTER OF CREDIT

FORM OF TRANSFER REQUEST

Irrevocable Standby Letter of Credit No. _____

Current Beneficiary:

Applicant:

To: [Name of Issuer] ("Issuer")

The undersigned, as the current "Beneficiary" of the above-referenced Letter of Credit, hereby requests that you reissue the Letter of Credit in favor of the transferee named below [insert transferee name and address below]:

From and after the date this transfer request is delivered to Issuer, the transferee shall be the "Beneficiary" under the Letter of Credit for all purposes and shall be entitled to exercise and enjoy all of the rights, privileges and benefits thereof.

Dated: _____

Northern States Power Company, a [Minnesota
or Wisconsin] corporation

By: _____

Name: _____

Title: _____

[Notary Acknowledgement]

To be signed by a person purporting to be an authorized representative of Beneficiary and indicating his or her title or other official capacity, and acknowledged by a notary public.

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EXHIBIT H - FORM OF GUARANTY

GUARANTY

This Guaranty is executed and delivered as of this _____ day of _____, 20__ by _____, a _____ [corporation] ("Guarantor"), in favor of Northern States Power Company ("Company"), in connection with the performance by _____, a _____ [limited liability company] ("Seller") of a Battery Storage Energy Purchase Agreement dated _____, 20__ between Seller and Company (the "PPA").

- RECITALS -

A. Seller proposes to construct, own and operate Battery Storage System having a Battery Storage System Nameplate Capacity of approximately _____ MW located in _____ County, _____ (the "Facility").

B. Seller and Company have entered into this PPA for the purchase and sale of electrical energy from the Facility on the terms and conditions set forth therein.

C. Seller is controlled by Guarantor. Guarantor expects to derive substantial benefits from the performance of this PPA by Seller and Company. To induce Company to enter into and continue this PPA and to consummate the purchase and sale of electrical energy contemplated by this PPA, Guarantor has agreed to guarantee the obligations of Seller as provided in this Guaranty.

NOW, THEREFORE, in consideration of the foregoing, Guarantor agrees as follows:

- AGREEMENT -

1. Guaranty. Subject to the provisions of this Guaranty, Guarantor hereby absolutely, irrevocably, unconditionally, and fully guarantees to Company the due, prompt, and complete observance, performance, and discharge of each and every payment obligation of Seller under this PPA, whether incurred before or after the date of delivery of this Guaranty (the "Obligations"). This is a guaranty of payment, not of collection, and as such, Company shall not be required to institute, pursue, or exhaust any remedies against Seller before instituting suit, obtaining judgment, and executing thereon against Guarantor under this Guaranty. This Guaranty shall survive termination of this PPA to the extent necessary to enforce and complete the rights, duties and obligations of Company and Seller thereunder.

2. Maximum Liability. Notwithstanding anything herein to the contrary, Guarantor's maximum liability under this Guaranty shall be limited to _____ Dollars (US\$_____) plus costs of collection under Section 10 below.

3. Rights of Company. Guarantor hereby grants to Company, in Company's discretion and without the need to notify or obtain any consent from Guarantor, and

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without termination, impairment, or any other effect upon Guarantor's duties hereunder, the power and authority from time to time:

(a) to renew, compromise, extend, accelerate, or otherwise change, substitute, supersede, or terminate the terms of performance of any of the Obligations, in each case in accordance with this PPA;

(b) to grant any indulgences, forbearances, and waivers, on one or more occasions, for any length of time, with respect to Seller's performance of any of the Obligations; and

(c) to accept collateral, further guaranties, and/or other security for the Obligations, and, if so accepted, then to impair, exhaust, exchange, enforce, waive, or release any such security.

4. Performance. If any of the Obligations are not performed according to the tenor thereof, and any applicable notice and cure period provided by this PPA has expired ("Default"), Guarantor shall immediately upon receipt of written demand by Company (a) perform or cause Seller to perform the Obligation in Default, and (b) pay, reimburse, and indemnify Company against any liabilities, damages, and related costs (including attorneys' fees) incurred by Company as a result thereof, all in such manner and at such times as Company may reasonably direct.

5. Satisfaction. Satisfaction by Guarantor of any duty hereunder incident to a particular Default or the occurrence of any other Default shall not discharge Guarantor except with respect to the Default satisfied, it being the intent of Guarantor that this Guaranty be continuing until such time as all of the Obligations have irrevocably been discharged in full, at which time this Guaranty shall automatically terminate. If at any time the performance of any Obligation by Seller or Guarantor is rescinded or voided under the U.S. Bankruptcy Code or otherwise, then Guarantor's duties hereunder shall continue and be deemed to have been automatically reinstated, restored, and continued with respect to that Obligation, as though the performance of that Obligation had never occurred, regardless of whether this Guaranty otherwise had terminated or would have been terminated following or as a result of that performance.

6. Notice of Acceptance. Guarantor waives and acknowledges notice of acceptance of this Guaranty by Company.

7. Waivers by Guarantor. Guarantor hereby waives and agrees not to assert or take advantage of:

(a) all set-offs, counterclaims, and, subject to Section 4 above, all presentments, demands for performance, notices of non-performance, protests, and notices of every kind that may be required by Applicable Laws;

(b) any right to require Company to proceed against Seller or any other person, or to require Company first to exhaust any remedies against Seller or any other person, before proceeding against Guarantor hereunder;

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- (c) any defense based upon an election of remedies by Company;
- (d) any duty of Company to protect or not impair any security for the Obligations;
- (e) the benefit of any laws limiting the liability of a surety;
- (f) any duty of Company to disclose to Guarantor any facts concerning Seller, this PPA or the Facility, or any other circumstances, that would or allegedly would increase the risk to Guarantor under this Guaranty, whether now known or hereafter learned by Company, it being understood that Guarantor is capable of and assumes the responsibility for being and remaining informed as to all such facts and circumstances; and
- (g) until all Obligations in Default have been fully paid and/or performed, any rights of subrogation, contribution, reimbursement, indemnification, or other rights of payment or recovery for any payment or performance by it hereunder. For the avoidance of doubt, if any amount is paid to Guarantor in violation of this provision, such amount shall be held by Guarantor for the benefit of, and promptly paid to, Company.

8. Cumulative Remedies. The rights and remedies of Company hereunder shall be cumulative and not alternative to any other rights, powers, and remedies that Company may have at law, in equity, or under this PPA. The obligations of Guarantor hereunder are independent of those of Seller and shall survive unaffected by the bankruptcy of Seller. Company need not join Seller in any action against Guarantor to preserve its rights set forth herein.

9. Representations and Warranties. Guarantor represents and warrants to Company as follows:

- (a) Guarantor is a corporation, duly organized, validly existing, and in good standing under the laws of the state of its incorporation. Seller is a direct or indirect wholly-owned subsidiary of Guarantor. Guarantor has all necessary corporate power and authority to execute and deliver this Guaranty and to perform its obligations hereunder.
- (b) The execution, delivery and performance of this Guaranty has been duly and validly authorized by all corporate proceedings of Guarantor and is not in violation of any law, judgment of court or government agency. This Guaranty has been duly and validly executed and delivered by Guarantor and constitutes a legal, valid and binding obligation of Guarantor, enforceable against Guarantor in accordance with its terms.

10. Collection Costs. Guarantor shall pay to Company, upon demand, and in addition to the maximum liability set forth in Section 2 hereof, all reasonable attorneys' fees and other expenses which Company may expend or incur in enforcing the Obligations against Seller and/or enforcing this Guaranty against Guarantor, whether or not suit is filed, including, without limitation, all attorneys' fees, and other expenses incurred by Company in connection with any insolvency, bankruptcy, reorganization,

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arrangement, or other similar proceedings involving Seller that in any way affect the exercise by Company of its rights and remedies hereunder.

11. Severability. Should any one or more provisions of this Guaranty be determined to be illegal or unenforceable, all other provisions nevertheless shall be effective.

12. Waiver or Amendment. No provision of this Guaranty or right of Company hereunder can be waived, nor can Guarantor be released from Guarantor's duties hereunder, except by a writing duly executed by Company. This Guaranty may not be modified, amended, revised, revoked, terminated, changed, or varied in any way whatsoever except by the express terms of a writing duly executed by Company.

13. Successors and Assigns. This Guaranty shall inure to the benefit of and bind the successors and assigns of Company and Guarantor.

14. Governing Law. This Guaranty shall be governed by and construed in accordance with the law of the State of [Minnesota or Wisconsin] without regard to the principles of conflicts of law thereof. Venue for any dispute hereunder shall be as set forth in Section 13.5 of this PPA.

15. Notices. All notices, requests, claims, demands, and other communications hereunder shall be in writing and shall be given (and shall be deemed to have been duly given upon receipt) by delivery in the manner contemplated by this PPA, addressed as follows:

(a) if to Company: as provided in this PPA

(b) if to Guarantor: _____

Attn:

with a copy to: _____

Attn:

or to such other address (es) as the person to whom notice is given may have previously furnished to the others in writing in the manner set forth above.

IN WITNESS WHEREOF, Guarantor has caused this Guaranty to be duly executed and delivered to Company as of the day and year first above written.

[Name of Guarantor]

By: _____
Name:

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Title:

STATE OF _____)
) ss.
COUNTY OF _____)

The foregoing instrument was acknowledged before me this _____ day of _____, 20__, by _____, as _____ of _____.

Witness my hand and official seal.

My commission expires:_____.

(S E A L)

Notary Public

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**EXHIBIT I - AGC PROTOCOLS; DISPATCH AND AVAILABILITY REPORTING;
DATA COLLECTION**

AGC

1. **AGC Communications between Company and Seller.** Company will receive and send AGC Set-Point and related data over a secure analog or digital line. The data points covered under this PPA, as described below, may overlap data requirements for the Transmission Authority or Company's applicable forecasting group. Latitude and longitude coordinates for the location of the AGC communications at the facility are: [REDACTED].

<u>Facility</u>			
<u>Description</u>	<u>Units</u>	<u>Description</u>	<u>Units</u>
Actual Real Power	MW	AGC Set-Point (echo)	MW
		AGC Status	Remote/Local

2. **Response times and limitations of Facility in regard to AGC.** The following protocols outline the expectations for responding to the AGC Set-Point. Except in the case of the frequency changes, these protocols will be generally bound by the manufacturers' specifications for the equipment that Seller has chosen for the Facility.

Once the Facility has reached the AGC Set-Point, the Battery Energy Storage Facility output may not vary from the AGC Set-Point by more than two percent (2%) on average as measured during a 5-minute period.

3. **Backup Communications.** In the event of an AGC failure, Company and Seller shall communicate via telephone in order to correct the failure.

AVAILABILITY REPORTING REQUIREMENTS

- a. The Battery Storage System availability schedule shall be posted at 4:00 AM two (2) Business Days prior to the applicable Day and shall be applicable through the end of such Day. For example, on Monday, an availability schedule is required for Wednesday (midnight to midnight). On Tuesday, the schedule for Thursday. On Wednesday, the schedule for Friday, and so on. The schedule shall be submitted through an availability scheduling system as specified by Company to Seller. Prior to the Commercial Operation Date,

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Company shall provide Seller with the information necessary for Seller to access the chosen availability scheduling system.

- b. If any events or circumstances reduce the scheduled availability of the Battery Storage System by ten percent (10%) or more (or the current requirements of the applicable ERO if less than ten percent (10%)), such reduction shall be (1) communicated to the real-time operator via telephone with (2) an immediate update to the availability schedule in the availability scheduling system.

* * * * *

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EXHIBIT J - CAPACITY PAYMENT RATE

This EXHIBIT J sets forth the applicable rates for Energy and Capacity.

This entire Exhibit shall be deemed Confidential Information subject to Section 20.18.

Commercial Operation Year (Year)	Capacity Payment Rate (\$/kW-month)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

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EXHIBIT K - LENDER CONSENT PROVISIONS

In the event Seller collaterally assigns its rights hereunder to a Facility Lender as security, any related Lender Consent will contain provisions substantially as follows:

1. Seller and Company will neither modify nor terminate this PPA in any material respect, without the prior written consent of the Facility Lender.
2. The Facility Lender shall have the right, but no obligation, to do any act required to be performed by Seller under this PPA, and any such act performed by the Facility Lender shall be as effective to prevent or cure a default as if done by Seller itself.
3. If Company becomes entitled to terminate this PPA due to an Event of Default by Seller, Company shall not terminate this PPA unless it has first given notice of such Event of Default to the Facility Lender and has given the Facility Lender the same cure period afforded to Seller under Article 12 - of this PPA, plus an additional thirty (30) Days beyond Seller's cure period to cure such Event of Default; *provided*, that the total cure period shall in no event exceed one hundred eighty (180) Days. If the Facility Lender requires possession of the Facility in order to cure the Event of Default, and if the Facility Lender diligently seeks possession, the Facility Lender's additional thirty (30)-Day cure period shall not begin until foreclosure is completed, a receiver is appointed, any bankruptcy stay is removed, or possession is otherwise obtained by or on behalf of the Facility Lender.
4. The Facility Lender shall provide to Company a copy of any notices of default and/or intent to exercise remedies delivered to Seller under the Financing Documents.
5. Upon any foreclosure, deed-in-lieu or other exercise of the rights and remedies of the Facility Lender that results in a successor owner or operator of the Facility, the Facility Lender shall require and cause the successor (i) to assume all of Seller's prospective obligations under this PPA, (ii) to cure any then-existing defaults by Seller that are capable of cure by performance or the payment of money damages, (iii) to have substantial experience in the operation of power energy storage facilities akin to the Facility, either directly, through its Affiliates or through an operator acceptable to Company, and (iv) to enjoy (together with its parents and Affiliates) an Investment Grade Credit Rating or other creditworthiness satisfactory to Company. Except for the foregoing, the Facility Lender shall not be obligated to perform or be liable for any obligation of Seller under this PPA.
6. Upon any rejection or other termination of this PPA in connection with any bankruptcy or insolvency of Seller, the Facility Lender (or its successor) and Company shall enter into a new power purchase agreement on the same terms and conditions as this PPA and for the period that would have been remaining under this PPA but for such termination.

* * * * *

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EXHIBIT L-1 – EQUITY PURCHASE PRICE FORMULA

The “Equity Purchase Price” shall be determined in a manner substantially similar to the determination of the Purchase Price in Section 19.5(G), modified as required to take into account the structure of the sale as an equity purchase.

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EXHIBIT L-2 - PSA PROVISIONS

Any PSA executed to implement exercise of Company's ROFO rights will include provisions substantially as follows:

Type of Transaction

The transaction will be structured as an asset acquisition. Company ("Buyer") shall purchase and Seller shall sell 100% of the assets ("Assets") of a completed, commercially operational [battery] storage with Nameplate Capacity of [XX] MW AC and all facilities and other assets and rights relating to the project including any permits or other instruments necessary to operate and maintain the plan as designed and constructed (the "Project"), free and clear of all encumbrances and liabilities, except for permitted encumbrances and assumed liabilities as defined in the PSA.

Purchase Price and Payment Terms

Buyer shall pay Seller the "Purchase Price" which is determined pursuant to Section 19.5(C) of this PPA.

Buyer shall be entitled to withhold from the payment of the Purchase Price a total amount not to exceed 20% of the Purchase Price in the event of certain breaches of Seller's representations, warranties or covenants pending Seller's cure of any such breach.

Seller shall be responsible for all taxes relating to the pre-closing period and all transfer taxes and any sales, use or other taxes related to the purchase and sale of the Assets and any purchase or conveyance of real or personal property to be used in the Project.

Seller's Closing Deliverables:

Upon the terms and conditions to be defined within the PSA, the obligations of Buyer to consummate the transactions contemplated are subject to the satisfaction by Seller of certain closing conditions, including:

- Transfer of all of the Assets of the Project, which include all rights and title to assets necessary for the commercial operation of the Project, to Buyer or its designated Affiliate.
- An opinion of legal counsel that each material discretionary permit required for the Project has been obtained and is valid, binding, in full force and effect and non-appealable.
- Evidence that any liens on the Project, real property or any other assets or interests of the Project have been removed as of the closing other than permitted liens which have been scheduled or liens which have been scheduled and bonded to Buyer's reasonable satisfaction.
- Certain conditions do not exist at the time of closing including, but not limited to, the existence of a material adverse effect. A material adverse effect would be defined in the PSA and would include, in addition to other terms, a change in tax law that could have a negative impact on Buyer's business or the economic viability of the Project.

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- All certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Seller pertaining to the closing.

Buyer's Closing Deliverables:

Upon the terms and conditions to be defined within the PSA, the obligations of Seller to consummate the transactions contemplated are subject to the satisfaction by Buyer of certain closing conditions, including:

- Delivery of the Purchase Price.
- All certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Buyer pertaining to the closing.

Required Approvals

The transaction is subject to obtaining specified approvals, authorizations, or orders, including but not limited to the following (to the extent necessary):

- Approval of the board of directors of Buyer and the board of directors or similar governing body of Seller shall be obtained prior to execution of the PSA.
- Third party consents.
- Applicable governmental and regulatory approvals prior to closing, including to the extent necessary, any applicable state agencies or commissions regulating utility activities and any government agencies having approval, consent or authority over the transactions contemplated by the PSA, including but not limited to the MPUC, the NDPSC, the IRS, the FERC, the Department of Justice, the US Fish and Wildlife Service and the FAA.

Representations and Warranties

The transaction is subject to customary representations and warranties to be made by Buyer and Seller as of the execution date or the effective date of the PSA and the closing thereunder, including the following:

- Corporate existence and powers – Seller is a limited liability company validly existing and in good standing and has the power and authority to conduct its business as now conducted.
- Authority (execution and delivery)
- No conflicts - the transaction does not create any conflicts.
- Consents and approvals – no consent, approval or authorization is required in connection with the execution and performance of the PSA.
- Legal proceedings of Buyer– there are no legal proceedings pending, or to Buyer's knowledge, threatened in writing, against Buyer, that affect the consummation of the transaction contemplated by the PSA.
- Legal proceedings of Seller and the Project – there are no legal proceedings pending, or to Seller's knowledge, threatened in writing, against the Seller or the Project or affecting Seller's ability to sell the Project.

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- Sufficient funds – Buyer has available, or will maintain sufficient sources of, funds to complete the transaction.
- Compliance with Laws – Seller is in compliance with all laws applicable to the Seller, Project and the transactions contemplated by the PSA.
- Environmental – Seller and its Affiliates have no environmental liabilities and are in compliance with environmental requirements. Seller and its Affiliates have not received any notice of an alleged violation of environmental law pertaining to the Project from any governmental entity. There are no facts, circumstances, conditions or occurrences relating to the Project that could reasonably be expected to form the basis of a claim, requirement or obligation imposed by any governmental entity under any environmental law on Seller or its Affiliates.
- Contracts – Schedule of material contracts binding on the Seller or to which the Project is subject and Seller has furnished to Buyer true, correct and complete copies of all material contracts. Each scheduled contract, including but not limited to the Generator Interconnection Agreement, is in full force and effect and neither Seller nor the Project is in material violation or default under such contracts.
- Land Contracts – The land contracts and real property owned by the Project are in full force and effect, and shall comprise all of the real property interests necessary in connection with the interconnection, operation and maintenance of the Project, all in accordance with all laws, and are sufficient to enable the Project to be commercially operable as contemplated in the PSA, including legal and physical ingress and egress rights to and from public right-of-way for operation, and maintenance of the Project.
- Data – Seller has delivered to Buyer true, correct and complete copies of all battery data related to the Project.
- Permits - All permits required to own, operate and maintain the Project are held by Seller or an Affiliate, are final and non-appealable, are scheduled, and Seller has obtained and furnished to Buyer true, correct and complete copies of such permits. Such permits are in full force and effect and are legal, valid, binding and enforceable in accordance with their respective terms.
- Title – Seller or an Affiliate is in possession of and has good and marketable title to the Project free and clear of all encumbrances, except for permitted encumbrances. Seller and its Affiliates have no legal obligation or non-binding agreement in principle with any other person to sell or affect a sale of all, or any portion of, the Project.
- Other representation and warranties customary in a transaction of this nature, including those pertaining to taxes, title, finders, intellectual property, brokers and insurance.

Termination Provisions

The PSA may be terminated prior to the closing upon written notice by the terminating party (as described below) in the event of certain occurrences, including:

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- By either party, in the event the closing has not occurred by a date to be negotiated, regardless of the reason for such termination, provided that the terminating party is not in breach of the PSA.
- By either party in the event regulatory approvals for the transaction are not obtained on terms reasonably acceptable to Buyer.
- By Buyer in the event any authority has issued an order or taken any other action that restrains, enjoins, or otherwise prohibits the consummation of the transactions contemplated by the PSA, and such order or action is nonappealable.
- By Buyer in the event of material breach of the PSA by Seller.
- Security: Seller shall fund and maintain security in favor of Buyer, or a parent guaranty acceptable to Buyer, to secure Seller's obligations under the PSA including the indemnification provision below.

Indemnification

Each party shall indemnify and hold harmless the other party and its respective employees, representatives, officers, directors and agents from and against any and all damages arising out of the result of any breach or violation of any representation, warranty, covenant, inaccuracy within the PSA, or any liability not assumed as part of the PSA, or any fraud, willful misconduct, or negligence in performance of this PSA. Seller shall indemnify Buyer for any environmental (including hazardous material) claims arising prior to the closing date other than environmental claims resulting from Buyer's negligence. No claim for indemnification shall be brought against the Indemnifying Party until the total damages for which such party is liable exceeds in the aggregate a threshold amount to be negotiated, at which point indemnification may be sought for the full aggregate amount of damages, including those amounts that do not exceed the threshold. The aggregate damages to which the Indemnified Parties are entitled shall not exceed the indemnity cap, which shall be at least 30% of the purchase price. Such threshold and indemnity cap shall not apply to damages to the extent they arise from a breach of covenants required to be performed after the closing or from breach of certain "fundamental" representations (as applicable to each party) such as corporate existence, power, authority, conflicts, title, land contracts, real property, environmental, intellectual property or tax matters and shall not apply to liabilities arising prior to the closing date, which shall be the responsibility of Seller.

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EXHIBIT L-3 - MIPS A PROVISIONS

Any MIPS A executed to implement exercise of Company's ROFO rights will include provisions substantially as follows:

Type of Transaction

The transaction will be structured as an entity acquisition. Company ("Buyer") shall purchase and Seller shall sell 100% of its direct and indirect equity ownership interests of the project company ("Project Company") (including, if applicable, Seller's (or any of its Affiliates') direct and indirect equity ownership interest in any tax equity partnership (the "TE Partnership") that owns, directly or indirectly, equity ownership interests of the Project Company, together, the "Equity Interests"), which owns a completed, commercially operational [battery] storage with Nameplate Capacity of [XX] MW AC and all facilities and other assets and rights relating to the project including any permits or other instruments necessary to operate and maintain the plant as designed and constructed (the "Project"), free and clear of all encumbrances and liabilities, except for permitted encumbrances and assumed liabilities as defined in the PSA.

Purchase Price and Payment Terms

Buyer shall pay Seller the "Purchase Price", which is determined pursuant to Section 19.5(C) of this PPA.

Buyer shall be entitled to withhold from the payment of the Purchase Price a total amount not to exceed 20% of the Purchase Price in the event of certain breaches of Seller's representations, warranties or covenants pending Seller's cure of any such breach, with Buyer's aggregate holdback amount not to exceed 20% of the Purchase Price.

Seller shall be responsible for all taxes relating to the pre-closing period and all transfer taxes and any sales, use or other taxes related to the purchase and sale of the Equity Interests and any purchase or conveyance of real or personal property to the Project Company to be used in the Project.

Seller's Closing Deliverables:

Upon the terms and conditions to be defined within the PSA, the obligations of Buyer to consummate the transactions contemplated are subject to the satisfaction by Seller of certain closing conditions, including:

- Transfer of the Equity Interests, which include all rights and title to assets necessary for the commercial operation of the Project, to Buyer or its designated Affiliate.
- An opinion of legal counsel that each material discretionary permit required for the Project has been obtained and is valid, binding, in full force and effect and non-appealable.
- Evidence that any liens on the Equity Interests, Project Company, Project, real property or any other assets or interests of the Project Company have been removed as of the closing other than permitted liens which have been scheduled

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or liens which have been scheduled and bonded to Buyer's reasonable satisfaction.

- Certain conditions do not exist at the time of closing including, but not limited to, the existence of a material adverse effect. A material adverse effect would be defined in the PSA and would include, in addition to other terms, a change in tax law that could have a negative impact on Buyer's business, the Equity Interests, or the economic viability of the Project.
- All certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Seller pertaining to the closing.

Buyer's Closing Deliverables:

Upon the terms and conditions to be defined within the PSA, the obligations of Seller to consummate the transactions contemplated are subject to the satisfaction by Buyer of certain closing conditions, including:

- Delivery of the Purchase Price.
- All certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Buyer pertaining to the closing.

Required Approvals

The transaction is subject to obtaining specified approvals, authorizations, or orders, including but not limited to the following (to the extent necessary):

- Approval of the board of directors of Buyer and the board of directors or similar governing body of Seller shall be obtained prior to execution of the PSA.
- Third party consents.
- Applicable governmental and regulatory approvals prior to closing, including to the extent necessary, any applicable state agencies or commissions regulating utility activities and any government agencies having approval, consent or authority over the transactions contemplated by the PSA, including the MPUC, the NDPSC, the IRS, the FERC, the Department of Justice, the US Fish and Wildlife Service and the FAA.

Representations and Warranties

The transaction is subject to customary representations and warranties to be made by Buyer and Seller as of the execution date or the effective date of the PSA and the closing thereunder, including the following:

- Corporate existence and powers – Seller is a [corporation] validly existing and in good standing and has the power and authority to conduct its business as now conducted.

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- Project Company existence and powers – the Project Company is a limited liability company validly existing and in good standing and has the power and authority to operate and own the Project and has been engaged in no other business since its formation.
- (If applicable) The TE Partnership existence and powers – the TE Partnership is a limited liability company validly existing and in good standing and has the power and authority to own and manage the Project Company and the Project and has been engaged in no other business since its formation.
- Authority (execution and delivery)
- No conflicts - the transaction does not create any conflicts.
- Consents and approvals – no consent, approval or authorization is required in connection with the execution and performance of the PSA.
- Legal proceedings of Buyer– there are no legal proceedings pending, or to Buyer's knowledge, threatened in writing, against Buyer, that affect the consummation of the transaction contemplated by the PSA.
- Legal proceedings of Seller, TE Partnership (if applicable) and Project Company – there are no legal proceedings pending, or to Seller's knowledge, threatened in writing, against the Seller relating to the Project or affecting Seller's ability to sell the Equity Interests and there are no legal proceedings pending, or to Seller's knowledge, threatened in writing, against the Project Company or the TE Partnership (if applicable).
- Sufficient funds – Buyer has available, or will maintain sufficient sources of, funds to complete the transaction.
- Compliance with Laws – Seller, the TE Partnership (if applicable) and the Project Company are in compliance with all laws applicable to such entity and the transactions contemplated by the PSA.
- Environmental – Seller, the TE Partnership (if applicable), the Project Company and their respective Affiliates have no environmental liabilities (solely in the case of Seller relating to the Project) and are in compliance with environmental requirements (solely in the case of Seller relating to the Project). Seller and its Affiliates (including the TE Partnership, if applicable, and the Project Company) have not received any notice of an alleged violation of environmental law pertaining to the Project from any governmental entity. There are no facts, circumstances, conditions or occurrences relating to the Project, the TE Partnership, if applicable, or the Project Company that could reasonably be expected to form the basis of a claim, requirement or obligation imposed by any governmental entity under any environmental law on Seller or its Affiliates (including the TE Partnership, if applicable, and the Project Company) or Buyer.

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- Contracts – Schedule of material contracts binding on the (x) Seller relating to the TE Partnership, if applicable, the Project Company or the Project), (y) TE Partnership, if applicable, the Project Company or the Project, or the assets of any of the TE Partnership, if applicable, or the Project Company, has been provided and Seller has furnished to Buyer true, correct and complete copies of all such contracts. Each scheduled contract, including but not limited to the Generator Interconnection Agreement, is in full force and effect and neither Seller, the TE Partnership, if applicable, nor the Project Company, nor to the knowledge of Seller any other counterparty thereto, is in material violation or default under such contracts.
- Land Contracts – The land contracts and real property owned by the Project Company are in full force and effect, and shall comprise all of the real property interests necessary in connection with the interconnection operation and maintenance of the Project, all in accordance with all laws, and are sufficient to enable the Project to be commercially operable as contemplated in the PSA, including legal and physical ingress and egress rights to and from public right-of-way for operation, and maintenance of the Project.
- Data – Seller has delivered to Buyer true, correct and complete copies of all battery data related to the Project.
- Permits - All permits required to own, operate and maintain the Project are held by the Project Company, are scheduled, and Seller has obtained and furnished to Buyer true, correct and complete copies of such permits. Such permits are non-appealable, in full force and effect and are legal, valid, binding and enforceable in accordance with their respective terms.
- Title – The Project Company is in possession of and has good and marketable title to the Project free and clear of all encumbrances, except for permitted encumbrances. Seller has good and marketable title to the Project Company's equity interests, free and clear of all encumbrances. Seller and its Affiliates have no legal obligation or non-binding agreement in principle with any other person to sell or affect a sale of all, or any portion of, the Project or the Project Company.
- Other representation and warranties customary in a transaction of this nature, including those pertaining to taxes, title, finders, intellectual property, brokers and insurance.

Termination Provisions

The PSA may be terminated prior to the closing upon written notice by the terminating party (as described below) in the event of certain occurrences, including:

- By either party, in the event the closing has not occurred by a date to be negotiated, regardless of the reason for such termination, provided that the terminating party is not in breach of the PSA.
- By either party in the event regulatory approvals for the transaction are not obtained on terms reasonably acceptable to Buyer.
- By Buyer in the event any authority has issued an order or taken any other action that restrains, enjoins, or otherwise prohibits the consummation of the transactions contemplated by the PSA, and such order or action is nonappealable.

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- By Buyer in the event of material breach of the PSA by Seller.
- Security: Seller shall fund and maintain security in favor of Buyer, or a parent guaranty acceptable to Buyer, to secure Seller's obligations under the PSA including the indemnification provision below.

Indemnification

Each party shall indemnify and hold harmless the other party and its respective employees, representatives, officers, directors and agents from and against any and all damages arising out of the result of any breach or violation of any representation, warranty, covenant, inaccuracy within the PSA, or any liability not assumed as part of the PSA, or any fraud, willful misconduct, or negligence in performance of this PSA. Seller shall indemnify Buyer for any environmental (including hazardous material) claims arising prior to the closing date other than environmental claims resulting from Buyer's negligence. No claim for indemnification shall be brought against the Indemnifying Party until the total damages for which such party is liable exceeds in the aggregate a threshold amount to be negotiated, at which point indemnification may be sought for the full aggregate amount of damages, including those amounts that do not exceed the threshold. The aggregate damages to which the Indemnified Parties are entitled shall not exceed the indemnity cap, which shall be at least 30% of the purchase price. Such threshold and indemnity cap shall not apply to damages to the extent they arise from a breach of covenants required to be performed after the closing or from breach of certain "fundamental" representations (as applicable to each party) such as corporate existence, power, authority, conflicts, title, land contracts, real property, environmental, intellectual property or tax matters and shall not apply to liabilities arising prior to the closing date, which shall be the responsibility of Seller.

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EXHIBIT M - BATTERY STORAGE SYSTEM TESTING PROTOCOLS

This Exhibit M sets forth the Performance Criteria and protocols for any testing of the Battery Storage System under this PPA. The Commercial Operation Test, Periodic Test, and other discretionary testing identified in Section 5.6 are sometimes referred to in this Exhibit individually as a “Test” and jointly as the “Tests.”

PART I. GENERAL.

The Tests shall be conducted in accordance with Good Utility Practices and the provisions of this Exhibit M.

PART I. REQUIREMENTS APPLICABLE TO THE TESTS.

A. Test Parameters.

During any Test, at a minimum, the following parameters shall be measured and recorded simultaneously for the Battery Storage System at the level of granularity necessary to assess the measured criteria:

- (i) Time;
- (ii) Net electrical energy output to the Point of Delivery (kWh);
- (iii) Net electrical energy input from the Point of Delivery (kWh);
- (iv) State of Charge (MWh);

B. Performance Test Showing. Seller must demonstrate to Company's reasonable satisfaction, that the Battery Storage System:

- (i) is capable of storing and delivering the MW and MWh amount identified by Seller as the maximum rated power and energy;
- (ii) can deliver full rated power (MW) to the Point of Delivery for [insert as-bid storage duration] consecutive hours, totalling to the Guaranteed Storage Capacity, inclusive of identified Round Trip Efficiency losses.

C. Performance Test Conditions.

- (i) At all times during a Test, the Battery Storage System, including all auxiliary equipment, shall be operated in compliance with the Test Plan, Good Utility Practices, all operating protocols and conditions recommended, required, or established by the manufacturer, and all operating protocols, conditions, constraints, settings, parameters or the equivalent that are or would be in place during normal operations of the Facility.
- (ii) Company in its sole discretion may elect to shorten the run periods or waive a particular portion of a Test at any time. Such election or waiver during one Test does not shorten any run period or waive any portion of any subsequent Test.

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- (iii) Abnormal Conditions. If abnormal operating conditions occur during a Test, Company may postpone or reschedule all or part of such Test in its reasonable discretion in accordance with PART I.F. or PART I.G., below.
 - (iv) Applicable Laws. The Battery Storage System shall be operated in compliance with all Applicable Laws, including those governing safety, noise, air, and water emissions during any Test.
 - (v) Instrumentation and Metering. Permanently installed instruments shall include but not be limited to revenue metering devices located in the switchyard where the Facility is located.
- D. Test Records. Seller shall provide all records associated with PART I.A. with the Final Report described below in PART I.H. The records shall include copies of the raw data taken during the Test. This information will be provided in a format reasonably acceptable to Company. Collectively, the records and data provided with the Final Report shall be "Test Records".
- E. Incomplete Test. If any Test is not completed in accordance herewith, Company may in its sole discretion: (i) accept the Test results up to the time the Test stopped (other than in the case such Test is a Commercial Operation Test); (ii) require that the portion of the Test not completed, be completed within a reasonable specified time period; or (iii) require that the Test be entirely repeated.
- F. Retest. After the successful completion of a Test, Seller has the right, for any reason, to conduct a retest at Seller's sole expense, including the cost of charging the Battery Storage System.

If the Test Records provided by Seller to Company in accordance with PART I.D. are not in accord with the records and notes of the Company, Company may require the Test to be repeated. If the retest determines that the Test Records provided by Seller to Company are correct, then such retest will be deemed to be a Company Dispatched Test. If the retest determines that the Test Records provided by Seller to Company are incorrect, then such retest will be deemed to be a Seller Initiated Test. The records from any retest shall be used to determine Battery Storage System performance as of the date of the original Test being repeated.
- G. Final Report. Within fifteen (15) Business Days after the completion of a Test (including a retest), Seller shall prepare and submit to Company a written report of the Test in a format reasonably acceptable to Company. At a minimum, the report shall include:
 - (i) a record of the personnel present during all or any part of the Test, whether serving in an operating, testing, monitoring or other such participatory role;

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- (ii) a record verifying that inspections took place and the results were acceptable prior to testing initiation;
- (iii) a record of the test conditions (e.g. weather conditions) and test set up (e.g. equipment type and placement used);
- (iv) a record of any unusual or abnormal conditions or events that occurred during the Test and any actions taken in response thereto;
- (v) the Test Records;
- (vi) the system performance in relation to the Performance Criteria identified in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels, either by direct measurement or via agreed to calculation; and
- (vii) Seller's statement of either Seller's acceptance of the Test or Seller's rejection of the Test results and reason(s) therefore.

Within ten (10) Business Days after receipt of such report, Company shall notify Seller in writing of either Company's acceptance of the Test results or Company's rejection of the Test and reason(s) therefore.

If Company rejects the results of any Test or retest, or Seller rejects the results of the initial Commercial Operation Test, such Test shall be repeated in accordance with PART I.F.

PART II. TEST PROCEDURES.

Any Test shall be performed according to the provisions of this Exhibit M, and the Test Plan below.

A. GENERAL:

- (i) This document provides the procedure for Test and evaluation of the Battery Storage System for the Facility.
- (ii) The sole purpose of the Test will be the determination of Maximum Charging Rate, Maximum Discharging Rate, Minimum Discharging Time, Minimum Charging Time, Storage Capacity, and Round Trip Efficiency of the Battery Storage System for comparison to the Guaranteed Performance values provided in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.
- (iv) Data shall be recorded by the SCADA System data logging functions. The use of alternative means for data acquisition shall be used only with prior written consent of Company.
- (v) Prior to the start of testing the Battery Storage System, the control settings (tuning and constants) shall be verified.
- (vi) Any alteration or modifications to test measurement devices, or to the Battery Storage System, which could reasonably be expected to influence the outcome of the applicable Test or would not be present during normal operations of the Facility, shall not be permitted, without prior written consent of Company, and if accepted by Company, shall be fully documented by Seller and Company.

Northern States Power Company Storage Energy Purchase Agreement

B. RESPONSIBILITIES:

- (i) Specific responsibilities for this Test program are as follows:
 - a. Seller:
 - i. Perform commissioning.
 - iii. Support Company with testing and interface with the Utility/ISO as required to schedule and perform testing.
 - b. Company:
 - i. Support Seller with testing and interface with the Utility/ISO as required to schedule and perform testing.
 - ii. Perform energy testing through SCADA.
 - iii. Provide energy for the Test.

C. MEASUREMENTS & INSTRUMENTATION:

- (i) Instrumentation for the Test will consist of Battery Storage System instruments. Calibration certificates will be provided with the instruments.
- (ii) The State of Charge during all tests shall be read from the Battery Management System.
- (iii) The charge rate and discharge rates shall be measured using the Electric Metering Devices.

D. TEST PROCEDURE TO MEASURE THE PERFORMANCE CRITERIA:

- (i) A Test shall be performed to determine Maximum Charging Rate, Maximum Discharging Rate, Minimum Discharging Time, Minimum Charging Time, Storage Capacity, and Round Trip Efficiency of the Battery Storage System.
- (ii) The Battery Storage System shall be discharged to zero percent (0%) SOC and held for a period of at least five (5) minutes.
- (iii) The Battery Storage System shall be charged at the Guaranteed Maximum Charging Rate specified in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels until the Guaranteed Storage Capacity specified in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels is achieved and available for discharge, as measured at the POI. The maximum AC power charging rate achieved for a period of **[insert bid duration in hours]** continuous hours during this charge cycle shall be recorded and used for satisfaction of the Guaranteed Maximum Charging Rate. The total AC energy input into the Battery Storage System and the time until the Battery Storage System reaches a SOC of one hundred percent (100%) shall be measured, recorded, and used for satisfaction of the Guaranteed Minimum Charging Time.
- (iv) The system shall be left at rest in an active standby state for five (5) minutes.

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- (v) The Battery Storage System shall be discharged at the Guaranteed Maximum Discharging Rate specified in Exhibit M-1 – Battery Storage System Guaranteed Performance Levels until the SOC reaches zero percent (0%). The maximum AC power discharging rate achieved for a minimum of [insert bid duration in hours] continuous hours shall be recorded and used for satisfaction of the Guaranteed Maximum Discharging Rate. The total AC energy discharged from the Battery Storage System and the time until the Battery Storage System reaches a SOC of zero percent (0%) shall be measured and recorded. The total AC energy discharged from the Battery Storage System will be used for satisfaction of the Guaranteed Storage Capacity. The time period until the system has supplied the Guaranteed Storage Capacity will be used for satisfaction of Guaranteed Minimum Discharging Time.
- (vi) The total AC energy input and the total AC energy output from the system recorded in steps D.(iii) and D.(v) shall be used to determine Round Trip Efficiency for conformance to the Guaranteed Round Trip Efficiency defined in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

* * * *

Northern States Power Company Storage Energy Purchase Agreement

EXHIBIT M-1 - BATTERY STORAGE SYSTEM GUARANTEED PERFORMANCE LEVELS

This Exhibit M-1 - Battery Storage System Guaranteed Performance Levels sets forth the guaranteed performance levels ("Guaranteed Performance") for certain Performance Criteria.

Guaranteed Round Trip Efficiency:

The Guaranteed Round Trip Efficiency shall be as set forth in the table below:

Year	RTE
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
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Northern States Power Company Storage Energy Purchase Agreement

<u>Performance Metric</u>	<u>Guaranteed Level</u>	<u>Point of Measurement</u>
Guaranteed Storage Capacity	[] MWh	Point of Delivery
Self-Discharge Rate	[]/month	Point of Delivery
Guaranteed Minimum Charging Time	[] hours	Point of Delivery
Guaranteed Maximum Charging Rate	[] MW	Point of Delivery
Guaranteed Minimum Discharging Time	[] hours	Point of Delivery
Guaranteed Maximum Discharging Rate	[] MW	Point of Delivery
Maximum Ramp Rate	[] MW/second	Point of Delivery
Guaranteed Response Time	[] seconds	Point of Delivery
Grid Charging Capability	Pass	Point of Delivery

Northern States Power Company Storage Energy Purchase Agreement

EXHIBIT N- RESERVED

* * * * *

Northern States Power Company Storage Energy Purchase Agreement

EXHIBIT O- BATTERY STORAGE SYSTEM OPERATING PROCEDURES

The Battery Storage System Operating Procedures will include the provisions set forth in this Exhibit O - Battery Storage System Operating Procedures. If requested by Company, then no later than ninety (90) Days prior to the Commercial Operation Date, the Operating Committee shall develop the Battery Storage System Operating Procedures in accordance with Section 10.9. The Battery Storage System Operating Procedures can be reviewed annually (date and time to be mutually agreed) to optimize operations for both Parties. Parties shall cooperate to integrate the systems and controls necessary to implement the Battery Storage System Operating Procedures.

I. Operational limitations:

The operation of the Battery Storage System shall be subject to the following limitations:

- (a) The Annual Throughput and Annual State of Charge as defined in this PPA.
- (b) The requirements and limitations set forth in Section 5.2(D).

II. Data points to be sent from Seller to Company Via SCADA

The following data points will be transmitted via SCADA from Seller to Company and represent energy storage level data:

Table 1

<u>Energy Storage</u>	
<u>Description</u>	<u>Units</u>
Real Power Set-Point (echo)	MW
Actual Real Power	MW
Battery State of Charge	% & MWh
Charge Capacity	MW
Discharge Capacity	MW
Remaining Throughput (Commercial Operation Year)	MWh
YTD Average SOC (Commercial Operation Year)	%
Storage Capacity	MWh
Additional Data Points Reserved for Future Use	

The following data points will be transmitted via SCADA from Company to Seller and represent energy storage level data:

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Table 2

<u>Energy Storage</u>	
<u>Description</u>	<u>Units</u>
Charge Power Set-Point*	MW
Discharge Power Set-Point*	MW
Duration of Charge/Discharge Set-Point**	minutes
Target State of Charge*	%
Control Mode (target time or target SOC)	Boolean
Additional Data Points Reserved for Future Use	

*Parties will resolve any conflicts in priority of signal in the Battery Storage System Operating Procedures.

**System will observe either time entry or SOC target depending on Control Mode

Data points transmitted via SCADA from Seller to Company are subject to Battery Storage Operating Procedures.

1. **Response times of Battery Storage System.** The Battery Storage System Operating Procedures will include protocols that outline the expectations for responding to the Company's set points.

2. **Backup communications.** In the event of a communications failure, Company and Seller shall communicate via telephone in order to correct the failure.

* * * * *

Northern States Power Company Storage Energy Purchase Agreement

EXHIBIT P - SAFETY REQUIREMENTS

Seller shall design and construct the Facility in compliance with all Applicable Laws and shall ensure the Facility is operated in compliance with Good Utility Practices. Seller shall identify codes and standards that are applicable to the design of the Facility and ensure that upon substantial completion the Facility meets applicable codes and standards. [Technology specific codes and standards] Only non-occupiable Battery Storage System enclosures shall be considered and seller shall have the Battery Storage System enclosures certified to UL 9540 [or appropriate code]. Seller shall design, construct, and install the Facility under the guidance of NFPA 855 [or appropriate code] and shall comply with all applicable portions of that standard. Seller is solely responsible for maintaining the Facility in compliance with all Applicable Laws. Seller will provide Company with an independent registered professional engineer's certification stating that the Facility has been completed in all material respects (including compliance with all Applicable Laws) prior to COD.

Prior to COD, Seller will provide documentation submitted as part of the permitting process and, if not otherwise submitted as part of such permitting process, the following additional documents:

1. Operations and maintenance documentation, including an operations manual and maintenance manual, and schedule for planned maintenance;
2. Safety procedures for personnel (may be included within the operations or maintenance manual), and supplier safety manual;
3. Training materials for local first responders, identifying known hazards and failure modes, and methods for approach and action, if appropriate;
4. Emergency management plan, including instructions on how to interpret alarms and faults, location of emergency stops, egress pathways, known hazards, and emergency contact information for a subject matter expert who can be available on site within 2 hours; and
5. System drawings and documentation, including all physical, electrical, mechanical, and communications diagrams for all Facility sub-components, to allow for confirmation of claimed safety features including but not limited to, respectively, sufficient spacing, security, and signage; appropriate electrical ratings, grounding, and interconnections; foundations and construction materials; awareness of system operation and alarms; and fault ranges and emergency stops, but excluding any vendor proprietary drawings. As applicable, certifications for all claimed standards compliance should be provided.

* * * * *

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EXHIBIT Q - EXAMPLE ADJUSTMENT CALCULATION

Example of Round Trip Efficiency Adjustment

Example of Round Trip Efficiency Adjustment based on the following assumed facts:

- (a) Seller's actual Round Trip Efficiency as determined by latest test (RTE) = 85%.
- (b) Seller's Guaranteed Round Trip Efficiency (RTE_G) = 87%.
- (c) Amount of Discharging Energy delivered to the Point of Delivery for the affected hour (Discharging MWh_{Actual}) = 100 MWh.
- (d) Discharging Energy Price for the affected hour (Discharging LMP) = \$50/MWh.

Given these assumed facts, the Round Trip Efficiency Adjustment is calculated as follows:

Round Trip Efficiency Adjustment

$$\begin{aligned} &= [1 - (\text{RTE}_{\text{test}} / \text{RTE}_G)] \times [(\text{Discharging MWh}_{\text{Actual}} * \text{Discharging LMP})] \\ &= [1 - (85\% / 87\%)] \times [(100 \text{ MWh} \times \$50/\text{MWh})] \\ &= 2.3\% \times \$5,000 \\ &= \$115 \end{aligned}$$

Example of CAF Calculation

Example of Capacity Availability Factor calculation based on the following assumed facts:

- (a) Seller's Guaranteed Storage Capacity = 400 MWh.
- (b) Seller's Scheduled Maintenance Energy = 7,200 MWh as reflected on an approved Maintenance Schedule delivered pursuant to Section 10.2(A) and calculated assuming:
 - (i) Approved Maintenance Schedule included 24 hours of planned outages/deratings meeting the definition of Battery Storage System Planned Outages. Outages/derates during the period were actually in accordance with the approved Maintenance Schedule.

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- (ii) The most recently completed Test reflected a 300 MWh Storage Capacity.
- (c) Seller's Available Capacity = 178,560 MWh as reported by the by the Facility's SCADA System in accordance with Exhibit O – Battery Storage System Operating Procedures for such period.
- (d) Period Energy = Assumes 31 Days in the calculation period and calculated as (31 Days X 24 hours per Day X 300 MWh)

Given these assumed facts, the Capacity Availability Factor is calculated as follows:

Capacity Availability Factor

$$\begin{aligned} &= (AC + SME) / PE \\ &= [178,560 \text{ MWh} + 7,200 \text{ MWh}] / (31 \text{ Days} \times 24 \text{ hours per Day} \times 300 \text{ MWh}) \\ &= 245,280 \text{ MWh} / 223,200 \text{ MWh} \\ &= 0.8323 \end{aligned}$$

Northern States Power Company Storage Energy Purchase Agreement

EXHIBIT R - METER AND COMMUNICATIONS REQUIREMENTS

These meter requirements shall apply to all Electric Metering Devices.

- Electric Metering Devices shall meet requirements set forth in American National Standards Institute (ANSI) C12.1 and 12.20. Current transformers and voltage transformers supplying this meter should meet requirements of IEEE/ANSI C57.13 and ANSI C57.13.6. In addition to meeting these requirements the current transformers should be high accuracy extended range transformers with at least 0.15% accuracy from 1% to full rating factor, and high voltage transformers should be at least 0.3% accuracy from 90% to 100% of rated voltage. Prior to the purchase of Electric Metering Devices, current transformers and potential transformers and associated communication equipment, Seller must submit relevant information such that Company can review and verify that the equipment meets Company requirements. For Company-owned meters, potential transformers will utilize nominal secondary voltages of 115 volts or 120 volts. Backup meters may utilize current transformers with a lower accuracy class than 0.15% upon mutual agreement of the Parties.
- No later than ninety (90) Days prior to generating any Test Energy, Seller shall provide to Company in mutually agreeable format all necessary specifications related to the Electric Metering Devices and/or communication therewith including, but not limited to, the make, model, port configuration, connection assignments, electronic security definitions, firewall definitions, and physical locations.
- Company may inspect and verify that the equipment was approved and properly installed. In addition, Company may elect to test the Electric Metering devices for accuracy, current transformers and potential transformers and verify that the communication circuits to Company are operational.
- Upon prior written notice sufficiently in advance, Company shall have the right to make requests in regard to reasonable modifications to Seller's metering equipment and configurations in order to ensure accurate telemetering and communication.
- Company shall have the right to install any telemetering and communication equipment Company deems reasonably necessary for purposes related to this PPA. Seller shall, upon prior written notice sufficiently in advance, cooperate with any such installation.
- Electric Metering Devices shall be programmed to, at any time of remote electronic communications and access, provide a time and date stamp of downloaded delivery information.
- Electric Metering Devices shall be programmed to, at any time of manual read of the meter's display, provide the time and date of the information gathered. The Seller shall provide the communication channels for the Company's remote

Northern States Power Company Storage Energy Purchase Agreement

terminal unit and the Company's Itron Enterprise Edition Meter Data Management Agent. The implementation of these communication paths and RTU shall follow Company's latest standard. The Seller must have these communication paths installed, tested, and functional prior to generating Test Energy.

- Company shall have the right, via read-only access, and upon prior reasonable written notice to Seller, to independently audit Seller's meters and any records pertaining to the amount of energy generated by the Facility and any associated losses. Any audit shall be performed at the Facility or if applicable, other location within the same state as the Facility which is mutually agreed upon by both Company and Seller. Records related to such audits, inspections, testing or adjustments shall be maintained and subject to audit by Company for a period of twenty-four (24) months. Company shall further have the right to request and receive in physical or electronic form any and all records or data files related to such audits, inspections, testing or adjustments.
- Seller shall provide secure and reliable communication from the Electric Metering Devices as follows:
 - o Distributed Network Protocol ("DNP") output from the meter to Company's EMCC via a remote terminal unit located near the Electric Metering Devices and hardwired from the meter to the remote terminal unit.
 - o Time stamped meter register and interval data from the meter to Company's Itron Enterprise Edition Meter Data Management Agent with servers located in [insert current server location] [or] [Denver, CO] or successive data software package and servicer as Company defines. Electric Metering Devices must have an Itron approved Translation Interface Module to facilitate correct data transmission over this communication path.
 - o Prior to generating Test Energy, Seller shall provide to Company one-line electrical drawings of the Facility showing the electrical location of the Electric Metering Devices for Company's review and approval.

Northern States Power Company [Wind] [Solar] + Storage Energy Purchase Agreement

[WIND] [SOLAR] GENERATING AND BATTERY STORAGE

ENERGY PURCHASE AGREEMENT

BETWEEN

NORTHERN STATES POWER COMPANY

AND

[REDACTED]



- [date] -

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Northern States Power Company [Wind] [Solar] + Storage Energy Purchase Agreement

**[WIND] [SOLAR] GENERATING AND BATTERY STORAGE
ENERGY PURCHASE AGREEMENT**

BETWEEN

Northern States Power Company

AND

[REDACTED], LLC

This [Wind] [Solar] Generating and Battery Storage Energy Purchase Agreement (this “PPA”) is made as of this [REDACTED] day of [REDACTED], 20[REDACTED] (“Effective Date”), by and between (i) Northern States Power Company, a [Minnesota or Wisconsin] corporation with a principal place of business at [414 Nicollet Mall, Minneapolis, MN 55401/1414 W Hamilton Ave, Eau Claire, WI 54701-7252] (“Company”), and (ii) [REDACTED], LLC, a [REDACTED] [limited liability company] with a principal place of business at [REDACTED] (“Seller”). Company and Seller are hereinafter referred to individually as a “Party” and collectively as the “Parties.”

WHEREAS Seller desires to develop, design, construct, interconnect, own, operate and maintain the Facility as defined herein; and

WHEREAS Seller desires to sell and deliver, and Company desires to accept and receive, certain products and services, including but not limited to the Energy (including all Environmental Attributes) and Ancillary Services generated, stored and delivered from the Facility to the Point of Delivery at the prices and on the terms and conditions set forth in this PPA.

NOW THEREFORE, in consideration of the mutual covenants herein contained, the sufficiency and adequacy of which are hereby acknowledged, the Parties agree to the following:

Article 1 - Rules of Interpretation

1.1 Interpretation.

(A) Capitalized terms listed in this PPA shall have the meanings set forth in Exhibit A- Definitions or as otherwise defined in this PPA, whether in the singular or the plural or in the present or past tense. Words not otherwise defined in this PPA shall (i) have meanings as commonly used in the English language, (ii) be given their generally accepted meaning consistent with Good Utility Practices, and (iii) be given their well-known and generally accepted technical or trade meanings.

(B) The following rules of interpretation shall apply: (1) The masculine shall include the feminine and neuter; (2) references to “Articles,” “Sections” or “Exhibits” shall be to articles, sections, or exhibits of this PPA except as the context may otherwise require; (3) all Exhibits are incorporated into this PPA (*provided, however*, that in the event of a conflict with the terms of this PPA, this PPA shall control); and (4) use of the words “include” or “including” or similar words shall be interpreted as “include without limitation” or “including, without limitation.”

Northern States Power Company [Wind] [Solar] + Storage Energy Purchase Agreement

(C) This PPA was negotiated and prepared by both Parties with the advice and participation of counsel. None of the provisions hereof shall be construed against one Party on the ground that such Party is the author of this PPA or any part hereof.

(D) [Solar] Unless specifically designated as DC, each reference to “MW” or “kW” herein shall be AC MW or AC kW, as applicable. “AC” means alternating electric current; “DC” means direct electric current.

1.2 Interpretation with Other Agreements.

(A) This PPA does not provide Seller authorization to interconnect the Facility or inject power into the Transmission Authority’s System. Seller shall contract for interconnection services in accordance with the applicable Transmission Tariff. Seller acknowledges that the Interconnection Agreement is/will be a separate contract and that (i) this PPA is not binding on the Transmission Authority, (ii) this PPA does not create any rights between Seller and the Transmission Authority, and (iii) the Interconnection Agreement does not modify the Parties’ rights and obligations under this PPA. The applicable Transmission Authority shall be deemed to be a separate and unaffiliated contracting party for purposes of this PPA, regardless of whether such Transmission Authority is Company or an Affiliate of Company.

(B) This PPA does not provide for the supply of retail power for purposes of operating the Facility, including start-up, shutdown, [turbine] [panel] adjustment, lighting, HVAC or any other purpose (“House Power”). For the avoidance of doubt, House Power expressly excludes any Charging Energy. Seller shall contract with the utility providing House Power to the Site (the “Local Provider”) for the supply of House Power. Seller acknowledges that (i) Seller must obtain House Power independently, (ii) this PPA is not binding on the Local Provider, (iii) this PPA does not create any rights between Seller and the Local Provider, and (iv) Seller’s contract for House Power does not affect the Parties’ rights and obligations under this PPA. For purposes of this PPA, the Local Provider shall be deemed to be a separate and unaffiliated contracting party regardless of whether the Local Provider is Company or an Affiliate of Company; *provided* that, if (and only if) the Local Provider is Company or an Affiliate of Company, Seller may obtain House Power by self-generating and netting such self-generation from the Energy provided to Company unless prohibited by Applicable Law.

1.3 Good Faith and Fair Dealing. The Parties shall act reasonably and in accordance with the principles of good faith and fair dealing in the performance of this PPA. Unless expressly provided otherwise in this PPA, (a) when this PPA specifically references the consent, approval, or similar action by a Party, such consent or approval shall not be unreasonably withheld, conditioned or delayed, and (b) wherever this PPA specifically gives a Party a right to determine, require, specify or take similar action with respect to a matter, such determination, requirement, specification or similar action shall be Commercially Reasonable.

Northern States Power Company [Wind] [Solar] + Storage Energy Purchase Agreement

Article 2 - Term and Termination

2.1 This PPA shall become effective as of the date of its execution and shall remain in full force and effect until 11:59 pm on the last Day of the calendar month during which occurs the []th anniversary of the Commercial Operation Date (the "Scheduled Termination Date"), subject to early termination as provided in this PPA. Applicable provisions of this PPA shall continue in effect after termination to the extent necessary to (i) provide for final billings, payments and adjustments, (ii) enforce or complete the duties, obligations or responsibilities of the Parties (including under Section 12.1(B)-(E), Section 12.2(C), Section 12.3(B)-(C), Article 13 - and Article 17 - below), and (iii) address any remedies or indemnifications arising prior to termination.

Article 3 - Facility Description

3.1 Description. Seller shall construct, interconnect, own, operate, and maintain the Facility, as further described in Exhibit C - Facility Description and Site Maps. A scaled map that identifies the Site, the location of the Facility, the [Wind Turbines] [Solar Units], the Battery Units, the Interconnection Point and Interconnection Facilities, the Point of Delivery, the Battery Storage System Metering Point, and other important facilities, is included in Exhibit C - Facility Description and Site Maps.

3.2 General Design of the Facility.

(A) Seller shall design, construct, operate and maintain the Facility according to Good Utility Practices and the Interconnection Agreement.

(B) The Facility shall include all equipment specified in Exhibit C - Facility Description and Site Maps and otherwise necessary to fulfill Seller's obligations under this PPA, including all equipment necessary (i) to meet the requirements of Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection and Exhibit O - Battery Storage System Operating Procedures, and (ii) to interconnect successfully with the Transmission Authority's System for the delivery of Energy to the Point of Delivery. [Solar] The DC capacity of the Solar Facility shall be the aggregate maximum design output for each Solar Unit without giving effect to any limitation on the interconnection capacity specified in the Interconnection Agreement for the Facility. The DC capacity of the Facility shall not exceed the amount specified in Exhibit C - Facility Description and Site Maps.

(C) The [Wind] [Solar] Nameplate Capacity shall be [] MW [Solar; add "AC"] +/- 0.5%. The Battery Storage System Nameplate Capacity shall be [] MW AC and [] MWh. Seller shall certify to Company the final actual [Wind] [Solar] Nameplate Capacity and Battery Storage System Nameplate Capacity promptly following COD. [The interconnection capacity for the Facility shall be [] MW, which shall be set forth in the Interconnection Agreement. *to be included if the interconnection capacity is larger than the Nameplate Capacity*]

Article 4 - Implementation

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4.1 Project Development.

(A) Seller shall enter into and perform at its expense all contracts, including any equipment procurement contracts, required for (i) the engineering, procurement, construction, acquisition, manufacture, delivery and installation of the Facility, including any equipment procurement contracts, and (ii) the generation, storage and delivery of Energy from the Facility (generally, the “Construction Contracts”) with qualified and experienced contractors. Upon written request by Company, Seller shall promptly provide copies of any or all Construction Contracts to Company. At Company’s sole discretion, Seller may also provide a memorandum of agreement executed by Seller and the contracting party related to a Construction Contract. Such memorandum of agreement shall set forth the basic terms of such contract, including the names of the parties thereto, the date of such contract, a summary of any products or services to be provided and other information reasonably sufficient for Company to determine that the Construction Contract contains those obligations necessary for Seller to satisfy the Construction Milestones. All Construction Contracts or memorandum of agreements obtained by Company shall be deemed Confidential Information subject to Section 20.18 below.

(B) In its efforts to achieve COD, Seller shall use Commercially Reasonable Efforts to achieve the milestones set forth in Exhibit B - Construction Milestones and shall notify Company promptly following achievement of each such Construction Milestone. In addition, Seller shall achieve each milestone set forth in the table below (the “Critical Path Development Milestone”) on or before the applicable deadline for achieving such Critical Path Development Milestone specified in the table below. Seller shall provide to Company, on or before the applicable deadline to achieve each Critical Path Development Milestone, evidence reasonably satisfactory to Company that the Critical Path Development Milestone has been achieved. Seller shall also provide any additional evidence reasonably requested by Company that the Critical Path Development Milestone has been achieved, including certifications from an officer of Seller.

Critical Path Development Milestone	To be completed no later than (completion deadline):
Acquisition of all Seller’s Needed Permits required to construct the Facility	<i>[To be based on bid submission and RFP requirements]</i>
Execution of all Construction Contracts	<i>[To be based on bid submission and RFP requirements]</i>
Closing of project financing for the Facility or providing the Company with proof of financial capability to	<i>[To be based on bid submission and RFP requirements]</i>

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construct the Facility	

If Seller anticipates a CPD Delay because it is unable, using Commercially Reasonable Efforts, to achieve any of the Critical Path Development Milestones by the applicable deadline, then Seller may extend the timeframe to achieve such Critical Path Development Milestones as set forth in Section 12.2(B) subject to the payment of Liquidated Delay Damages so long as the following conditions are satisfied:

1. At least thirty (30) Days prior to the applicable completion deadline set forth above, Seller shall submit to Company (a) a written description of the reason for the expected failure; and (b) a Recovery Plan for completing all necessary work to achieve completion of the missed Critical Path Development Milestone by a date certain (which plan may contemplate the payment of Liquidated Delay Damages).
2. Seller shall commence the work contemplated by the Recovery Plan within five (5) Days after submitting such Recovery Plan to Company.
3. Seller shall be solely responsible for any costs or expenses incurred by Seller as a result of the formulation and implementation of the Recovery Plan.

Nothing in this Section 4.1(B) shall be construed to: (x) relieve Seller of its obligations under this PPA; (y) modify the deadlines for achieving the remaining Critical Path Development Milestones, including the Target COD, as applicable (except for the update to the milestone schedule pursuant to Section 12.2(B) and the missed Critical Path Development Milestone which Seller is attempting to cure under this Section 4.1(B) or (z) extend the applicable cure period set forth in Section 12.2(B) or impair the Company's right to terminate this PPA pursuant to Section 12.2(C). For clarity, failure to cure a CPD Delay within the applicable cure period set forth in Section 12.2(B) shall be subject to termination as set forth in Section 12.2(C).

(C) Prior to the Commercial Operation Date, Seller shall (i) submit monthly progress reports to Company in a form agreed to by the Parties, advising Company of the current status of each Construction Milestone and Critical Path Development Milestone, any significant developments or delays (along with an action plan for making up delays), and Seller's best estimate of the Commercial Operation Date; (ii) provide copies of reports submitted to the Facility Lender relating to status, progress and development of the Facility, and (iii) invite Company to participate in monthly meetings to discuss the progress reports, answer questions, and assess the schedule. Seller shall make all relevant counterparties under the Construction Contracts available to Company, upon request, in order to keep Company fully informed on the status of development.

(D) Upon request, Company shall have the right to monitor the

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construction, start-up, testing, and operation of the Facility at the Site to verify compliance with this PPA, *provided, however*, that Company shall comply with all of Seller's applicable safety and health rules and requirements.

(E) Neither Company's review of any Construction Contracts, memoranda thereof and Seller's reports, nor its discussions with Seller and its contractors, nor its monitoring of development and construction of the Facility, shall be construed as an endorsement by Company of the design, engineering, construction or testing thereof nor as any express or implied warranty as to the performance, safety, durability, or reliability of the Facility.

4.2 Environmental Matters.

(A) No later than sixty (60) Days following PUC Approval, Seller shall complete and provide to Company a valid and comprehensive independent "Phase I" environmental site assessment of the Site that is conducted in compliance with ASTM E1527-21 or E2247-16, as applicable (including associated raw data, if requested by Company), which report shall have been prepared within a reasonably proximate time such that it reflects the then-current conditions of the Site. Seller shall notify Company promptly (i) if (and to what extent) any Environmental Contamination on the Site will preclude or interfere with Seller's ability to perform its obligations under this PPA, and (ii) Seller's plan for remediation thereof that would allow Seller to perform under this PPA as and when due. The Phase I report delivered to Company under this paragraph shall be deemed Confidential Information for purposes of Section 20.18.

(B) Throughout the Term, Seller promptly shall:

1. disclose to Company and remediate, at Seller's sole cost and expense, any Environmental Contamination identified at the Site;
2. provide to Company copies of any further environmental assessments or investigations of the Site (including associated raw data, if requested by Company); and
3. disclose to Company the existence of any enforcement, legal, or regulatory action or proceeding relating to any alleged presence of Environmental Contamination and/or the alleged violation of any Applicable Law related to protection of human health, the environment, or natural resources including protected species.

(C) For purposes hereof:

1. "Environmental Contamination" means the introduction or presence of Hazardous Materials at such levels, quantities or location, or of such form or character, that (i) requires remediation under Applicable Law, (ii) presents a material risk that the Site will not be available or usable for the purposes contemplated by this PPA, and/or (iii) will preclude or interfere with Seller's ability

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to perform its obligations under this PPA as and when due.

2. “Hazardous Materials” means any substance, contaminant, chemical, material, gas, or particulate matter that is regulated by any Governmental Authority as an environmental pollutant or which is deemed or may be deemed hazardous, dangerous, damaging or toxic to public health, public welfare, or the natural environment (including protection of non-human forms of life, land, water, groundwater, and air), including any material or substance that is (i) defined as “toxic,” “polluting,” “hazardous waste,” “hazardous material,” “hazardous substance,” “extremely hazardous waste,” “solid waste” or “restricted hazardous waste” under any provision of Applicable Law; (ii) petroleum, including any fraction, derivative or additive; (iii) asbestos; (iv) polychlorinated biphenyls; (v) per- and polyfluoroalkyl substances (vi) radioactive material; (vii) designated as a “hazardous substance” pursuant to the Clean Water Act, 33 U.S.C. §1251 *et seq.* (33 U.S.C. §1251); (viii) defined as a “hazardous waste” pursuant to the Resource Conservation and Recovery Act, 42 U.S.C. §6901 *et seq.* (42 U.S.C. §6901); (ix) defined as a “hazardous substance” pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §9601 *et seq.* (42 U.S.C. §9601); (x) defined as a “chemical substance” under the Toxic Substances Control Act, 15 U.S.C. §2601 *et seq.* (15 U.S.C. §2601); or (xi) defined as a pesticide under the Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. §136 *et seq.* (7 U.S.C. §136).

4.3 Permits.

(A) Seller shall obtain and pay for all Permits necessary under Applicable Law or advisable pursuant to Good Utility Practices for the construction, ownership, operation and maintenance of the Facility and the generation and delivery of the products and services required by this PPA. Seller shall keep Company informed as to the status of its permitting efforts and shall provide Company the opportunity to review and comment on major applications for draft and final Permits. Seller shall promptly inform Company of (i) any Permits that Seller is unable to obtain, which are delayed, limited, suspended, terminated or otherwise constrained, along with a statement of whether and to what extent this circumstance may limit or preclude Seller’s ability to perform under this PPA, and (ii) Seller’s plan to overcome such issue(s) to allow Seller to perform this PPA as and when due. Company shall have the right to inspect and obtain copies of all Permits held by Seller.

(B) Seller represents and warrants to Company that, (i) except for those Permits identified in Exhibit F - Seller’s Needed Permits (each of which Seller anticipates will be obtained by Seller in the ordinary course of business), all Permits and other actions required or recommended by applicable Governmental Authorities to authorize Seller’s execution, delivery and performance of this PPA [Wind] (including Permits with respect to protected species)] have been duly obtained and are in full force and effect; (ii) no event has occurred which allows, or after notice of lapse of time would allow, revocation or termination by the issuer thereof or which results in any other material

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impairment of the rights of the holder of any such Permit; and (iii) Seller has no reason to believe that any Governmental Authority is considering limiting, suspending or revoking any such Permit.

(C) Throughout the Term, Seller shall promptly disclose to Company the existence of any enforcement, legal, or regulatory action or proceeding relating to the alleged violation of any Permit held by Seller, which proceeding (if successful) could materially interfere with Seller's performance of this PPA.

(D) For purposes hereof, "Permits" means all applicable licenses, permits, certificates of authority, authorizations, approvals, registrations, and similar consents and orders issued or granted by a Governmental Authority for construction, ownership, operation and maintenance of the Facility and the generation and delivery of Energy therefrom.

4.4 Safety Requirements; Governmental Inspections. Seller shall, and shall cause its Affiliates and contractors to, design and construct the Facility and conduct all work or cause all work in connection therewith to be conducted in accordance with Exhibit P - Safety Requirements. Seller shall, and shall cause its Affiliates and contractors to, take all actions to comply with Exhibit P - Safety Requirements. Seller shall notify Company (i) sufficiently in advance of any known upcoming significant inspections by any Governmental Authority relating to the Facility, to allow Company the opportunity to attend, and (ii) promptly after any unscheduled or impromptu inspection with a description of the nature and outcome of such inspection.

4.5 Commercial Operation.

(A) Seller shall cause COD to occur no later than [REDACTED], 20[REDACTED] (the "Target COD"). Company shall not be obligated to accept and establish a Commercial Operation Date earlier than [REDACTED], 20[REDACTED] [*insert date that is 90 days prior to Target COD*].

(B) Seller shall notify Company of the date on which Seller believes the Facility has achieved Commercial Operation in writing (a "COD Notice"). A COD Notice shall include all necessary supporting documentation of the satisfaction or occurrence of all COD Conditions. Company shall have ten (10) Business Days to review a COD Notice and raise any Commercially Reasonable objection to Seller's satisfaction of any of the COD Conditions, *provided, however*, that Seller's COD Notice shall be deemed accepted by Company if Company fails to object within such time period. Seller may notify Company of completion of one or more COD Conditions on an individual and incremental basis prior to COD, *provided, however*, that Company shall in all cases have up to ten (10) Business Days to review and object to each such notice.

(C) For purposes hereof, the "Commercial Operation Date" or "COD" means 12:01 am on the Day after which Seller's COD Notice has been accepted by Company or deemed accepted by Company pursuant to Section 4.5(B); and

1. the "COD Conditions" are:

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a. an officer of Seller, authorized to bind Seller and who is familiar with the Facility, has confirmed in writing that (1) all necessary and material Permits have been obtained, are in full force and effect and the entity granting the Permit has not placed any temporary or conditional restrictions or limitations on the Facility or its operation, (2) Seller is in compliance with this PPA in all material respects, (3) Seller has made all necessary arrangements to obtain and pay the Local Provider for House Power, and (4) the Facility is available to commence normal operations in accordance with Seller's operating agreements, Construction Contracts, and applicable manufacturers' warranties;

b. Seller has proven to Company's reasonable satisfaction that (1) Seller and the Transmission Authority have executed the Interconnection Agreement, and Seller has received no notice of breach thereof from the Transmission Authority, (2) the Facility is interconnected to the Transmission Authority's System, and has been fully tested, achieved initial synchronization, and been successfully operated at a generation level acceptable to the Transmission Authority, without experiencing any abnormal or unsafe operating conditions on any interconnected system, (3) Seller has or is capable of declaring commercial operation under the Interconnection Agreement and (4) Seller has made all other arrangements necessary to deliver Energy during the Term;

c. Seller has obtained and provided to Company an independent registered professional engineer's certification stating that the Facility has been completed in all material respects, except for "punch list" items that do not have a Material Adverse Effect on the ability of the Facility to operate for its intended purpose and are not required for the safe operation of the Facility or otherwise affect the capacity, efficiency, reliability, operability, safety or mechanical or electrical integrity of the Facility;

d. Seller has demonstrated the functionality and reliability of the Facility's communications systems and AGC interface with Company's EMCC, the capability of the Facility to receive and respond to signals from Company's SCADA System;

e. Seller has demonstrated the accuracy of the Electric Metering Devices and their ability to communicate with the Company in accordance with Exhibit S - Meter and Communications Requirements;

f. Seller has successfully completed a Commercial Operation Test in accordance with Section 5.6(A):

g. [Wind Turbines] [Solar Units] comprising not more or less than one hundred percent (100%) of the [Wind] [Solar] Facility

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Nameplate Capacity, and associated equipment sufficient to allow such [Wind Turbines] [Solar Units] to generate and deliver Renewable Energy to the Point of Delivery, have been installed and become operable.

h. Battery Units comprising one hundred percent (100%) of the Battery Storage System Nameplate Capacity planned for the Facility, and associated equipment sufficient to allow such Battery Units to store Charging Energy and deliver Discharging Energy to the Point of Delivery, have been installed and become operable;

i. Seller has demonstrated the accuracy and reliability of the Real Time Data, including Park Potential, required by Section 10.6 and completed a comprehensive check of the AGC data points to be sent from Seller to Company via the SCADA System to the Company's satisfaction, all in accordance with Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection;

j. Seller has demonstrated the ability to fulfill the forecasting requirements including the usage of the availability forecast system as described in Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection and Exhibit O - Battery Storage System Operating Procedures;

k. Seller has provided to Company all documentation submitted consistent with Exhibit P - Safety Requirements.

l. Seller has executed and delivered to Company all documents or instruments required under Article 16 -.

m. Seller has provided evidence reasonably satisfactory to Company that it is compliant with and has adopted and implemented the appropriate policies pertaining to, the Forced Labor Laws consistent with Section 15.2(B). Seller shall also provide any additional evidence or certifications reasonably requested by Company that the requirements of this subsection have been met, including certifications from an officer of Seller or third-parties, certificates of origin documentation or importer statements.

n. an officer of Seller, authorized to bind Seller and who is familiar with the Facility, shall certify in writing that all Construction Craft Employees were covered by a collective bargaining agreement with a union affiliated with the local council of North America's Building Trades Unions ("Building Trades CBA"). If Seller cannot provide such certification as to a specified portion of the work, then an officer of Seller, authorized to bind Seller and who is familiar with the Facility shall certify in writing that Seller met and conferred, in good faith, with the local council of North America's

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Building Trades Unions and attempted to find and hire those trade(s) of Construction Craft Employee(s) covered by a Building Trades CBA for that portion of the work, and, if such Construction Craft Employee(s) covered by a Building Trades CBA were not available, that Seller (or Seller's construction contractor) entered into a site-specific building trades collective bargaining agreement covering that portion of the work.

(D) For purposes hereof, the first "Commercial Operation Year" shall mean the period starting at 12:01 a.m. on the Commercial Operation Date and ending at 11:59 pm on the last Day of the calendar month in which the first anniversary of COD occurs, and each successive "Commercial Operation Year" shall mean the twelve (12) month period following the prior Commercial Operation Year. The applicable Committed Energy amount and the Annual Throughput Limit [*bid-specific -- may be n/a*] for the first Commercial Operation Year shall be prorated to reflect the number of Days by which the first Commercial Operation Year exceeds three hundred sixty-five (365) Days.

(E) Prior to COD, should Seller require Company's assistance in meeting the COD Conditions because the Transmission Authority considers Company to be the market participant for the Facility, Company shall use Commercially Reasonable Efforts to cooperate with and provide assistance to Seller, so long as Seller provides any security the Transmission Authority requires and reimburses Company for all expenses, including fees of counsel, Company may incur in providing such cooperation and assistance.

4.6 Test Energy.

(A) Seller shall provide Company and Transmission Authority with the information necessary to have the Facility registered with the Transmission Authority for inclusion in any generation and energy storage modeling maintained by the Transmission Authority, sufficiently in advance to allow the Facility to be registered in such model at least four (4) months [*NSP – six (6) months if Transmission Owner is not NSP*] prior to generating any Test Energy. Company shall cooperate reasonably to assist in the registration of the Facility to allow generation of Test Energy.

(B) Seller shall coordinate the production and delivery of Test Energy with Company, with not less than seven (7) Business Days' prior written notice, or such other Commercially Reasonable prior written notice as Company may reasonably request. Company shall provide all Grid Charging Energy required to charge the Battery Storage System and Discharging Energy from the Facility derived from such Grid Charging Energy shall be treated as dispatched by the Company hereunder. Company shall reasonably cooperate with Seller to provide such Grid Charging Energy at a time that will mitigate the costs of such Grid Charging Energy (including, if requested by Seller, by providing Seller with projections of the Charging Energy Price), and Seller shall reimburse Company for the cost of the Grid Charging Energy (based on the Charging Energy Price at the time of charging) to the extent that it exceeds the cost of the Discharging Energy discharged by the Battery Storage System derived from such Grid Charging Energy (based on the

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Discharging Energy Price at the time of discharging).

(C) For purposes hereof, “Test Energy” means Renewable Energy generated by the Facility prior to COD that is required to satisfy the COD Conditions or as otherwise determined by the Company in the exercise of its reasonable discretion.

Article 5 - Delivery and Testing

5.1 Arrangements.

(A) Seller shall be responsible for arranging, maintaining and paying the costs associated with the interconnection of the Facility to the Transmission Authority’s System. Seller shall comply with the Transmission Authority’s requirements for interconnection and shall comply with all requirements set forth in the applicable Transmission Tariff.

(B) Seller’s interconnection application shall request that the Transmission Authority study the Facility for Network Resource Interconnection Service under the Transmission Tariff. The resulting Interconnection Agreement must be Network Resource Interconnection Service. Seller hereby authorizes Company to contact, discuss and obtain information concerning the Facility and the Interconnection Facilities directly with/from the Transmission Authority. Promptly upon request by Company, Seller shall confirm such authorization in writing to the Transmission Authority and any applicable transmission owners in such form as may be requested by Company or the Transmission Authority.

(C) To the extent required, Company shall arrange and be responsible for scheduling and transmission services beyond the Point of Delivery with respect to the output of the Facility. To the extent applicable, Company shall be the market participant with respect to the output of the Facility, as defined by the Transmission Authority.

(D) Seller shall be responsible for all interconnection, electric losses, transmission and ancillary service arrangements and costs required to deliver Energy. Company shall be responsible for all electrical losses, transmission and ancillary service arrangements and costs required to transmit and deliver Energy beyond the Point of Delivery.

5.2 Charging Requirements.

(A) Company shall be responsible for arranging, managing, purchasing, and scheduling all of the Charging Energy for the Battery Storage System in accordance with the terms of Section 7.2 and Section 7.3 and Exhibit O - Battery Storage System Operating Procedures. Seller will be responsible for delivery of [Wind] [Solar] Charging Energy from the [Wind] [Solar] Facility to the Battery Storage System. Company will be responsible for delivering Grid Charging Energy at the Point of Delivery, and Seller shall be responsible for accepting and transferring Grid Charging Energy from the Point of

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Delivery to the Battery Storage System. Seller shall be responsible for delivering all Discharging Energy up to the Point of Delivery. Company shall be responsible for accepting and transferring all Discharging Energy at and from the Point of Delivery.

(B) Seller shall take any and all action necessary to allow the delivery of Charging Energy to the Battery Storage System in accordance with the terms of this PPA, including maintenance, repair or replacement of equipment in Seller's possession or control used to deliver the Charging Energy from the Point of Delivery to the Battery Storage System and receive any such Charging Energy at the Point of Delivery.

(C) Except with respect to the establishment of the ability to deliver Charging Energy to the Battery Storage System, Company shall be responsible for the costs required to supply any Grid Charging Energy to the Point of Delivery; *provided*, that (i) Seller shall be responsible for certain costs arising out of a Seller Initiated Test as set forth in Section 5.6 and (ii) Seller shall be responsible for charging the Battery Storage System from Renewable Energy generated by the [Wind] [Solar] Facility to the extent Seller is directed to do so by Company.

(D) The Battery Storage System may not be, and Company shall not issue any instruction, order, Dispatch Notice or other communication requesting or requiring the Battery Storage System to be charged, discharged or operated in any manner which results in an amount of Energy discharged by the Battery Storage System in any given Commercial Operation Year which exceeds the Annual Throughput Limit, except to the extent provided in accordance with Section 8.5 and 8.6. **[bid-specific -- may be n/a]**

5.3 Market Changes.

(A) If at any time during the Term, the Transmission Authority changes or the facilities at the Point of Delivery cease to be subject to the Transmission Tariff, the Parties shall cooperate in good faith to facilitate the delivery of Energy, at the least possible cost to the Parties, consistent with this PPA to the extent possible.

(B) If and to the extent that changes to the rules of the Market Operator require Company to change the manner in which Company schedules and dispatches the Facility, the Parties shall cooperate in good faith to change their protocols for operation of the Facility accordingly, at the least possible cost to the Parties, consistent with this PPA to the extent possible.

(C) In addition, if as a result of any change in Applicable Law the Company is not able to realize the capacity and Ancillary Services products that the Facility is able to provide to the Company as of the Effective Date and such capacity and Ancillary Services products can be provided by the Facility subject to the Seller making capital expenditures to comply with such change in Applicable Law, then Seller agrees that it shall make all such required capital expenditures so that the Facility is able to provide such capacity and Ancillary Services products to the Company.

5.4 Communication Protocols. To facilitate the exchange of information

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between the Parties, the Parties shall follow the communication protocols set forth in Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection.

5.5 Electric Metering Devices.

(A) All Electric Metering Devices used to measure Energy located and installed at the Point of Delivery shall be owned and maintained by Company or the Transmission Authority, unless otherwise agreed to by Company; and all Electric Metering Devices located at or within the Facility shall be owned and maintained by Seller, at no cost to Company, unless the Company requests otherwise. All Electric Metering Devices shall meet the requirements of Exhibit S - Meter and Communications Requirements.

1. Meter readings will be adjusted to reflect losses from the Electric Metering Devices to the Point of Delivery in accordance with applicable manufacturers' parameters or as otherwise agreed by the Parties.

2. Seller shall configure Electric Metering Devices via electronic remote communications and via physical access in a manner that enables separate, bi-directional (as applicable) meter readings for all Energy transmitted between, or at, the following points as set forth in Exhibit C - Facility Description and Site Maps:

- a. Facility and the Point of Delivery;
- b. To and from the Battery Storage System; and
- c. [Wind Turbines] [Solar Units] and the Point of Delivery

(B) Seller shall configure Electric Metering Devices, installed in accordance with and conforming to the Local Provider's electrical service and tariff requirements, as necessary, to separately account for all House Power.

(C) Seller shall arrange any necessary authorization to provide Company access to all Electric Metering Devices for purposes related to this PPA and shall provide Company the opportunity to be present at any time when any such Electric Metering Devices is to be inspected, tested or adjusted.

(D) Either Party may elect to install and maintain, at its own expense, backup Electric Metering Devices ("Back-Up Metering"), *provided, however*, that the specifications, installation and testing of any such Back-Up Metering shall be consistent with the requirements for the Electric Metering Devices. Upon written request from the other Party, the installing Party shall test the Back-Up Metering. The actual cost of any such test shall be borne by the Party requesting the test, unless, upon such test, Back-Up Metering is inaccurate by more than one percent (1%), in which case the cost of the retest shall be borne by the installing Party. If requested in writing, the installing Party shall provide copies of any inspection or testing reports to the requesting Party.

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(E) If an Electric Metering Device or Back-Up Metering fails to register, or if the measurement is inaccurate by more than one percent (1%), if requested by Company, an adjustment shall be made correcting all measurements as follows:

(F) If the Electric Metering Device is found to be defective or inaccurate, the Parties shall use Back-Up Metering, if installed, to determine the amount of such inaccuracy, *provided, however*, that Back-Up Metering has been tested and maintained and adjusted for losses on the same basis as the Electric Metering Device. If Back-Up Metering is not installed, or Back-Up Metering is also found to be inaccurate by more than one percent (1%), the Parties shall use the best available information for the period of inaccuracy, adjusted for losses to the Point of Delivery in accordance with applicable manufacturers' parameters or as otherwise agreed by the Parties.

(G) If the Parties cannot agree on the actual period during which inaccurate measurements were made, the period shall be the shorter of (i) the last one-half of the period from the last previous test of the Electric Metering Device to the test that found the Electric Metering Device to be defective or inaccurate, or (ii) one hundred eighty (180) Days immediately preceding the test that found the Electric Metering Device to be defective or inaccurate.

(H) To the extent that an adjustment period covers a period of deliveries for which payment has already been made by Company, Company shall use the corrected measurements as determined in accordance with this Article 5 - to re-compute the amount due for the period of the inaccuracy and shall subtract or add the previous payments made by Company for this period from such re-computed amount. The net difference shall be reflected as an adjustment on the next regular invoice in accordance with Article 9 -.

5.6 Battery Storage System Testing.

(A) Prior to the Commercial Operation Date, Seller shall schedule and successfully complete a "Commercial Operation Test" during which Company shall have exclusive dispatch rights to the Facility to demonstrate the Facility's ability to meet the Guaranteed Performance listed in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels when responding to Company's Dispatch Notice.

(B) On an annual basis, no earlier than one-hundred eighty (180) Days and no later than thirty (30) Days prior to each Commercial Operation Year during the Delivery Period, upon seven (7) Days prior written notice to Company, Seller shall schedule and complete a Periodic Test to demonstrate that the Facility is capable of meeting the Guaranteed Performance in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels. Company has the right to not permit a Periodic Test if it conflicts with the requirement of the ERO. In addition, either Party shall have the right to require a retest at any time if such Party reasonably believes that the actual Performance Criteria have varied materially from the results of the most recent Tests. Such retest shall be scheduled as soon as is reasonably practicable for the Parties consistent with Good Utility Practices.

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Any such retest shall be deemed a Seller Initiated Test, as defined in Section 5.6(D), except to the extent that such discretionary testing can be conducted during a period in which Company is already charging or discharging the Battery Storage System in a manner which can allow accommodation of such testing, in which case such Test may be deemed to be a Company Dispatched Test, as defined in Section 5.6(D).

(C) If Seller fails any Periodic Test, then Seller shall be required to commence repairs in accordance with Section 10.3.

(D) Seller may also conduct other discretionary tests, at times and for durations agreed to by Company, that Seller deems necessary for purposes of reliably operating the Facility or for re-performing a required Test. If such discretionary testing is conducted during a period in which Company is already charging or discharging the Battery Storage System in a manner which can allow accommodation of such testing ("Company Dispatched Test"), Seller shall not be obligated to pay for the electricity required to charge the Battery Storage System relating to such Company Dispatched Test of the Battery Storage System, and Discharging Energy from the Facility shall be treated as dispatched by Company hereunder. If discretionary testing is conducted during a period in which Company is not charging or discharging the Battery Storage System in a manner which can allow accommodation of such testing ("Seller Initiated Test"), then Seller may provide the electricity required to charge the Battery Storage System from the [Wind] [Solar] Facility or Company shall provide all electricity required to charge the Battery Storage System, in each case relating to such Seller Initiated Test of the Facility; provided that to the extent Company provides Grid Charging Energy to Seller in connection with such Test, then Company shall reasonably cooperate with Seller in its efforts to perform the Seller Initiated Test at a time that will mitigate the costs of such Energy (including, if requested by Seller, by providing Seller with projections of the Grid Charging Energy Price), and Seller shall reimburse Company for the cost of such Grid Charging Energy (based on the Grid Charging Energy Price at the time of charging) used to charge the Battery Storage System to the extent that it exceeds the cost of the Grid Discharging Energy discharged by the Battery Storage System during such Seller Initiated Test (based on the Grid Charging Energy Price at the time of discharging). Company shall reasonably cooperate with Seller to schedule testing during periods when Company is dispatching the Facility so that such testing will be deemed to be a Company Dispatched Test; provided that, Company is not required to use or change its utilization of its owned or controlled assets or market positions to facilitate the characterization of such testing as a Company Dispatched Test.

Article 6 - Conditions Precedent

6.1 PUC Approval.

(A) No later than forty-five (45) Days after the Effective Date, Company may apply to the MPUC/NDPSC for PUC Approval. If Company fails to apply for PUC Approval within forty-five (45) Days following the Effective Date, Company shall be deemed to have waived its right to obtain PUC Approval and to terminate this PPA

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under this Section 6.1, and this PPA shall remain in full force and effect thereafter.

(B) If Company applies for PUC Approval, Company shall use Commercially Reasonable Efforts to obtain PUC Approval as soon as reasonably practicable. Seller shall cooperate with Company's efforts to obtain PUC Approval.

(C) If Company applies for PUC Approval, Company shall have the right to terminate this PPA, without any further financial or other obligation to Seller as a result of such termination, by notice to Seller:

1. at any time within thirty (30) Days following issuance of a written order by the MPUC and/or the NDPSC (as applicable) rejecting PUC Approval, or granting PUC Approval with conditions unacceptable to Company in its sole discretion;

2. at any time between the one hundred eightieth (180th) and two hundred fifteenth (215th) Day following Company's application for PUC Approval, if prior to the date of such termination the MPUC and/or the NDPSC (as applicable) has not issued a written order granting or rejecting PUC Approval; **[if applicable as specified in the RFP]**

3. at any time within thirty (30) Days following timely request for reconsideration (in whole or in any material part) by any third party with standing, of a written order of the MPUC or NDPSC (as applicable) granting PUC Approval; and/or

4. at any time within thirty (30) Days following timely appeal by any party with standing, of a written order of the MPUC or the NDPSC (as applicable) granting PUC Approval.

If Company is eligible but fails to terminate this PPA by the applicable date, Company shall be deemed to have waived its right to terminate this PPA under this Section 6.1(C), and this PPA shall remain in full force and effect thereafter.

(D) For purposes of this PPA, "PUC Approval" means a written order of the MPUC and/or an Advance Determination of Prudence from the NDPSC, which alone or in combination make(s) an affirmative determination that all costs incurred under this PPA are recoverable from Company's retail customers pursuant to Applicable Law, subject only to the requirement that the MPUC and NDPSC (as applicable) retain ongoing prudency review of Company's performance and administration of this PPA, as determined by Company in its sole discretion.

6.2 Other Company CPs. **[if any]**.

6.3 Seller CPs. **[if any - bid specific]**.

6.4 Return of Security Fund. Following a termination pursuant to Section 6.1 **[or**

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Section 6.2 [or Section 6.3], the Company will return to Seller the undisputed amount of the remaining initial Security Fund within five (5) Business Days of such termination.

Article 7 - Sale and Purchase

7.1 General Obligation.

(A) Subject to the provisions of this PPA, beginning on the Commercial Operation Date, Seller shall generate from the [Wind] [Solar] Facility, store in the Battery Storage System, and deliver to the Point of Delivery, and sell to Company, and Company shall receive and purchase at the Point of Delivery, the Energy, Ancillary Services and other products and services required by this PPA. Seller shall not curtail or interrupt deliveries of Energy to Company for economic reasons of any type.

(B) Seller shall not sell any products or services required by this PPA to any third party.

(C) Title and risk of loss of the products and services transacted by this PPA shall transfer from Seller to Company at the Point of Delivery.

7.2 AGC. Beginning on the Commercial Operation Date, Company shall dispatch the Facility through the EMCC AGC system in accordance with Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection. Seller shall ensure that, throughout the Term:

(A) the SCADA System signal is capable of functioning on all AGC-Set-Points within the margin of error specified in the manufacturer's energy set-point margin of error; and

(B) the Facility AGC Remote/Local status is in "Remote" set-point control during normal operations.

7.3 Battery Storage System Dispatch.

(A) During each Operating Day, Company's EMCC will have the exclusive right to dispatch the Battery Storage System, seven (7) Days per week and twenty-four (24) hours per Day (including holidays), by providing Dispatch Notices to Seller in accordance with the Battery Storage System Operating Procedures and subject to the requirements and limitations set forth in this PPA. Seller shall abide with all directives from Company's EMCC, subject only to Good Utility Practices.

(B) For each Operating Day, Seller shall provide to Company (in accordance with the protocols outlined in Exhibit O - Battery Storage System Operating Procedures and as may be updated by written agreement of the Operating Committee pursuant to Section 10.8) an hourly schedule of the expected availability of the Battery Storage System for such Operating Day, no later than two (2) Business Days before such Operating Day (the "Availability Notice"). Seller must update Company immediately,

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unless an event or circumstance makes it unsafe to do so, then as soon as practicable, in accordance with the protocols outlined in Exhibit O - Battery Storage System Operating Procedures if the availability of the Battery Storage System for dispatch by Company changes or is likely to change after the Availability Notice is submitted. Seller shall accommodate Company's reasonable requests for changes in the time or form of delivery of the Availability Notices.

7.4 Environmental Attributes. The Parties acknowledge that existing and future Applicable Laws create significant value in the ownership, use and allocation of Environmental Attributes. To the full extent allowed by Applicable Law, Seller hereby assigns to Company (and Company shall own and be entitled to claim) all Environmental Attributes existing or created during the Term associated with the Facility and the Renewable Energy, at no additional charge to Company under this PPA.

(A) Seller hereby irrevocably assigns to Company all rights, title and authority for Company to register the Facility as an Eligible Energy Resource and own, hold and manage the Environmental Attributes associated with the Facility in Company's own name and to Company's account, including any rights associated with any renewable energy information or tracking system that exists or may be established (including participation in any applicable REC Registration Program) with regard to monitoring, registering, tracking, certifying, and/or trading such Environmental Attributes. Seller hereby authorizes Company to act as its agent for the purposes of registering the Facility as an Eligible Energy Resource, and tracking, certifying, registering and reporting such Environmental Attributes. Seller grants to Company full authority to hold, use, sell and/or trade such Environmental Attributes for the Company's own account in all applicable renewable energy information or tracking systems. Upon the request of Company, at no cost to Company, (i) Seller shall deliver or cause to be delivered to Company appropriate attestations/certifications of such Environmental Attributes, and (ii) Seller shall cooperate with Company's tracking, registration, reporting and certification of such Environmental Attributes.

(B) Prior to the Commercial Operation Date, Seller shall complete and return to Company all applications and forms and provide all supporting documentation required by Applicable Law for accreditation and assignment of all Environmental Attributes. Such applications, forms and supporting documentation include but are not limited to: (i) Assignment of Registration rights, (ii) Schedule A Form, (iii) EIA 860 Verification, (iv) the Interconnection Agreement, (v) Manufacturer's specifications for the [turbines] [panels], (vi) revenue meter number and (vii) COD Notice.

(C) For purposes hereof, "Environmental Attributes" includes but is not limited to existing and future, (i) Renewable Energy Credits, (ii) environmental credits, benefits or attributes, (iii) emissions reductions, (iv) avoided emissions and reporting rights for avoided emissions of pollutants to the air, soils or waters, such as sulfur oxides (SO_x), nitrogen oxides (NO_x), carbon monoxide (CO), greenhouse gases (such as carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆) that have been or may in the future be determined

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by the United Nations Intergovernmental Panel on Climate Change or by Applicable Law to contribute to the threat of climate change; (v) avoidances (including emission rate credits), offsets, allowances and green tags, and (vi) zero-emission electricity credits, that are attributable to the Facility during the Term and/or Renewable Energy under this PPA, recognized by Applicable Law, including any rights to compensation therefor.

(D) For the avoidance of doubt, Environmental Attributes exclude: (i) PTCs, ITCs and other local, state or federal tax credits providing a tax benefit to Seller based on ownership of the Facility or energy production therefrom, including the [wind] PTCs] or [solar] ITCs] that may be available to Seller with respect to the Facility under IRC [wind] §45 or [solar] §48, and (ii) depreciation and other tax benefits arising from ownership or operation of the Facility.

7.5 Ancillary Services.

(A) During the Term, Seller shall make available to Company and Company shall own, all Ancillary Services associated with the Facility, including but not limited to the sole right to sell Ancillary Services associated with the Facility and to retain all revenues therefrom. Seller shall use Commercially Reasonable Efforts to maximize the Ancillary Services available from the Facility.

(B) Any compensation Seller receives under the Interconnection Agreement or otherwise from third parties for Ancillary Services shall be provided to Company at no additional cost to Company under this PPA. To implement the foregoing, Seller shall credit Company, as a reduction to Seller's monthly invoice or other mutually-agreed mechanism, for any compensation that Seller receives from third parties for such Ancillary Services; *provided*, that if a Governmental Authority or Transmission Authority implements new or revised requirements for generators and/or energy storage resources to create, modify, or supply Ancillary Services, requiring Seller to install additional equipment after the Effective Date to meet such requirements, then Seller, after consultation with Company shall, if requested to do so by Company, install any such additional equipment and shall be allowed to reduce the amount to be credited to Company for Ancillary Services by an amount sufficient to recover the cost of such additional equipment (up to the amount of any cap agreed to by the Parties for such work). Any cost not so recovered by Seller in any billing period shall be carried forward as a reduction of the amount of the credit in subsequent billing periods. The invoice for the final billing period of the Term shall include any costs not yet recovered by Seller pursuant to this Section 7.5(B).

(C) For purposes hereof, "Ancillary Services" mean any service associated, directly or indirectly, with the reliable generation and/or transmission of energy from the Facility from time to time, including but not limited to: operating reserves, ramp capability, reactive supply, reactive supply capability, voltage control, voltage control capability, and any rights to compensation for any of these services. "Ancillary Services" also includes any other service identified as an "ancillary service" or "other ancillary service" in the Transmission Tariff. For the avoidance of doubt, "Ancillary Services" include

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any service associated, directly or indirectly, with the reliable generation and/or transmission of energy from the Facility, regardless of whether the Facility, the Transmission Authority or the Company is deemed to be the service provider for the service.

Article 8 - Payment Calculations

8.1 Payment for Renewable Energy.

(A) Company shall pay Seller [] [Number derived by multiplying 70% by the Energy Payment Rate for the first Commercial Operation Year. Can be deleted if there is only one Energy Payment Rate], for all Test Energy delivered to Company.

(B) Subject to the reduction as set forth in Section 8.5(C), commencing on the Commercial Operation Date, Company shall pay the Energy Payment Rate to Seller for all Renewable Energy delivered by the Facility to the Point of Delivery, up to one hundred fifteen percent (115%) of the Committed Energy, in each Commercial Operation Year (such payment in any given month, the "Monthly Energy Payment"); *provided* that, Company shall never be required to pay for net instantaneous output of the Facility (as measured at the Point of Delivery) in excess of the Generation Limit. For purposes of this PPA the "Generation Limit" shall be the lesser of the (i) [wind] [solar] Nameplate Capacity or (ii) the power transfer limit as established in the Interconnection Agreement. Without the express written consent of Company, Seller shall not permit the aggregate amount of the net instantaneous output of the Facility delivered to the Point of Delivery and the Battery Storage System at any given moment in time to exceed the Generation Limit.

(C) The Energy Payment Rate shall be deemed Confidential Information for purposes of Section 20.18 below.

(D) For purposes of determining the amount of Renewable Energy delivered by Seller to the Point of Delivery hereunder in any given period, Company shall subtract from the total amount of Energy delivered by Seller to the Point of Delivery during such period an amount equal to the Grid Discharging Energy.

8.2 Excess Energy.

(A) Seller shall notify Company promptly upon Seller's delivery of Renewable Energy that exceeds one hundred ten percent (110%) of the Committed Energy for a Commercial Operation Year. Within ten (10) Business Days of any such notice, Company shall elect by notice to Seller either to accept or to decline any Excess Energy generated by the Facility through the balance of such Commercial Operation Year. Failure by Company to deliver such notice shall be deemed an election by Company to decline any Excess Energy for that Commercial Operation Year.

(B) If Company elects to accept Excess Energy, Company shall pay Seller the full Energy Payment Rate for all Excess Energy for the balance of that

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Commercial Operation Year.

(C) If Company declines Excess Energy, Company's purchases of Renewable Energy with respect to the applicable Commercial Operation Year shall cease when Renewable Energy reaches one hundred fifteen percent (115%) of the Committed Energy for such Commercial Operation Year. For the avoidance of doubt, Company shall continue to have the exclusive right to control the dispatch of the Battery Storage System (including to charge the Battery Storage System with Grid Charging Energy, and dispatch such Battery Energy), regardless of whether Company declines Excess Energy.

(D) For purposes hereof, "Excess Energy" means all Renewable Energy generated by the Facility in any Commercial Operation Year in excess of one hundred fifteen percent (115%) of the Committed Energy for such Commercial Operation Year, measured at the Point of Delivery.

8.3 Curtailments.

(A) For purposes of this PPA, a "Curtailment" shall be defined as a curtailment of the output of the Facility arising out of:

1. The Transmission Authority, or any Governmental Authority directing a curtailment, reduction, or re-dispatch of generation to the extent that such action results in a curtailment of the output of the Facility under Applicable Law, including planned maintenance Outages on any part of the transmission system or any testing of the transmission system, any declaration of an "Emergency Condition" or "Force Majeure" (as such terms are defined in the Interconnection Agreement), or any non-dispatch or reduction in dispatch of the Facility as a result of the tags, offers, bids, plans or schedules for the Facility submitted by Company.

2. A forced or unscheduled interruption or Outage (including as a result of interruption or curtailment of electric transmission service), but (without limiting the other sub-clauses and clause of this Section 8.3) only for so long and only to the extent necessitated by such forced or unscheduled interruption or Outage.

3. Company, subject to Section 5.1(D), or Transmission Authority requiring Seller, by telephonic communication or through use of the AGC Set Point, to curtail the delivery of Renewable Energy from the Facility. Seller shall promptly comply with each such notification.

4. The lack of available transmission from the Facility to the Point of Delivery.

(B) No payment shall be due to Seller from Company for Renewable Energy curtailed as a consequence of a Curtailment.

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8.4 Payment for Capacity.

(A) Company shall pay Seller a monthly payment for capacity (the "Monthly Capacity Payment") based upon the following formula:

Monthly Capacity Payment = (C x CP x CAF), where:

C = (the "Capacity") for the applicable month is the lesser of the Maximum Charging Rate or Maximum Discharging Rate, in each case as determined by the most recently completed Test and stated in kW. For avoidance of doubt, the Capacity shall not be greater than the Battery Storage System Nameplate Capacity.

CP = Capacity Payment Rate, as set forth in Exhibit J - Energy Payment Rate; Committed Energy; Capacity Payment Rate.

CAF (the "Capacity Availability Factor") = (AC + SME) ÷ PE, where:

AC = Available Capacity for any period, stated in MWh, means the maximum amount of Storage Capacity that is available from the Facility as reported by the Facility's SCADA System in accordance with Exhibit O – Battery Storage System Operating Procedures for such period. For purposes of calculating Available Capacity:

Storage Capacity that is unavailable for dispatch by Company shall be considered to be available for the purposes of determining Available Capacity when (and only when):

- (i) the Facility is disconnected from the Transmission Authority's System pursuant to the Interconnection Agreement, and the disconnection is not caused by actions of Seller or problems with the Facility; and/or
- (ii) the Discharging Energy cannot be delivered by Seller or received by Company due to an Emergency or an event of Force Majeure affecting the Transmission Authority's System at or beyond the Point of Delivery; and/or
- (iii) Company has contracted for non-firm transmission service, and the Discharging Energy cannot be received at the Point of Delivery due to transmission constraints affecting the Transmission Authority's System.

By way of example only, the Available Capacity shall be deemed unavailable for purposes of this Section 8.4(A):

- (i) if, to the extent and for so long as the Facility is subject to a Forced Outage, including an Outage caused by Force Majeure at the Site or prior to the Point of Delivery;

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- (ii) if Company has contracted for firm transmission service, but the Discharging Energy cannot be received by Company at the Point of Delivery due to transmission constraints affecting the Transmission Authority's System.

SME = "Scheduled Maintenance Energy" for any period, stated in MWh and set forth on an approved Maintenance Schedule in accordance with Section 10.2(A), means the amount of energy that is not available from the Facility during such period due to planned outages/deratings that meet the definition of Battery Storage System Planned Outages and were included on an approved Maintenance Schedule in accordance with Section 10.2(A); *provided, however*, if the actual number of Battery Storage System Planned Outages during the measurement period is less than as set forth in an approved Maintenance Schedule for such period, then the Scheduled Maintenance Energy shall be adjusted to reflect the actual number of Battery Storage System Planned Outages and calculated in the same manner as set forth in Section 10.2(A).

PE = Period Energy for any period, stated in MWh, means the product of the Storage Capacity, as determined by the most recently completed Test, and the total number of hours in such period.

For the avoidance of doubt, the calculated CAF cannot be greater than 1.

For the avoidance of doubt, a GSU Transformer Failure shall not be considered in the calculation of the Capacity Availability Factor set forth in this Section 8.4(A).

(B) The Capacity Payment Rate shall be deemed Confidential Information for purposes of Section 20.18 below.

(C) For the avoidance of doubt, monthly payments to Seller may be subject to a reduction in accordance with Section 8.5.

8.5 Energy Payment Reductions.

(A) For each month of the Delivery Period, the monthly payments to Seller may be reduced by (i) the Round-Trip Efficiency Adjustment as set forth in Section 8.5(B) and/or, (ii) the Committed Energy Deficiency Adjustment as set forth in Section 8.5(C) and/or, (iii) the adjustment set forth in Section **Error! Reference source not found.**

(B) Round Trip Efficiency Adjustment. If the Round Trip Efficiency as determined by the most recently completed Test is less than the then-applicable Guaranteed Round Trip Efficiency, then the Monthly Capacity Payment shall be reduced by the Round Trip Efficiency Adjustment, based upon the following formula:

$$[1 - (RTE_{test} / RTE_G)] \times (\text{Discharging } MWh_{Actual} * \text{Discharging LMP})$$

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where:

RTE_{test} = the Round Trip Efficiency as determined by the most recently completed Test.

RTE_G = the then-applicable Guaranteed Round Trip Efficiency, as identified in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

$Discharging\ MWh_{Actual}$ = the Discharging Energy delivered to Company at the Point of Delivery for the affected hour expressed in MWh.

$Discharging\ LMP$ = the Discharging Energy Price for each $Discharging\ MWh_{Actual}$ for the affected hour expressed in Dollars per MWh; *provided*, that the Discharging LMP may not, in any event, be less than \$0.00 for any given hour.

In no event shall the Round Trip Efficiency Adjustment be less than \$0.00. Sample calculations for the Round Trip Efficiency Adjustment are set forth in Exhibit R - Example Adjustment Calculations.

(C) Committed Energy Deficiency Adjustment. Seller's failure to deliver to Company the Committed Energy (as adjusted pursuant to Exhibit Q - Methodology for Adjusting Committed Energy) shall result in a reduction in the Monthly Energy Payment to Seller as set forth below (the "Committed Energy Deficiency Adjustment").

1. Beginning at COD should Seller fail to deliver to Company at least ninety percent (90%) of the Committed Energy in either two (2) consecutive Commercial Operation Years, or three (3) non-consecutive out of six (6) consecutive Commercial Operation Years (as adjusted pursuant to Exhibit Q - Methodology for Adjusting Committed Energy), the Monthly Energy Payment Company makes to Seller during the Commercial Operation Year following such failure shall be reduced by ten percent (10%).

2. Beginning with the [Insert Term minus five (5) years] Commercial Operation Year, should Seller fail to deliver to Company at least ninety percent (90%) of the Committed Energy in either two (2) consecutive Commercial Operation Years, or three (3) non-consecutive out of six (6) consecutive Commercial Operation Years (as adjusted pursuant to Exhibit Q - Methodology for Adjusting Committed Energy), the Monthly Energy Payment Company makes to Seller during the Commercial Operation Year following such failure shall be reduced by fifteen percent (15%).

3. Beginning with the third(3rd) Commercial Operation Year,

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should Seller fail to deliver to Company at least eighty-five percent (85%) of the Committed Energy in either two (2) consecutive Commercial Operation Years, or three (3) non-consecutive out of six (6) consecutive Commercial Operation Years (as adjusted pursuant to Exhibit Q - Methodology for Adjusting Committed Energy), the Monthly Energy Payment Company makes to Seller during the following Commercial Operation Year shall be reduced by fifteen percent (15%).

4. Beginning with the **[Insert Term minus five (5) years]** Commercial Operation Year, should Seller fail to deliver to Company at least eighty-five percent (85%) of the Committed Energy in either two (2) consecutive Commercial Operation Years, or three (3) non-consecutive out of six (6) consecutive Commercial Operation Years (as adjusted pursuant to Exhibit Q - Methodology for Adjusting Committed Energy), the Monthly Energy Payment Company makes to Seller during the following Commercial Operation Year shall be reduced by twenty percent (20%).

5. Beginning with the third Commercial Operation Year, should Seller fail to deliver to Company at least eighty percent (80%) of the Committed Energy in either two (2) consecutive Commercial Operation Years, or three (3) non-consecutive out of six (6) consecutive Commercial Operation Years (as adjusted pursuant to Exhibit Q - Methodology for Adjusting Committed Energy), the Monthly Energy Payment Company makes to Seller during the following Commercial Operation Year shall be reduced by twenty percent (20%).

6. Beginning with the **[Insert Term minus five (5) years]** Commercial Operations Years, should Seller fail to deliver to Company at least eighty percent (80%) of the Committed Energy in either two (2) consecutive Commercial Operation Years, or three (3) non-consecutive out of six (6) consecutive Commercial Operation Years (as adjusted pursuant to Exhibit Q - Methodology for Adjusting Committed Energy), the Monthly Energy Payment Company makes to Seller during the following Commercial Operation Year shall be reduced by twenty-five percent (25%).

For the avoidance of doubt, should more than one Energy Payment Reduction percentage under this Section apply to the same Commercial Operation Year, only the largest payment reduction shall apply to that Commercial Operation Year.

(D) If Seller fails to accurately or timely respond to a Company Dispatch Notice, then unless such failure is expressly permitted under this PPA (including due to a Force Majeure or Excused Outage), if the Market Operator assesses a penalty or similar charge (including as applicable, an excessive or deficient energy charge referenced in the protocols of the Market Operator) on the Company due to or arising out of such failure and Company provides documentation of the same to Seller along with any other details and documentation as reasonably requested by Seller, then Company shall provide and pass through to Seller such penalty or charge. Company shall reduce Seller's next monthly invoice payment by an amount equal to such Market Operator charges, in

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accordance with Section 8.5(A).

8.6 Excess Throughput Payment.

(A) Company shall pay Seller a payment equal to [] for each MWh of Energy discharged by the Battery Storage System above the Annual Throughput Limit in any given Commercial Operation Year as adjusted pursuant to Section 8.7 below. The total Discharging Energy shall not exceed one-hundred ten percent (110%) of the Annual Throughput Limit in any given Commercial Operation Year. For purposes of determining the amount of Energy discharged by the Battery Storage System in any given Commercial Operation Year, any Energy discharged by the Battery Storage System during a Seller Initiated Test or a Periodic Test shall be excluded.

8.7 Annual Throughput Limit Banking and Borrowing.

(A) If, in any Commercial Operation Year, Company has not used all of the Annual Throughput Limit for such Commercial Operation Year, then [insert five percent (5%) of Annual Throughput Limit] MWh of the unused Annual Throughput Limit for such Commercial Operation Year shall be added to the Annual Throughput Limit for the subsequent Commercial Operation Year.

(B) If, in any Commercial Operation Year, Company has used all of the Annual Throughput Limit for such Commercial Operation Year, then, for such Commercial Operation year, Company may add up to [insert five percent (5%) of Annual Throughput Limit] MWh of the Annual Throughput Limit allocated to the subsequent Commercial Operation Year, which use shall reduce the Annual Throughput Limit for the subsequent Commercial Operation Year.

8.8 Excess Annual State of Charge Payment. If applicable, no later than thirty (30) Days after the end of each Commercial Operation Year, Company shall pay Seller a payment equal to one-thousand Dollars (\$1,000) for every one-tenth of one percent (0.1%) the average State of Charge for a Commercial Operation Year exceeds the Annual State of Charge Limit as defined in this PPA.

Article 9 - Billing and Payment

9.1 Billing.

(A) The billing period under this PPA shall be the calendar month.

(B) As soon as practicable and in any event within twenty (20) Days after the end of each month, or (ii) ten (10) Days after receipt by Company of the monthly report required from Seller pursuant to Section 10.4(B), Company shall provide to Seller a statement containing Company's calculation of the amount due to Seller for such month, including the applicable billing parameters based upon Company's reading of the Electric Metering Devices consistent with Section 5.5.

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(C) No later than fifteen (15) Business Days following receipt of Company's billing statement, Seller shall submit an invoice to Company in a form and by a method to be agreed by the Parties, showing the amount due to Seller for the relevant month, specifying the products and services provided, billing meter register reads for relevant measurement quantities, total usage in kWh being billed, date and time at which accumulated and billed production was read by the Electric Metering Devices, all billing parameters, rates and factors, and any other data relevant to the calculation of payments due to Seller. Such invoice shall include an explanation of any items in dispute, as well as all supporting documentation upon which Seller relies.

9.2 Payment. All payments shall be remitted via check or electronic funds transfer, as designated by the owed Party, on or before the fifteenth (15th) Business Day following receipt of the invoice described in Section 9.1(C). Remittances received by mail will be considered to have been paid when due if the postmark indicates the payment was mailed on or before the fifteenth (15th) Business Day following receipt of the billing invoice.

(A) If a payment is late, a late payment charge shall be applied to the unpaid balance for the number of Days the payment was late and shall be added to the next billing statement. Late payment charges shall include interest calculated using the prime rate of interest as published on the date of the invoice in *The Wall Street Journal* (or, if unavailable, an equivalent publication on or about that date).

(B) Company at any time may offset against amounts owed to Seller, any liquidated amounts, accrued damages and other payments, and undisputed billing errors and adjustments, which are owed by Seller to Company.

(C) Seller and Company may net their obligations to each other under this PPA, and payment of the net amount shall discharge all mutual undisputed obligations between the Parties.

9.3 Billing Disputes. Either Party may dispute invoiced amounts pursuant to Section 13.1 and shall pay to the other Party at least the portion of invoiced amounts that is not disputed, on or before the invoice due date. When the billing dispute is resolved, the amount owed shall be netted in the monthly billing period's invoice following the date of such resolution, with late payment interest charges calculated on the amount owed in accordance with Section 9.2(A).

Article 10 - Operations and Maintenance

10.1 Operation and Administration.

(A) Seller shall staff, control, and operate the Facility consistent with Good Utility Practices, Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection, Exhibit O - Battery Storage System Operating Procedures, and this PPA. Personnel of Seller shall be available 24x7 via telephone or other electronic means with (i) the capability of remotely starting, operating and stopping the Facility within ten (10) minutes, and (ii) the ability to be present at the Site within thirty (30) minutes or sooner, to

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the extent required in accordance with Good Utility Practices and subject to Exhibit P - Safety Requirements.

(B) Seller shall comply with Good Utility Practices, its obligations under this PPA, the Interconnection Agreement, and the requirements of all Governmental Authorities and all reasonable requirements of Company in the operation of the Facility. By way of example only, Seller shall perform all capacity testing of the Facility and related reporting, as and when required by Governmental Authorities. Any such testing shall be deemed to be a Seller Initiated Test.

(C) Seller shall provide to Company a day-ahead availability schedule in accordance with Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection, Exhibit O - Battery Storage System Operating Procedures, and any other reporting requirements required for compliance with NERC reliability standards. Company shall forward Seller's forecast to the applicable local reliability coordinator on Seller's behalf, *provided, however*, that Seller shall remain responsible to ensure the timeliness and accuracy of forecasts and any changes to the real-time or forecast availability of the Facility. If and to the extent that the ERO modifies the forecasting or other reporting requirements imposed on Company or the Facility, Seller shall timely provide required data to Company or the ERO, as applicable.

(D) Seller shall, and shall cause its Affiliates and contractors to operate, and maintain the Facility and conduct all work or cause all work in connection therewith to be conducted in accordance with Exhibit P - Safety Requirements. Seller shall, and shall cause its Affiliates and contractors to, take all actions to comply with Exhibit P - Safety Requirements.

10.2 Facility Maintenance.

(A) Seller shall maintain the Facility in accordance with Good Utility Practices. Seller shall coordinate its regular maintenance requirements for the Facility with Company ("Maintenance Schedules"). Seller shall provide Maintenance Schedules, including planned Outages of the Facility (including any Battery Storage System Planned Outages) and a calculation of the expected Scheduled Maintenance Energy for such planned Outage based on the Storage Capacity as determined by the most recently completed Test, to Company in writing and sufficiently in advance for Company's Commercially Reasonable review, and shall be subject to Company's Commercially Reasonable approval. Seller shall coordinate with Company and the Transmission Authority on the timing and duration of planned Outages. Company has the right to not permit a planned Outage if it conflicts with the requirements of the ERO or if the ERO rejects the planned Outage request.

(B) Seller shall minimize the amount of scheduled maintenance during the months of January, February, June, July, August, September and December to the maximum extent consistent with Good Utility Practices. Seller shall coordinate with Company and the Transmission Authority on the timing and duration of planned Outages

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of the Facility (including any Battery Storage System Planned Outages).

(C) When Forced Outages occur, Seller shall notify Company's EMCC of the existence, nature, start time, and expected duration of the Forced Outage as soon as practical, but in no event later than one (1) hour after the Forced Outage occurs. Seller shall immediately inform Company's EMCC of changes in the expected duration of the Forced Outage except to the extent relieved of this obligation by Company's EMCC with respect thereto.

(D) Seller shall develop and provide Company with a copy of its Facility cold weather policy. In the event of a Facility Forced Outage or derate of more than ten percent (10%) of the Battery Storage System Nameplate Capacity, Company may request that Seller shall conduct a root cause analysis, take corrective action(s) as are reasonable under the circumstances to prevent reoccurrences and provide a copy of such analyses and corrective action(s) to Company.

10.3 Repair Obligations.

(A) In the event that:

1. operating performance demonstrates any of the following:

a. the Minimum Charging Time is in excess of one-hundred two percent (102%) of the Guaranteed Minimum Charging Time;

b. the Maximum Charging Rate is less than ninety-eight percent (98%) of the Guaranteed Maximum Charging Rate;

c. the Minimum Discharging Time is in excess of one-hundred two percent (102%) of the Guaranteed Minimum Discharging Time;

d. the Maximum Discharging Rate is less than ninety-eight percent (98%) of the Guaranteed Maximum Discharging Rate;

e. the Response Time is in excess of one-hundred two percent (102%) of the Guaranteed Response Time;

f. the Storage Capacity is less than ninety-eight percent (98%) of the Guaranteed Storage Capacity, or,

2. a Test demonstrates that any of the Performance Criteria do not meet the levels required to pass such Test in accordance with the standards set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels;

3. then Seller shall repair the Battery Storage System in accordance with Good Utility Practices and the procedures set forth in this Section

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10.3.

(B) Within fourteen (14) Days of any failure, set forth in Section 10.3(A), Seller shall either (i) demonstrate such remedy to the reasonable satisfaction of Company (a "Successful Repair") or, (ii) present to Company a description of the reason for the failure and a plan and schedule for completing a Successful Repair (the "Repair Plan").

10.4 Books and Records.

(A) Seller shall maintain an accurate and up-to-date hourly operating log for the Facility, in electronic format, with records of production for each clock hour; changes in operating status; Forced Outages; information required by Governmental Authorities in the prescribed format; and other information reasonably requested by Company. Seller shall deliver the operating log to Company electronically for each month within five (5) Business Days of the end of such month, if requested by Company.

(B) Seller shall deliver to Company information on Facility performance during each calendar month within five (5) Business Days after the end of each month using definitions provided by (or consistent with) the NERC Generation Availability Data System Manual, or any successor document. The data delivered to Company shall include planned and unplanned derated hours, average derated kW during the derated hours, scheduled maintenance hours, average derated kW during scheduled maintenance hours, the operating log referenced in Section 10.4(A) above, and any other additional supporting documentation as reasonably requested by Company.

(C) Seller and Company shall each keep complete and accurate records and all other data required by each of them for the purposes of proper administration of this PPA, including metering, billing and payment records, and such records as may be required by Governmental Authorities. Originals or copies of all Operating Records shall be maintained at the Site or such other [Minnesota or Wisconsin] location as may be specified by Seller from time to time. Company may examine and make copies of such Operating Records from time to time upon request, during normal business hours.

10.5 Access to Facility. Representatives of Company shall have access to the Facility from time to time, on Commercially Reasonable prior written notice, to read meters, perform inspections and take such other actions as may be appropriate to facilitate Company's performance of this PPA. While at the Facility, such representatives shall observe Seller's standard safety precautions and shall conduct themselves in a manner that will not interfere with operation of the Facility.

10.6 Real Time Data.

(A) Seller shall communicate all data necessary for Company to integrate the Facility into Company's EMCC in real time ("Real Time Data") through the Facility's SCADA System in accordance with Exhibit I - AGC Protocols; Dispatch and

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Availability Reporting; Data Collection, and subject to Exhibit O - Battery Storage System Operating Procedures. Seller shall maintain the Facility's SCADA System and communications system so that they are capable of interfacing with and reacting to Company's AGC Set-Point and responding to signals from Company's EMCC in accordance with the AGC Protocols, subject to Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection, and Exhibit O - Battery Storage System Operating Procedures.

(B) Seller shall use Commercially Reasonable Efforts to maintain and, when necessary, adjust the real time Park Potential of the Facility when Company communicates to Seller a measured difference of plus or minus two percent (2%) between the metered Renewable Energy and Park Potential, during periods when generation is not curtailed.

(C) From and after the Commercial Operation Date, Seller shall provide Company, at Seller's expense, real time performance and meteorological data for all [Wind Turbines] [Solar Units] and meteorological stations at the Facility in accordance with Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection for the Term. Seller shall maintain Seller-owned data collection systems that are compatible with Company's PI System. Seller shall ensure that real time communications capabilities are available and maintained for transmission to Company's PI System. Seller shall ensure that all meteorological equipment at a minimum meets the specifications set forth in Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection. Company shall have the right to disclose data gathered through Company's PI System publicly; *provided, however*, that such data is (i) masked to obscure the origin of the data and (ii) aggregated so that the data cannot be correlated and used by competitors of Seller and/or the supplier of the [Wind Turbines] [Solar Units], except as otherwise provided in Section 20.18.

10.7 Accreditation. Seller shall perform from time to time, at its expense, any reporting and testing (including capacity testing) of the Facility required by Governmental Authorities.

10.8 Operating Committee and Operating Procedures.

(A) Company and Seller shall each appoint one representative and one alternate representative to act as the Operating Committee in matters relating to the Parties' performance obligations under this PPA and to develop operating arrangements for the generation, delivery, dispatch, and receipt of Energy from the Facility. The Parties' initial representatives on the Operating Committee are set forth in Exhibit D - Notices and Contact Information.

(B) If requested by Company, the Operating Committee shall develop mutually agreeable written Battery Storage System Operating Procedures for the [Wind] [Solar] Facility and the Battery Storage System that are consistent with the requirements of this PPA, including Section 5.2 and Exhibit O - Battery Storage System Operating Procedures in order to address administrative matters such as: day-to-day

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communications; key personnel; operations-center interface; metering, telemetering, telecommunications, and data acquisition procedures; operations and maintenance scheduling and reporting; reports; operations log; testing procedures; and such other matters as may be mutually agreed upon by the Operating Committee. For the avoidance of doubt, Company (or its representative on the Operating Committee) shall have no obligation to agree to operational limitations except for those set forth in Part I of Exhibit O - Battery Storage System Operating Procedures.

(C) The Operating Committee shall review the requirements for AGC and data collection from time to time after the Effective Date and may agree on modifications thereto to the extent necessary or convenient for operation of the Facility in accordance with this PPA.

(D) The Operating Committee shall have authority to act in all technical and day-to-day operational matters relating to performance of this PPA and to attempt to resolve potential disputes, provided, however, that except as explicitly provided herein, the Operating Committee shall have no authority to amend or waive any provision of this PPA, including any provision included within Exhibit O - Battery Storage System Operating Procedures.

Article 11 - Security for Performance

11.1 Security Fund.

(A) During the Term of this PPA, Seller shall fund and maintain security in favor of Company, at Seller's expense, to secure Seller's obligations to Company under this PPA (the "Security Fund"), in accordance with this Article 11 -.

(B) Seller shall establish and fund the Security Fund in the amount of [insert \$200/kW x Facility Nameplate Capacity kW], no later than thirty (30) Days following the Effective Date. Within five (5) Business Days following COD, the amount of the Security Fund shall be reduced to [insert \$75/kW x (Facility Nameplate Capacity kW)].

(C) Without notice to Seller, Company may draw from the Security Fund such amounts as are necessary to recover amounts owing to Company pursuant to this PPA, including any Liquidated Delay Damages, Actual Damages, liquidated damages for failure to achieve COD, and any amounts for which Company is entitled to indemnification under this PPA. Company may, in its sole discretion, draw all or any part of such amounts from any form of security to the extent available pursuant to this Article 11 - and in any sequence Company may select. Company's failure or delay to draw any amount from the Security Fund in any instance shall not prejudice Company's rights to subsequently recover such amount from the Security Fund or in any other manner.

(D) Company shall notify Seller within five (5) Business Days following any draw on the Security Fund by Company, including the amount thereof and the basis therefor.

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11.2 Replenishment. Seller shall replenish the Security Fund to the applicable levels set forth in Section 11.1(B) within fifteen (15) Business Days after Company makes a draw on the Security Fund; *provided however*, following COD such replenishment shall not exceed the amount remaining under the Damage Cap (as provided in Section 12.4(A)). Notwithstanding the foregoing, within fifteen (15) Business Days after Company makes a draw on the Security Fund associated with the damages described in Section 12.4(B), Seller shall replenish all amounts drawn from the Security Fund.

11.3 Form.

(A) The Security Fund may be in the form of an irrevocable standby letter of credit substantially in the form of Exhibit G - Form of Letter of Credit (a "Letter of Credit") from a financial institution acceptable to Company ("Issuer").

1. The Letter of Credit must be issued by a bank or other financial institution that is acceptable to Company with a minimum rating of A- by Standard & Poor's and A3 from Moody's (unenhanced by third-party support). No letters of credit will be accepted from banks which are rated below A-/A3 by one or more rating agencies. (If there are split ratings amongst rating agencies, the Company will use the lowest of the different ratings within the same rating agency and amongst different rating agencies). The Letter of Credit must be issued by a U.S. branch/office and such branch/office must have an acceptable minimum rating of A-/A3 on its own by at least one of the rating agencies. If such rating is equivalent to A-/A3, the Issuer must not be on credit watch or have a negative outlook by any rating agency. The above ratings are defined as follows (if available): Long term issuer rating, Long Term Senior Unsecured rating or Long Term Counterparty Risk Assessment/Rating (for Moody's).

2. The Letter of Credit must be for a minimum term of three hundred sixty (360) Days. Seller shall give Company at least thirty (30) Days advance notice prior to any expiration or earlier termination of the Letter of Credit. Seller shall cause the renewal or extension of the Letter of Credit for additional consecutive terms of three hundred sixty (360) Days or more (or, if shorter, through the end of the period required under Section 11.5 below) more than thirty (30) Days prior to each expiration date of the security. If the Letter of Credit is not renewed or extended at least thirty (30) Days prior to its expiration date or otherwise is terminated early, Company shall have the right to draw immediately upon the Letter of Credit and to place the amounts so drawn in Company's account until such time as Seller provides a substitute form of security meeting the requirements of this Section 11.3.

(B) The Security Fund may be in the form of U.S. currency deposited into an escrow account with a state or federally chartered commercial bank with an office in the State of [Minnesota or Wisconsin], with net assets of at least \$1 billion (the "Escrow Account").

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(C) The Escrow Account shall be governed by an escrow and account control agreement in a form mutually satisfactory to Seller, Company and the escrow agent, provided that (a) Company shall hold a first and exclusive perfected security interest in the funds in the Escrow Account, (b) Company shall be permitted unilaterally to draw down any amount therein, regardless of any protest by Seller or any other party liable thereon (*provided* that nothing in the escrow agreement shall preclude any protest against Company by Seller, following any draw, that such draw did not comply with this PPA), and (c) Seller shall pay all fees and expenses of the escrow agent.

(D) Funds held in the Escrow Account may be invested as Seller may direct in any of the following:

1. a money-market fund sponsored by the escrow agent;
2. U.S. treasury obligations with a maturity of ninety (90) Days or less;
3. commercial paper rated "A" or better, with a maturity of ninety (90) Days or less; and
4. other liquid investment-grade investments with maturities of three months or less, approved by Company in advance (such approval not to be unreasonably withheld or delayed).

(E) All investment income on the Escrow Account shall be taxable to, and accrue for the benefit of, Seller. After the Commercial Operation Date, periodic sweeps by Seller for recovery of interest earned by the escrowed funds shall be allowed, and, at any time the balance in the Escrow Account exceeds the required amount of security, the escrow agent may remit any excess to Seller.

(F) Following COD, the Security Fund may consist of a guaranty substantially in the form of Exhibit H - Form of Guaranty, from a parent or other guarantor ("Guarantor") acceptable to Company in its sole and absolute discretion, and up to an amount within Company's sole and absolute discretion. Subject to Company's sole and absolute discretion, to be eligible to provide a guaranty, the proposed Guarantor must have a minimum tangible net worth of at least \$250,000,000 and an Investment Grade Credit Rating (and if such Credit Rating is exactly equivalent to BBB- (S&P) / Baa3 (Moody's), the Guarantor must not be on credit watch by any rating agency). If the Credit Rating of the Guarantor is downgraded below Investment Grade, put on credit watch, or an event occurs that (in the reasonable determination of Company) portends a Material Adverse Effect in the creditworthiness of the Guarantor, then Company may require Seller to convert the guaranty to a Security Fund instrument meeting the criteria set forth in either paragraph (A) or paragraph (B) above no later than ten (10) Days after notice from Company.

(G) Upon request by Seller, Company shall negotiate in good faith any immaterial changes to Exhibit G - Form of Letter of Credit and/or Exhibit H - Form of

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Guaranty, provided that Seller shall pay or reimburse Company for the incremental direct expenses (including the fees and expenses of counsel) incurred by Company in connection therewith.

(H) Seller may change the form of the Security Fund at any time and from time to time upon Commercially Reasonable prior written notice to Company, *provided, however*, that the Security Fund must at all times satisfy the requirements of this Article 11 -.

11.4 Replacement. In the event that the Security Fund ever fails to comply with the requirements of this Article 11 - or Company determines in a Commercially Reasonable manner that an event has occurred or circumstances have developed that threaten to cause the Security Fund to fail to comply with the requirements of this Article 11 - (e.g., a Guarantor is placed on negative credit watch by a rating agency), Seller shall be required to replace the Security Fund with security in compliance with Section 11.3 within five (5) Days following notice thereof from Company.

11.5 Survival. The Security Fund shall survive termination of this PPA to be available to pay any amounts owed to Company arising prior to or upon termination. Promptly following (i) the end of the Term and the completion of all of Seller's obligations under this PPA, or (ii) termination of this PPA for any reason prior to the Scheduled Termination Date, Company shall determine the amount, if any, owed by Seller for any obligations or damages arising out of this PPA. Company may draw such amount and shall release the balance of the Security Fund (including any accumulated interest, if applicable) to Seller.

11.6 Expenses. Seller shall reimburse Company for its direct expenses (including the fees and expenses of counsel) incurred by Company in connection with the preparation, negotiation, execution and/or release (including making a draw of funds) of the Security Fund under this Article 11 -.

Article 12 - Default and Remedies

12.1 Default by Seller: General.

(A) Events. Any of the following events shall constitute a default by Seller under this PPA. If no cure period is provided below, such default shall be deemed an Event of Default by Seller immediately upon its occurrence. If a cure period is provided below, such default shall mature into an Event of Default if not cured within the indicated cure period, subject to Section 13.3 below.

1. Seller's application for, or consent (by admission of material allegations of a petition or otherwise) to, the appointment of a receiver, trustee or liquidator for Seller or for all or substantially all of its assets, or its authorization of such application or consent, or the commencement of any proceedings seeking such appointment without such authorization, consent or application, which proceedings continue undismissed or unstayed for a period of sixty (60) Days from

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inception.

Cure Period: None.

2. Seller's authorization or filing of a voluntary petition in bankruptcy or application for or consent (by admission of material allegations of a petition or otherwise) to the application of any bankruptcy, reorganization, readjustment of debt, insolvency, dissolution, liquidation or other similar law of any jurisdiction or the institution of such proceedings against Seller without such authorization, application or consent, which proceedings remain undismissed or unstayed for sixty (60) Days from its inception or which result in adjudication of bankruptcy or insolvency within such time.

Cure Period: None.

3. Seller's assignment of this PPA or the Facility or any Change of Control, not permitted by Section 19.1.

Cure Period: None.

4. Any representation or warranty by Seller that materially affects its ability to perform this PPA (a) is proven to have been false in any material respect when made or, (b) ceases to remain true in all material respects during the Term, *provided however*, that a representation or warranty that ceases to remain true due to a change in Applicable Law shall not be considered an Event of Default.

Cure Period: Thirty (30) Days after Company provides notice of such breach.

5. Seller's failure to establish and, once established, maintain the Security Fund as and in the amounts required under Article 11 -.

Cure Period: Five (5) Business Days after Company provides notice of Seller's failure.

6. Seller's failure to obtain and maintain insurance in scope and amounts required under Article 16 -.

Cure Period: Five (5) Business Days after Company provides notice of Seller's failure.

7. Seller's failure to make any payment to Company as and when required by this PPA, including Liquidated Delay Damages, Actual Damages, and any required indemnification.

Cure Period: Ten (10) Business Days after Company provides notice that the amount is overdue.

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8. The breach by Seller of the Interconnection Agreement, which breach (i) materially interferes with Seller's production and/or delivery of any product or service to be produced or delivered pursuant to this PPA or Company's ability to accept or receive such product or service, (ii) Company's ability to transmit Energy beyond the Point of Delivery, and/or (iii) otherwise has a Material Adverse Effect on Company.

Cure Period: Thirty (30) Days from the breach or the cure period allowed by the Interconnection Agreement (whichever is longer).

9. Beginning with the third Commercial Operation Year, Seller's failure to deliver to Company at least eighty-five percent (85%) of the Committed Energy in either three consecutive Commercial Operation Years, or four non-consecutive out of six consecutive Commercial Operation Years. For purposes of establishing a default by Seller under this paragraph, the Committed Energy shall be adjusted as provided in Exhibit Q - Methodology for Adjusting Committed Energy.

Cure Period: Seller shall be deemed to have cured this default if, in the Commercial Operation Year following such default, Seller delivers to Company at least ninety percent (90%) of the Committed Energy for such Commercial Operation Year (again as adjusted pursuant to Exhibit Q - Methodology for Adjusting Committed Energy).

10. Seller starts-up, operates, charges, or discharges or permits or causes any third party (including Seller's designated operator) to start-up, operate, charge or discharge any Battery Storage System other than as specifically permitted under this PPA.

Cure Period: None.

11. Seller intentionally or knowingly delivers, or attempts to deliver, Energy for sale under this PPA that was not associated with or stored by the Facility.

Cure Period: None.

12. The monthly Capacity Availability Factor of the Battery Storage System is less than ninety percent (90%) on average for a Commercial Operation Year, provided however, that for purposes of this Event of Default only, if Seller's failure to meet the Capacity Availability Factor during a Commercial Operation Year(s) is directly attributable to a GSU Transformer Failure, such GSU Transformer Failure not to exceed in the aggregate eighteen (18) months in duration during the Term, the number of Days in which such GSU Transformer

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Failure occurred shall be deducted from the calculation of the Capacity Availability Factor of the Battery Storage System for the Commercial Operation Year(s) in which the GSU Transformer Failure occurred. Seller may only claim one (1) GSU Transformer Failure during the Term.

Cure Period: Seller shall be deemed to have cured this default if the average Capacity Availability Factor of the Battery Storage System is at least ninety percent (90%) for the subsequent Commercial Operation Year.

13. Any failure set forth in Section **Error! Reference source not found.** or Section **Error! Reference source not found.**

Cure Period: Seller shall be deemed to have cured this default if a subsequent Test performed within a one hundred eighty (180) Day period demonstrates that all of the Performance Criteria meet the levels required to pass such Test in accordance with the standards set forth in Exhibit M-1 – Battery Storage System Guaranteed Performance Levels, *provided however*, that the cure period may be extended to a total of three hundred sixty-five (365) Days if Seller provides a written opinion from a mutually-agreeable Independent Engineer that a cure can reasonably be achieved within such additional period.

14. Seller's failure to achieve an Equivalent Availability Reporting Factor of the [Wind] [Solar] Facility of not less than ninety percent (90%) for a Commercial Operation Year pursuant to Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection.

Cure Period: Seller shall be deemed to have cured this default if in the following Commercial Operation Year, Seller achieves an Equivalent Availability Reporting Factor of not less than ninety-five percent (95%), for the [Wind] [Solar] Facility, pursuant to Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection.

15. The failure by Seller to perform or observe any other material obligation to Company under this PPA, unexcused by Force Majeure (other than failure to achieve COD, which is addressed in Section 12.2 below).

Cure Period: Thirty (30) Days after Company provides notice thereof; *provided*, that if such default is not reasonably capable of cure within such thirty (30) Day period, Seller shall have such additional period of time (not to exceed ninety (90) Days in any event) as is reasonably necessary for cure, so long as Seller initiates cure within such thirty (30) Day period and diligently prosecutes the cure to conclusion thereafter.

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16. Seller removes from the Site equipment upon which the Commercial Operation Test has been based, except for the purposes of replacement, refurbishment, repair or maintenance, and the equipment is not returned within five (5) Days after notice from Company.

Cure Period: Equipment returned five (5) Days after Company provides notice.

17. Seller makes any material misrepresentation or omission in any report (including any status report, logs, and reports required under Section 4.1, Section 5.5, Section 10.4, Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection; and Exhibit M - Battery Storage System Testing Protocols) required to be made or furnished by Seller pursuant to this PPA.

Cure Period: Five (5) Days after Company provides notice.

18. Subject to Section 7.3, Seller makes any material misrepresentation or omission in any Availability Notice.

Cure Period: Such Event of Default may be cured if (i) the default was caused solely by an inadvertent error or omission of an administrative or clerical nature and (ii) such default is cured within one (1) Business Day after knowledge of such inadvertent error or omission in the Availability Notice.

(B) Remedies for Default. In connection with any default by Seller under this Section 12.1 (whether or not cured by Seller), Company may:

1. Seek Actual Damages in such amounts and on such basis for the default as authorized by this PPA;
2. Offset against any payments due to Seller, any Actual Damages and other amounts due from Seller; and/or
3. Draw any Actual Damages and other amounts due from Seller, from the Security Fund.

(C) Termination for Event of Default. Upon and at any time following an Event of Default by Seller under this Section 12.1, in addition to its rights under Section 12.1(B) above, Company may terminate this PPA effective immediately upon notice to Seller, without penalty or further obligation to Seller. In connection with any such termination, Company may collect from Seller (subject to the Damage Cap) all Actual Damages arising from such Event of Default through the Scheduled Termination Date.

(D) Specific Performance. In addition to the other remedies specified herein, upon any Event of Default of Seller under this Section 12.1, Company may elect to treat this PPA as being in full force and effect and Company shall have the right to

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specific performance.

(E) *Option to Acquire Facility upon Termination due to Seller Default.* If Company terminates this PPA under this Section 12.1 following COD, then, at any time within ninety (90) Days following such termination, Company may give notice to Seller of Company's intent to purchase the Facility from Seller (a "Default Option Preliminary Exercise Notice").

1. As soon as practicable following delivery of a Default Option Preliminary Exercise Notice, the Parties shall appoint an independent appraiser experienced in appraising utility-scale [wind] [solar] with battery storage power generation facilities to determine the fair market value ("Default FMV") of the Facility. If the Parties cannot agree on the identity of the appraiser, the appraiser shall be selected by the Arbitration Service. Seller shall provide to the appraiser full access to the Facility and the Site, to Seller's contracts, books and records, and to relevant personnel of Seller, during normal business hours. Such access shall include the right to conduct inspections and tests (including environmental testing of the Site and operating tests on the Facility) necessary or appropriate for the determination of the Default FMV of the Facility. Company shall pay all fees and costs of the appraiser. The Parties shall direct the appraiser to use his/her best efforts to complete and deliver his/her appraisal to the Parties within forty-five (45) Days following his/her appointment and to keep all information obtained by appraiser from any investigations as Confidential Information subject to the provisions of Section 20.18.

2. Following delivery of a Default Option Preliminary Exercise Notice, Seller shall provide to Company full access to the Facility and the Site, to Seller's contracts, books and records, and to relevant personnel of Seller, during normal business hours. Such access shall include the right to conduct lien searches, surveys, inspections and tests (including environmental testing of the Site and operating tests on the Facility) necessary or appropriate for due diligence review of the Facility. All information obtained by Company from such investigations shall be deemed Confidential Information subject to Section 20.18. All inspections, testing and access to the Facility and the Site by Company and the appraiser shall comport with all of Seller's policies governing the use, operation, and maintenance of the Facility, including health, safety and environmental requirements.

3. Within sixty (60) Days following receipt of an appraisal under this Section 12.1(E), Company may elect to purchase the Facility from Seller (a "Default Option"). If Company fails to notify Seller of Company's election within such sixty (60)-Day period, Company shall be deemed to have elected not to exercise the Default Option. If Company exercises the Default Option, the purchase price to be paid by Company for the Facility in connection with any exercise of the Default Option shall be the Default FMV of the Facility, as determined by the appraiser. Seller shall cooperate in all respects reasonably

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necessary for Company to exercise its Default Option rights.

4. If Company exercises the Default Option, the Parties shall negotiate and execute a PSA, subject to clause (iv) below. The PSA shall include the terms and conditions set forth in Exhibit L-2 - PSA Provisions. In the event that the Parties cannot agree on the final form of PSA, (i) the issue shall be submitted to “baseball” arbitration in [Minneapolis, MN or Eau Claire, WI] before one arbitrator appointed by the Arbitration Service, i.e. each Party shall submit to the arbitrator a form of proposed PSA, and the arbitrator shall be required to select one of the two forms to be used as the PSA in the transaction, without compromise, as the arbitral award, (ii) the period for closing of the transaction shall be extended for the period required to complete arbitration, (iii) the Party whose form PSA is rejected shall pay the fees and costs of the Arbitration Service, and (iv) if Company’s form of PSA is rejected, Company shall have thirty (30) Days following such rejection to decide whether to execute and deliver Seller’s form of PSA or abandon the transaction.

5. This Section 12.1(E) shall be specifically enforceable by Company, without bond and without the need to prove irreparable harm.

12.2 Default by Seller: Failure to Achieve Critical Path Development Milestone or COD.

(A) Delay. Seller shall be in default under this PPA if the Facility fails to achieve any Critical Path Development Milestone by the date set forth in Section 4.1(B) (“CPD Delay”) or COD by the Target COD (“COD Delay”).

1. Seller shall be liable to pay [insert \$250/MW x (Facility Nameplate Capacity MW)] (“CPD Liquidated Delay Damages”) to Company as a liquidated damage and not a penalty, in lieu of Actual Damages, for each Day of each CPD Delay. CPD Liquidated Delay Damages shall begin to accrue on the Day after the applicable missed Critical Path Development Milestone (in each case, as it may be extended due to Force Majeure) until the first to occur of the satisfaction of the applicable Critical Path Development Milestone or termination of this PPA pursuant to Section 12.2(C) below. CPD Liquidated Delay Damages shall apply if any Critical Path Development Milestone is missed, and the payment of CPD Liquidated Delay Damages with respect to any given Critical Path Development Milestone shall extend each subsequent Critical Path Development Milestone on a day-for-day basis. In the event Seller incurs CPD Liquidated Delay Damages but subsequently achieves COD by the Target COD, Company shall reimburse Seller all such CPD Liquidated Delay Damages.

2. Seller shall be liable to pay [insert \$250/MW x (Facility Nameplate Capacity MW)] (“COD Liquidated Delay Damages” and, together with CPD Liquidated Delay Damages, the “Liquidated Delay Damages”) to Company as a liquidated damage and not a penalty, in lieu of Actual Damages, for each Day

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of a COD Delay. COD Liquidated Delay Damages shall begin to accrue on the Day after the Target COD (in each case, as it may be extended due to Force Majeure), until the first to occur of the COD or termination of this PPA pursuant to Section 12.2(C) below. The payment of CPD Liquidated Delay Damages shall not cure Seller's failure to achieve COD by the Target COD. For the avoidance of doubt, if Seller is delayed in reaching one or more Critical Path Development Milestones and the Target COD, then Seller may incur both CPD Liquidated Delay Damages and COD Liquidated Delay Damages.

3. Except as provided in Section 12.2(C) below, the payment of Liquidated Delay Damages shall be Company's sole and exclusive remedy for a CPD Delay or COD Delay.

(B) Cure. Subject to the obligations in this Section 12.2(B), Seller shall have a cure period of up to ninety (90) Days for its failure to achieve any Critical Path Development Milestone by the date set forth in Section 4.1(B) (subject to compliance with Seller's obligations in Section 4.1(B) or Commercial Operation by the Target COD, as applicable so long as the following conditions are satisfied:

1. Seller's payment of accrued Liquidated Delay Damages shall be a condition to any such cure. In order to utilize the cure period set forth in this Section 12.2(B), Seller must, at any time prior to, but no later than, 6:00 a.m. on the third (3rd) Business Day immediately prior to the Critical Path Development Milestone date set forth in Section 4.1(B) or the Target COD, as applicable (as such dates may have been previously extended pursuant to this Section 12.2(B)), provide Company with (a) Notice of its election to extend such Critical Path Development Milestone date or the Target COD, (b) Seller's reasonable estimate of the required duration of the full estimated extension period, and (c) its payment of the applicable Liquidated Delay Damages for each Day of the full estimated extension period; provided, that if the actual delay is less than the full estimated extension period, then Company shall refund to Seller any unused portion of the applicable Liquidated Delay Damages. For the avoidance of doubt, (i) the Security Fund may not be utilized by Seller for the payment of Liquidated Delay Damages and (ii) the payment of CPD Liquidated Delay Damages shall only extend the Critical Path Development Milestones and not the Target COD, and payment of the COD Liquidated Delay Damages shall only extend the Target COD and not the Critical Path Development Milestones. To the extent Seller achieves the Commercial Operation Date prior to the Target COD as extended pursuant to this Section 12.2(B), Company shall refund Seller any estimated COD Liquidated Delay Damages corresponding to the number of Days by which the extended Target COD Date exceeded the Commercial Operation Date.

2. In addition, for any extensions pursuant to Section 12.2(B) of more than an aggregate total of forty-five (45) Days, Seller must, at any time prior to, but no later than, 6:00 a.m. on the third (3rd) Business Day immediately prior to the Critical Path Development Milestone date set forth in Section 4.1(B) or the

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Target COD, as applicable (as such dates may have been previously extended pursuant to this Section 12.2(B)), provide a written opinion from a mutually-agreeable Independent Engineer that such Critical Path Development Milestone or COD, as applicable, can reasonably be achieved within such additional period.

(C) Termination. Failure to cure a CPD Delay or COD Delay within the applicable cure period set forth in Section 12.2(B) shall be an Event of Default by Seller. Upon such an Event of Default, Company may (i) terminate this PPA immediately upon notice to Seller, without penalty or further obligation to Seller except as to costs and balances incurred prior to the effective date of such termination, and (ii) in connection therewith, in addition to accrued Liquidated Delay Damages but in lieu of Actual Damages for the balance of the Term, collect from Seller liquidated damages therefor in the amount of [insert \$100/kW x (Facility Nameplate Capacity kW)].

12.3 Default by Company.

(A) Events. Any of the following events shall constitute a default by Company under this PPA. If no cure period is provided below, such default shall be deemed an Event of Default by Company immediately upon its occurrence. If a cure period is provided below, such default shall mature into an Event of Default if not cured within the indicated cure period, subject to Section 13.3 below.

1. Company's application for, or consent (by admission of material allegations of a petition or otherwise) to, the appointment of a receiver, trustee or liquidator for Company or for all or substantially all of its assets, or its authorization of such application or consent, or the commencement of any proceedings seeking such appointment without such authorization, consent or application, which proceedings continue undismissed or unstayed for a period of sixty (60) Days from inception.

2. Cure Period: None.

3. Company's authorization or filing of a voluntary petition in bankruptcy or application for or consent (by admission of material allegations of a petition or otherwise) to the application of any bankruptcy, reorganization, readjustment of debt, insolvency, dissolution, liquidation or other similar law of any jurisdiction or the institution of such proceedings against Company without such authorization, application or consent, which proceedings remain undismissed or unstayed for sixty (60) Days from its inception or which result in adjudication of bankruptcy or insolvency within such time.

4. Cure Period: None.

5. Company's assignment of this PPA, not permitted by Section 19.2.

6. Cure Period: None.

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7. Any representation or warranty by Company that materially affects its ability to perform this PPA (a) is proven to have been false in any material respect when made or, (b) ceases to remain true in all material respects during the Term, *provided however*, that a representation or warranty that ceases to remain true due to a change in Applicable Law shall not be considered an Event of Default.

8. Cure Period: Thirty (30) Days after Seller provides notice of such breach.

9. Company's failure to make any payment to Seller as and when required by this PPA, including invoiced amounts, Actual Damages and any required indemnification.

10. *Cure Period*: Ten (10) Business Days after Seller provides notice that the amount is overdue. The failure by Company to perform or observe any other material obligation to Seller under this PPA, unexcused by Force Majeure.

11. *Cure Period*: Thirty (30) Days after Seller provides notice; *provided*, that if such default is not reasonably capable of cure within such thirty (30) Day period, Company shall have such additional period of time (not to exceed ninety (90) Days in any event) as is reasonably necessary for cure, so long as Company initiates cure within such thirty (30) Day period and diligently prosecutes the cure to conclusion thereafter.

(B) Remedies for Default. In connection with any default by Company (whether or not cured by Company), Seller may:

1. Seek Actual Damages in such amounts and on such basis for the default as authorized by this PPA; and/or

2. Offset against any payments due to Company, any Actual Damages and other amounts due from Company.

(C) Termination for Event of Default. Upon an Event of Default by Company, in addition to its rights under Section 12.3(B) above, Seller may terminate this PPA immediately upon notice to Company, without penalty or further obligation to Company, and in connection therewith, collect from Company all Actual Damages arising from such Event of Default through the Scheduled Termination Date.

12.4 Limitations on Damages.

(A) Except as otherwise provided in Section 12.4(B), following COD Seller's aggregate financial liability to Company for Actual Damages shall not exceed [insert \$75/kW x Facility Nameplate Capacity kW] (the "Damage Cap"). If at any time following COD, Company incurs damages in excess of the Damage Cap that Seller does not pay when billed by Company, Company shall have the right to terminate this PPA upon

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notice to Seller, without further obligation by either Party except as to costs and balances incurred prior to the effective date of such termination.

(B) Actual Damages payable by Seller arising out of any of the following events shall not be subject to the Damage Cap and shall not be credited against the Damage Cap:

1. damage to Company-owned facilities proximately caused by negligence, breach of this PPA or misconduct by Seller, its directors, officers, employees and agents;
2. Seller's intentional misrepresentation or intentional misconduct in connection with this PPA or the operation of the Facility;
3. the sale or diversion by Seller to a third party of any Energy or Ancillary Services from the Facility, excluding sales of Excess Energy under Section 8.2 and any sales in mitigation of damages;
4. Seller's failure (i) to maintain insurance coverages in the types and amounts required by this PPA or (ii) to apply any insurance proceeds as required by Section 16.5;
5. any indemnification claim under this PPA;
6. any Environmental Contamination caused or exacerbated by Seller; or
7. damages incurred by Company in connection with any bankruptcy or insolvency proceeding involving Seller, including Company's loss of the benefit of its bargain due to rejection or other termination of this PPA in such proceeding.

(C) The Parties confirm that the express remedies and measures of damages provided in this PPA satisfy the essential purposes hereof. If no remedy or measure of damages is expressly herein provided, the obligor's liability shall be limited to all direct damages proximately caused by such default ("Actual Damages") incurred by the non-defaulting Party, provided that if Seller is the defaulting Party, Actual Damages recoverable by Company hereunder may include Replacement Power Costs. **Neither Party shall be liable to the other Party for consequential, incidental, punitive, exemplary, special, treble, equitable or indirect damages, lost profits or other business interruption damages regardless of whether the relevant cause of action arises from statute, in tort or contract** (except to the extent expressly provided herein); *provided, however*, that if either Party is held liable to a third party for such damages and the Party held liable for such damages is entitled to indemnification from the other Party hereto, the Indemnifying Party shall be liable for, and obligated to reimburse the Indemnified Party for all such damages.

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(D) To the extent damages required to be paid hereunder are liquidated, the Parties acknowledge that Actual Damages would be substantial but difficult or impossible to determine, that otherwise obtaining an adequate remedy is inconvenient, and that the liquidated damages constitute a reasonable approximation of the harm or loss.

12.5 Bankruptcy. This PPA grants each Party the contractual right to “cause the liquidation, termination or acceleration” of the transactions within the meaning of Sections §556, §560 and §561 of the U.S. Bankruptcy Code, as they may be amended superseded or replaced from time to time. Upon a bankruptcy, a non-defaulting Party shall be entitled to exercise its rights and remedies under this PPA in accordance with the safe harbor provisions of the U.S. Bankruptcy Code set forth in, *inter alia*, Sections §362(b)(6), §362(b)(17), §362(b)(27), §362(o), §546(e), §548(d)(2), §556, §560 and §561, as they may be amended, superseded or replaced from time to time.

12.6 Cumulative Remedies. Except as explicitly provided to the contrary in this PPA, each right or remedy of the Parties provided for in this PPA shall be cumulative of and shall be in addition to every other right or remedy provided for in this PPA, and the exercise of one or more of the rights or remedies provided for herein shall not preclude the simultaneous or later exercise by such Party of any other rights or remedies provided for herein.

12.7 Duty to Mitigate. Each Party shall use Commercially Reasonable Efforts to mitigate any damages it may incur as a result of a default by the other Party under this PPA.

Article 13 - Dispute Resolution

13.1 Negotiation.

(A) In the event of any dispute arising under or associated with the Parties' performance of this PPA (a “Dispute”), within ten (10) Business Days following notice by either Party (a “Dispute Notice”), (i) each Party shall appoint a representative, and (ii) the representatives shall meet, negotiate and attempt in good faith to resolve the Dispute quickly, informally and inexpensively. Any Dispute that is mutually agreed by the Parties (each acting in its sole and complete discretion) to involve engineering, construction or technical matters as the sole or primary area of disagreement between the Parties shall be deemed to be a “Technical Dispute” (each, a “Technical Dispute”). The Parties agree that the technical expert for purposes of resolving any Technical Disputes shall be a mutually agreeable Independent Engineer, the costs and expenses for which will be shared equally by the Parties. The Independent Engineer may, if he or she deems it appropriate, hold a hearing on the subject of the Technical Dispute and shall, upon the request of either Party, meet with the Parties or their representatives with respect to such Technical Dispute within three (3) Business Days of the request for such meeting. The Independent Engineer shall render a decision solely resolving the Technical Dispute within five (5) Business Days of the meeting with the Parties or their representatives or hearing (if any), or such longer period as the Parties and the Independent Engineer may agree.

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The decision of the Independent Engineer shall be advisory rather than final and binding on the Parties.

(B) In the event the Parties' representatives cannot resolve the Dispute, or if either Party is not satisfied with the resolution of the Technical Dispute by the Independent Engineer, within thirty (30) Days after the first meeting, either Party may request that consideration and resolution of the Dispute be transferred to senior management. Within ten (10) Days following such a request, each Party shall submit a written summary of the Dispute describing the issues and claims to a senior officer of each Party designated to address the Dispute. Within ten (10) Business Days after receipt of each Party's Dispute summaries, the designated senior managers for both Parties shall negotiate in good faith to resolve the Dispute. If such senior managers are unable to resolve the Dispute thereafter, either Party may seek available legal remedies, subject to Sections 13.3, 19.3 and 19.5.

13.2 Time Bar. If no Dispute Notice has been issued within eighteen (18) months following the occurrence of events or circumstances giving rise to the Dispute (regardless of the actual knowledge of either Party of such events and circumstances), all claims related to such Dispute (including any allegations of billing errors) shall be deemed waived and the aggrieved Party shall thereafter be barred from proceeding thereon.

13.3 No Termination Pending Dispute Resolution. Notwithstanding Section 12.1 or Section 12.3 to the contrary:

(A) An Event of Default shall not be deemed to have occurred (and hence neither Party may terminate this PPA) for failure by the other Party to pay any amount(s) allegedly due totaling less than one hundred thousand Dollars (\$100,000), if (1) such amount(s) are disputed in good faith, (2) the Party alleged to owe such amount(s) promptly commences and diligently pursues resolution of the Dispute pursuant to Section 13.1, and (3) the owed amount (if any) is paid within ten (10) Business Days after all dispute resolution mechanisms are completed with respect thereto.

(B) An Event of Default by Seller shall not be deemed to have occurred (and hence Company may not terminate this PPA) for failure by Seller to pay any amount(s) allegedly due totaling one hundred thousand Dollars (\$100,000) or more, if;

1. such amount(s) are disputed by Seller in good faith;
2. Seller promptly commences and diligently pursues resolution of the Dispute pursuant to Section 13.1;
3. Seller either holds an Investment Grade Credit Rating, or posts cash collateral to secure its obligations (if any) with respect to the disputed amount(s), in an amount equal to the amount(s) in dispute, under a mutually agreeable third-party escrow and account control agreement, in addition to the Security Fund; and

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4. the owed amount (if any) is paid by Seller within ten (10) Business Days after all dispute resolution mechanisms are completed with respect thereto.

(C) An Event of Default by Company shall not be deemed to have occurred (and hence Seller may not terminate this PPA) for failure by Company to pay any amount(s) allegedly due totaling one hundred thousand Dollars (\$100,000) or more, if:

1. such amount(s) are disputed by Company in good faith;
2. Company promptly commences and diligently pursues resolution of the Dispute pursuant to Section 13.1;
3. Company either holds an Investment Grade Credit Rating, or posts cash collateral to secure its obligations (if any) with respect to the disputed amount(s), in an amount equal to the amount(s) in dispute, under a mutually agreeable third-party escrow and account control agreement; and,
4. the owed amount (if any) is paid by Company within ten (10) Business Days after all dispute resolution mechanisms are completed with respect thereto.

13.4 Governing Law. The interpretation and performance of this PPA and all actions related hereto (whether sounding in contract, tort or otherwise), shall be governed and construed in accordance with the laws of the State of [Minnesota or Wisconsin], exclusive of conflict of laws principles.

13.5 Venue. The Parties submit to the exclusive jurisdiction of the state courts of the State of [Minnesota or Wisconsin] for purposes of resolving any Dispute hereunder, except as provided in Sections Error! Reference source not found., and Section 19.3 and 19.5. Venue for any court proceedings shall lie exclusively in:

[NSPM] the Minnesota District Court for the Fourth District or, if jurisdictionally available, the U.S. District Court for the District of Minnesota.

[NSPW] [update as applicable] [the Wisconsin District Court for the [District] or, if jurisdictionally available, the U.S. District Court for the District of Wisconsin].

13.6 Waiver of Jury Trial. Seller and Company each hereby knowingly, voluntarily and intentionally waive any rights they may have to a trial by jury in respect of any litigation based hereon, or arising out of, under, or in connection with, this PPA or any course of conduct, course of dealing, statements (whether oral or written) or actions of Seller and Company related hereto and expressly agree to have any Disputes be adjudicated by a judge of the court having jurisdiction, without a jury, subject only to Sections 12.1(E), 19.3 and 19.5.

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Article 14 - Force Majeure

14.1 Definition. For purposes hereof, “Force Majeure” means an event or circumstance that prevents a Party from performing its obligations under this PPA, which event or circumstance (i) was not anticipated as of the Effective Date, (ii) is not within the control of or the result of the fault or negligence or failure to follow Good Utility Practices of the Party claiming excuse, and (iii) which by exercise of due diligence and foresight could not reasonably have been avoided. Force Majeure shall not include:

(A) any failure, inability, delay or excess cost, to procure any equipment or component to perform this PPA for any reason (this risk of which is assumed by Seller), including as a result of the imposition of tariffs or any other changes in Applicable Law or supply chain disruptions;

(B) acts or omissions of a third party (including vendors and contractors to Seller), unless such acts or omissions are themselves excused by reason of Force Majeure as defined in this Section 14.1;

(C) failure to obtain any Permits required for the Facility, including the Permits set forth on Exhibit F - Seller’s Needed Permits hereto;

(D) mechanical or equipment breakdown or failure to operate, under circumstances that are within the design criteria and/or normal operating tolerances of similar equipment;

(E) **[Solar only]** variability in solar irradiance, including periods of low solar irradiance resulting from cloud cover, pollution, dust, smoke, weather conditions, and other causes, in the area in which the Facility is located] **[Wind only]** variability in wind speed and direction, including changes in wind speed and direction resulting from weather conditions and other causes, in the area in which the Facility is located], except to the extent directly caused by circumstances that would constitute Force Majeure as defined in this Section **Error! Reference source not found.**;

(F) Environmental Contamination at the Site;

(G) changes in market conditions;

(H) any delay or failure by the Transmission Authority to perform its obligations under the Interconnection Agreement or any Curtailment or reduction in deliveries by the Transmission Authority;

(I) any delay or nonperformance by suppliers, vendors or other third parties with whom Seller has contracted, including the failure of such third party to deliver any required components to Seller, except to the extent such delay or nonperformance is directly caused by circumstances that would themselves constitute Force Majeure as defined in this Section 14.1 as applied to such third party;

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(J) the delay or effects of the COVID epidemic or pandemic (or any variant of COVID), except to the extent there occurs after the Effective Date: (A) the adoption or taking effect of any Applicable Law in respect of such COVID epidemic or pandemic (or any variant thereof), or (B) a change in any Applicable Law or any health or safety recommendation or guideline of a Governmental Authority in respect of such COVID epidemic or pandemic (or variant thereof);

(K) changes of Applicable Law, except to the extent the change (i) occurs after the Effective Date; and (ii) renders performance under the Agreement by the Party claiming Force Majeure illegal or impossible; or

(L) labor strikes, slowdowns, work stoppages, or other labor disruptions.

14.2 Applicability of Force Majeure. A Party shall be relieved of its obligations to perform this PPA and shall not be considered to be in default with respect to any obligation under this PPA if and to the extent such Party is prevented from fulfilling such obligation by Force Majeure, *provided, however*, that: (i) such Party gives notice describing the circumstances and impact of the Force Majeure no later than ten (10) Business Days after the occurrence of such Force Majeure; (ii) the relief from its obligations sought by such Party is of no greater scope and of no longer duration than is required by the Force Majeure; (iii) such Party proceeds with due diligence to overcome the Force Majeure and resumes performance of its obligations under this PPA as soon as practicable thereafter; and (iv) such Party provides notice upon conclusion of the Force Majeure. Failure to provide such notice within the required time period shall be deemed conclusive evidence that the claimed Force Majeure event either did not occur or did not impact Seller's ability to perform its obligations under this PPA in any fashion and thus Seller shall not be entitled to relief under this Article 14 -.

14.3 Limitations on Effect of Force Majeure.

(A) Force Majeure shall only relieve a Party of such obligations as are actually precluded by the Force Majeure.

(B) In no event will the existence of Force Majeure affect the Energy Payment Rate or extend this PPA beyond its stated Term.

(C) If, (i) prior to COD, Force Majeure affecting Seller continues for a period of ninety (90) consecutive Days or any one hundred fifty (150) non-consecutive Days or (ii) after COD Force Majeure affecting Seller continues for a period of one hundred eighty (180) consecutive Days or any two hundred seventy (270) non-consecutive Days in any three consecutive Commercial Operation Years, Company may, at any time following the end of such period, terminate this PPA upon notice to Seller, without further obligation by either Party except as to costs and balances incurred prior to the effective date of such termination.

Article 15 - Representations, Warranties and Covenants

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15.1 Each Party hereby represents and warrants to the other as follows, which representations and warranties shall be deemed to be repeated, if applicable, by each Party throughout the Term:

(A) Such Party is a valid separate legal entity, duly organized, validly existing and in good standing under Applicable Law. It is qualified to do business in the State in which the Facility is located and each other jurisdiction where the failure to so qualify would have a Material Adverse Effect on the business or financial condition of the other Party. It has all requisite power and authority to conduct its business, to own its properties, and to execute, deliver, and perform its obligations under this PPA.

(B) The Party's execution, delivery, and performance of all of its obligations under this PPA have been duly authorized by all necessary organizational action, and do not and will not:

1. require any consent or approval by any governing corporate or management body, other than that which has been obtained and is in full force and effect (evidence of which shall be delivered to the other Party upon its request);

2. violate any Applicable Law, the violation of which could have a Material Adverse Effect on the representing Party's ability to perform its obligations under this PPA; or

3. result in a breach or constitute a default under the representing Party's formation documents, bylaws or equivalent, or under any agreement relating to its management or affairs, any indenture or loan or credit agreement, or any other agreement, lease, or instrument to which it is a party or by which it or its properties or assets may be bound or affected, the breach or default of which could reasonably be expected to have a Material Adverse Effect on the representing Party's ability to perform its obligations under this PPA;

4. result in, or require the creation or imposition of any mortgage, deed of trust, pledge, lien, security interest, or other charge or encumbrance of any nature (other than as may be contemplated by this PPA) upon or with respect to any of the assets or properties of the representing Party now owned or hereafter acquired, the creation or imposition of which could reasonably be expected to have a Material Adverse Effect on the representing Party's ability to perform its obligations under this PPA.

(C) This PPA is a valid and binding obligation of the representing Party.

(D) The execution and performance of this PPA will not conflict with or constitute a breach or default under any contract or agreement of any kind to which the representing Party is a party or any judgment, order, or Applicable Law, applicable to it or its business.

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(E) Within the meaning of the U.S. Bankruptcy Code, (i) this PPA constitutes a “master netting agreement,” (ii) all transactions pursuant to this PPA constitute “forward contracts” or a “swap agreement,” (iii) the representing Party is a “forward contract merchant” and “master netting agreement participant,” and (iv) all payments made or to be made pursuant to this PPA constitute “settlement payments.”

(F) Such Party is (i) a producer, processor, or commercial user of, or a merchant handling, the commodity, which is the subject of this PPA, or the products or by products thereof; and (ii) entering into this PPA solely for purposes related to its business as such.

15.2 Seller further hereby covenants to Company throughout the Term that, in connection with its obligations under this PPA:

(A) Seller shall deliver to Company the products and services required by this PPA free and clear of all liens, security interests, claims and encumbrances or any interest therein or thereto by any person.

(B) No portion of the Facility (including any of its components and materials) will be extracted, mined, produced, manufactured, assembled or processed using any form of convict, indentured or forced labor, including indentured or forced child labor (“Forced Labor”). Seller represents and warrants that it shall at a minimum comply with all Forced Labor Laws, including but not limited to the UFLPA, Section 307 of the Tariff Act of 1930, 19 U.S.C. §1307, when performing the work under this Agreement. Without limiting any other obligation of Seller hereunder, Seller shall not, and shall ensure that its Affiliates, suppliers, subcontractors, and other business partners involved in any tier of the extraction, mining, production, processing, assembly or manufacturing of the materials and components used in the Project, within the United States or globally, do not (i) use any form of Forced Labor at any stage of extraction, mining, production, manufacturing, assembly or processing of any components or materials or (ii) cause or permit the Facility (including any of its components and materials) to originate from, or be extracted, mined, produced, manufactured, assembled or processed in any place or region known or suspected to use Forced Labor. Seller shall maintain adequate procedures, internal controls and audit procedures necessary to ensure compliance with this Section.

Article 16 - Insurance

16.1 Evidence of Insurance. No later than commencement of construction and thereafter no later than five (5) Business Days after each applicable expiration date, Seller shall provide to Company via email a copy of insurance certificates acceptable to Company evidencing that insurance coverages for the Facility are in force and in compliance with the specifications for insurance coverage set forth in Exhibit E - Insurance Coverage to this PPA. Such certificates shall

(A) name Company as an additional insured (except workers’ compensation);

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(B) provide that Company shall receive thirty (30) Days prior written notice of non-renewal, or cancellation of, or significant modification to any of the corresponding policies (except that such notice may be ten (10) Days for non-payment of premiums);

(C) provide a waiver of any rights of subrogation against Company, its Affiliates and their officers, directors, agents, subcontractors, and employees; and

(D) indicate that the "Commercial General Liability" policy has been endorsed as described above.

16.2 Policy Requirements. All policies shall be written with insurers with an AM Best rating of at least A-VII or a Standard & Poor's rating of at least A. All policies shall be written on an occurrence basis, except as provided in Section 16.4. All policies shall contain an endorsement that Seller's policy shall be primary in all instances regardless of like coverages, if any, carried by Company. Seller may satisfy its insurance requirements using any reasonable combination of primary and secondary coverage.

16.3 No Implied Limitation. Seller's liability under this PPA is not limited to the amount of insurance coverage required herein.

16.4 Term and Modification of Insurance.

(A) All insurance required under this PPA shall cover occurrences during the Term and for a period of two (2) years after the Term. In the event that any insurance as required herein is commercially available only on a "claims-made" basis, such insurance shall provide for a retroactive date not later than the Effective Date and such insurance shall be maintained by Seller for a minimum of six (6) years after the Term.

(B) Company shall have the right, at times deemed appropriate to Company during the Term, to request Seller to modify the insurance minimum limits specified in Exhibit E - Insurance Coverage in order to maintain Commercially Reasonable coverage amounts. Seller shall make Commercially Reasonable Efforts to comply with any such request.

(C) If any insurance required to be maintained by Seller hereunder ceases to be reasonably available and commercially feasible in the commercial insurance market, Seller shall provide notice to Company, accompanied by a certificate from an independent insurance advisor of recognized national standing, certifying that such insurance is not reasonably available and commercially feasible in the commercial insurance market for electric generating plants of similar type, geographic location and capacity. Upon receipt of such notice, Seller shall use Commercially Reasonable Efforts to obtain other insurance that would provide comparable protection against the risk to be insured.

16.5 Application of Proceeds. Except to the extent otherwise required by the Financing Documents, Seller shall apply any insurance proceeds first to reconstruction of

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the Facility following any material casualty to the Facility that occurs more than eighteen (18) months prior to the Scheduled Termination Date.

Article 17 - Indemnity

17.1 Indemnification: General. Each Party (the "Indemnifying Party") shall indemnify, defend and hold the other Party (the "Indemnified Party") harmless from and against all third-party claims, demands, lawsuits (including citizen suits), losses, liabilities, fines, penalties, and expenses (including attorneys' fees) (generally, "Losses"), to the extent proximately caused by:

- (A) a default under this PPA by the Indemnifying Party;
- (B) a violation or alleged violation of Applicable Laws by the Indemnifying Party; and
- (C) the negligence, intentional acts and other misconduct of the directors, officers, employees, or agents of the Indemnifying Party.

17.2 Indemnification: Environmental. Seller shall indemnify, defend and hold Company harmless from and against all Losses arising out of any claim by any Governmental Authority or other third party alleging Environmental Contamination at the Site and/or illegal disposal of Hazardous Materials off-site, regardless of merit and regardless of Seller's responsibility therefor.

17.3 Indemnification: House Power. If Seller obtains House Power from the Facility and/or a self-generation source other than the Facility, Seller shall: (i) at Company's discretion, provide evidence reasonably satisfactory to Company that it is permitted to do so under Applicable Law, and (ii) shall indemnify, defend and hold Company harmless from and against all Losses that may result therefrom.

17.4 Indemnification: Company Remote Start of Facility. Should Company remotely start the Facility, Seller shall indemnify, defend and hold Company harmless from and against all Losses that may result therefrom.

17.5 Limitations.

(A) The foregoing indemnification obligations shall apply notwithstanding any contributory misconduct of the Indemnified Party, but the Indemnifying Party's liability to indemnify the Indemnified Party shall be reduced in proportion to the percentage by which the Indemnified Party's misconduct caused the damages.

(B) Neither Party shall be indemnified for Losses resulting from the sole negligence or willful misconduct of the directors, officers, employees, or agents of such Party.

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(C) These indemnity provisions shall not be construed to relieve any insurer of its obligation to pay claims consistent with the provisions of a valid insurance policy. Nothing in this Article 17 - shall enlarge or relieve Seller or Company of any liability to the other for any breach of this PPA.

17.6 Procedures.

(A) Promptly after receipt by a Party of any claim or notice of the commencement of any action, administrative, or legal proceeding, or investigation as to which the indemnity provided for in this Article 17 - may apply, the Indemnified Party shall provide notice thereof to the Indemnifying Party; *provided* that a delay in providing such notice shall limit the obligations of the Indemnifying Party only to the extent that such delay actually prejudices the ability of the Indemnifying Party to contest the claim or defend the proceeding.

(B) The Indemnifying Party shall assume the defense thereof with counsel designated by such Party and satisfactory to the Indemnified Party, *provided, however*, if the defendants in any such action include both the Indemnified Party and the Indemnifying Party, and the Indemnified Party shall reasonably conclude that there may be legal defenses available to it which are different from or additional to, or inconsistent with, those available to the Indemnifying Party, the Indemnified Party shall have the right to select and be represented by separate counsel, at the Indemnifying Party's expense.

(C) If an Indemnifying Party fails to assume the defense of a claim meriting indemnification, the Indemnified Party may contest, settle, or pay such claim at the expense of the Indemnifying Party, *provided, however, that* settlement or full payment of any such claim may be made only following consent of the Indemnifying Party or, absent such consent, written opinion of the Indemnified Party's counsel that such claim is meritorious or otherwise warrants settlement.

17.7 Amounts Owed. In the event that a Party is obligated for indemnification under this Article 17 -, the amount owing to the Indemnified Party will be the amount of the Indemnified Party's actual Losses net of any insurance proceeds received by the Indemnified Party following Commercially Reasonable Efforts by the Indemnified Party to obtain such insurance proceeds.

Article 18 - Lender Provisions

18.1 Accommodation of Facility Lender.

(A) Company shall provide such consents to collateral assignment, certifications, representations, estoppels, information or other documents, as may be reasonably requested by Seller in connection with the financing of the Facility consistent with the terms set forth in Exhibit K - Lender Consent Provisions (generally, a "Lender Consent"), *provided, however*, that in providing a Lender Consent, Company shall have

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no obligation to

1. modify the terms of this PPA;
2. provide any consent or enter into any agreement that has a Material Adverse Effect on any of Company's rights, benefits, risks, or obligations under this PPA;
3. transfer or release any property or property interests of Company;
4. release or subordinate (or cause the release or subordination of) any lien on any property of Company for the benefit of Seller or the Facility Lender; or
5. permit any lien to be placed on property of Company.

(B) Seller shall reimburse, or shall cause the Facility Lender to reimburse, Company for the direct expenses (including the fees and expenses of counsel) incurred by Company in the preparation, negotiation, execution and/or delivery of each Lender Consent and any documents requested by Seller or the Facility Lender pursuant to this Section 18.1.

18.2 Lender Notices.

(A) Seller shall provide Company with a notice identifying the Facility Lender ("Lender Notice") and providing appropriate contact information for the Facility Lender. Following receipt of such notice, Company shall provide to the Facility Lender a copy of each notice of alleged default delivered to Seller under Section 12.1 or Section 12.2, and Company will accept a cure thereof performed by the Facility Lender, so long as the cure is accomplished within the applicable cure period set forth in this PPA or the relevant Lender Consent.

(B) Within ten (10) Days following Seller's receipt of each notice of default or Facility Lender's intent to exercise any remedies under the Financing Documents, Seller shall deliver a copy of such notice to Company.

Article 19 - Assignment

19.1 Assignment by Seller.

(A) Seller shall not sell, exchange or otherwise transfer the Facility or any material portion thereof to any third party, nor shall Seller undergo any Change of Control (whether voluntary or by operation of law), absent the prior written consent of

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Company, which shall not be unreasonably withheld or delayed. Company shall have no obligation to provide any consent under this Article 19 - unless

1. Seller has complied with Sections 19.3, 19.4 and 19.5, if and as applicable;
2. Seller has provided to Company such information concerning the transferee's direct and indirect ownership as Company reasonably requests;
3. the transferee has substantial experience in the operation of power generation facilities akin to the Facility, either directly, through its Affiliates or through a Qualified Operator;
4. the transferee (together with its parents and Affiliates) possesses an Investment Grade Credit Rating or other creditworthiness satisfactory to Company;
5. Seller has provided to Company at least thirty (30) Days' prior written notice of the transaction; and
6. Seller pays or reimburses Company for the direct expenses (including the fees and expenses of counsel) incurred by Company in connection with the transaction.

(B) Any Change of Control or sale, transfer, or assignment of any interest in the Facility completed without fulfilling the requirements of this PPA shall be null, void and a breach of this PPA.

(C) Seller shall assign this PPA to any successor owner of the Facility and shall cause such successor to assume all obligations of Seller (accrued and prospective) hereunder via a writing reasonably satisfactory to Company. Seller also may assign this PPA for collateral purposes to any Facility Lender and may subcontract some or all of its duties under this PPA, upon notice to but without the consent of Company.

(D) Except as permitted in this Section 19.1, Seller may not assign this PPA or any portion hereof. No assignment shall relieve Seller of its obligations under this PPA, nor impair any security posted by Seller unless such security is replaced in accordance with Article 11 -. Before this PPA is assigned by Seller, the assignee must first obtain such approvals as may be required by all applicable Governmental Authorities.

19.2 Assignment by Company.

(A) Company may assign this PPA to any Affiliate, or to any successor that provides retail electric service in all or substantially all of Company's service territory and is subject to rate and quality service regulation under the jurisdiction of the MPUC/NDPSC. Any other assignment of this PPA by Company shall require the prior written consent of Seller, not to be unreasonably withheld or delayed.

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(B) If an assignee of Company possesses a Credit Rating equal to or better than Investment Grade or Company's Credit Rating as of the date of assignment (whichever is higher), Seller shall release Company from its obligations hereunder if so requested by Company. Except for the foregoing, no assignment shall relieve Company of its obligations under this PPA.

(C) Any assignee of Company shall assume all obligations of Company (accrued and prospective) hereunder via a writing reasonably satisfactory to Seller. Before this PPA is assigned by Company, the assignee must first obtain such approvals as may be required by all applicable Governmental Authorities.

19.3 Right of First Offer ("ROFO").

(A) At any time after the Commercial Operation Date, but before the end of the Term:

1. if Seller proposes to sell the Facility to an unaffiliated third party, Seller shall first offer to sell the Facility to Company via notice to Company,

2. if Seller's parent proposes to sell a majority of any class of voting and/or non-voting equity interests in Seller (excluding interests owned by tax equity investors) to an unaffiliated third party, Seller shall cause its parent first to offer to sell such equity interests to Company via notice to Company, and

3. if Seller's parent owns no assets other than its equity interests in Seller and the parent of Seller's parent proposes to sell a majority of any class of voting and/or non-voting equity interests in Seller's parent (excluding interests owned by tax equity investors) to an unaffiliated third party, Seller shall cause its parent's parent first to offer to sell such equity interests to Company via notice to Company.

in each case (1) through (3) above, a "ROFO Notice". Any ROFO Notice shall describe the proposed transaction, including the minimum price, status of title to the Site, liabilities to be assumed and other terms which Seller or its relevant parent (as applicable) is willing to accept to proceed with the contemplated transaction. The contents of a ROFO Notice shall be deemed Confidential Information for purposes of Section 20.18 below.

(B) Following issuance of a ROFO Notice, Seller shall allow Company sixty (60) Days to investigate the proposed transaction and conduct due diligence. Due diligence shall include such physical inspections, surveys and operating tests of the Facility and the Site, such reviews of Seller's contracts, books and records, and interviews of such personnel, as Company may reasonably request. All information obtained by Company from such investigations shall be deemed Confidential Information subject to Section 20.18 below. Within such sixty (60)-Day period, Company may elect to purchase the Facility or the relevant equity interests (as applicable) on substantially the same terms as set forth in the ROFO Notice. If Company fails to notify Seller of Company's election

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within such sixty (60)-Day period, Company shall be deemed to have rejected the transaction.

(C) If Company elects to purchase the Facility or the specified equity interests (as applicable), the Parties shall negotiate and execute a PSA. If Company elects to purchase the Facility the PSA shall include the price and other terms set forth in the ROFO Notice and such other terms as are set forth in Exhibit L-2 - PSA Provisions. If Company elects to purchase the specified equity interests, the PSA shall include the price and other terms set forth in the ROFO Notice and such other terms as are set forth in Exhibit L-3– MIPS A Provisions.

(D) If Company rejects the transaction described in a ROFO Notice, Seller shall have the right to sell the Facility (or Seller's relevant parent shall have the right to sell the specified equity interests, as applicable) on terms that a reasonable person would determine are not more favorable to such buyer than the terms offered to the Company in the ROFO Notice, at any time within the twelve (12)-month period following issuance of the ROFO Notice. If Seller or its relevant parent fails to close a transaction on such terms within such twelve (12)-month period, any sale of the Facility or equity interests in Seller shall again be subject to this Section 19.3.

(E) This Section 19.3 shall be specifically enforceable by Company, without bond and without the need to prove irreparable harm.

(F) Seller shall cooperate in all respects reasonably necessary for Company to exercise its ROFO rights and shall operate the Facility in the ordinary course of business following the date of issuance of a ROFO Notice.

19.4 PFT.

(A) Seller shall give Company at least ninety (90) Days' prior written notice (a "PFT Notice") of any Pending Facility Transaction that does not otherwise trigger Company's ROFO rights under Section 19.3, in order to provide Company with an opportunity to discuss and negotiate with Seller the possible sale of the Facility to Company. Any PFT Notice shall include a fair summary of Seller's plans with respect to the Facility in connection with the proposed Pending Facility Transaction, to the extent then known by Seller. The contents of a PFT Notice shall be deemed Confidential Information for purposes of Section 20.18 below.

(B) Seller shall have no obligation to sell nor shall Company have any obligation to purchase the Facility, following any PFT Notice. Issuance of a PFT Notice shall not relieve Seller of its obligation to offer a ROFO to Company if and when applicable pursuant to Section 19.3. In the event that the transaction giving rise to the PFT Notice has not been completed within twelve (12) months following a PFT Notice, Seller shall be required to resubmit a PFT Notice for such transaction.

(C) Any breach of this Section 19.4 shall entitle Company to liquidated damages from Seller in the amount of [insert \$5/kW x Facility Nameplate Capacity (kW)]

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(D) For purposes hereof, a “Pending Facility Transaction” or “PFT” means:

1. any Change of Control of Seller;
2. the issuance by Seller or any of its Affiliates of a request for proposals or the response by Seller or any of its Affiliates to a request for proposal or similar process (e.g., auction) for the purchase or sale to any unaffiliated third party of any equity interests in Seller or the Facility, or any group(s) of assets or equity interests that includes the Facility;
3. the transmission by Seller or any of its Affiliates of a draft letter of intent, memorandum of understanding, term sheet or similar document (or a revised version thereof) to an unaffiliated third party with respect to the sale of any equity interests in Seller or the Facility, or any group(s) of assets or equity interests that includes the Facility; or
4. the execution by Seller or any of its Affiliates of any letter of intent, memorandum of understanding, term sheet or similar document, whether or not legally binding, which contemplates the sale or lease to an unaffiliated third party of any equity interests in Seller or the Facility or any group(s) of assets or equity interests that includes the Facility; *provided, however*, that a PFT does not include (i) any financing or refinancing of the Facility Debt, (ii) any transaction among Affiliates of Seller, and/or (iii) any transaction for which Seller offers ROFO rights to Company under Section 19.3.

19.5 Option.

(A) At any time during each of the periods that is within one hundred eighty (180) Days following any of (i) [solar] the sixth (6th) anniversary of COD, (ii) the tenth (10th) anniversary of COD, (iii) the fourteenth (14th) anniversary of COD and (iv) the end of the Term] [Wind] (i) the twelfth (12th) anniversary of COD and (ii) the end of the Term], Company (or an Affiliate) may give notice to Seller of Company’s (or such Affiliate) intent to purchase (i) the Facility from Seller (a “Facility Acquisition”) or (ii) all, but not less than all, of Ultimate Parent’s direct and indirect right, title and interest in the equity interests of Seller, and including, if applicable, Ultimate Parent’s direct and indirect right, title and interest in the tax equity partnership (the “TE Partnership”) that owns, directly or indirectly, equity interests in Seller (together, the “Equity Interest”) (an “Equity Interest Acquisition”) with such notice in either case referred to as an “Option Preliminary Exercise Notice”.

(B) As soon as practicable following delivery of an Option Preliminary Exercise Notice for a Facility Acquisition, the Parties shall appoint an independent appraiser experienced in appraising utility-scale [wind] [solar] with battery storage power generation facilities (as may be applicable to the bid) to determine the fair market value (“FMV”) of the Facility. If the Parties cannot agree on the identity of the appraiser, the appraiser shall be selected by the Arbitration Service.

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1. Seller shall provide to the appraiser full access to the Facility and the Site, to Seller's contracts, books and records, and to relevant personnel of Seller, during normal business hours. Such access shall include the right to conduct inspections, surveys and tests (including environmental testing of the Site and operating tests on the Facility) necessary or appropriate for the determination of FMV of the Facility.

2. Unless otherwise agreed to by Parties, Company shall engage and pay all fees and costs of the appraiser.

3. The Parties shall direct the appraiser to use his/her/its best efforts to complete and deliver his/her/its appraisal to the Parties within two (2) months following his/her/its appointment and to keep all information obtained by appraiser from any investigations as Confidential Information subject to the provisions of Section 20.18.

(C) In the case of an Option Preliminary Exercise Notice for an Equity Interest Acquisition, Company will deliver, together with the Option Preliminary Exercise Notice, its calculation of the purchase price for the Equity Interest Acquisition utilizing the formula for such determination set forth in Exhibit L-1 – Equity Purchase Price Formula. The Parties reasonably believe, based on all facts and circumstances at the time of executing this PPA, that the purchase price for the Equity Interest Acquisition so determined by such formula will not be less than the fair market value of the Equity Interest on the relevant date. All information obtained by Company from such investigations shall be deemed Confidential Information subject to Section 20.18.

(D) Following delivery of an Option Preliminary Exercise Notice, Seller shall provide to Company full access to the Facility and the Site, to Seller's contracts, books and records, and to relevant personnel of Seller, during normal business hours. Such access shall include the right to conduct lien searches, surveys, inspections and tests (including environmental testing of the Site and operating tests on the Facility) necessary or appropriate for due diligence review of the Facility. All information obtained by Company from such investigations shall be deemed Confidential Information subject to Section 20.18.

(E) All inspections, testing and access to the Facility and the Site by Company and the appraiser shall comport with all of Seller's policies governing the use, operation, and maintenance of the Facility, including health, safety and environmental requirements, and shall be conducted in a manner so as to minimize disruption in the operation of the Facility and to avoid any adverse economic impacts to Seller under this PPA.

(F) In the case of a Facility Acquisition, within sixty (60) Days following the determination of FMV as described above, Company may elect to purchase the Facility from Seller (an "Option"). If Company fails to notify Seller of Company's election within such sixty (60)-Day period, Company shall be deemed to have elected not

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to exercise the Option.

(G) In the case of a Facility Acquisition, the “Purchase Price” to be paid by Company for the Facility in connection with exercise of the First Option shall be the greater of:

1. the sum of:

a. (x) amount of Facility Debt (if any) as of the date of issuance of the Option Preliminary Exercise Notice, and

b. (y) if the relevant tax equity agreements allow the other members of the TE Partnership the option to purchase, at “fair market value” (as determined in those tax equity agreements) or a pre-determined price, the interest of the tax equity investor that has invested directly or indirectly in the Facility or Seller, then the amount of such purchase option price or, in any other case, the amount necessary to cause the after-tax internal rate of return of such tax equity investor’s investment to equal the targeted rate of return under its tax equity agreements, or

2. the FMV of the Facility, as determined by the appraiser.

(H) If Company exercises the Option, the Parties shall use Commercially Reasonable Efforts to negotiate and sign either:

1. A PSA for the Facility. The PSA shall include the terms and conditions set forth in Exhibit L-2 - PSA Provisions.

2. A PSA for the Equity Interest. The PSA shall include the terms and conditions set forth in Exhibit L-3– MIPSAs Provisions.

(I) This Section 19.5 shall be specifically enforceable by Company, without bond and without the need to prove irreparable harm.

(J) Seller shall cooperate, and cause its Affiliates to cooperate, in all respects reasonably necessary for Company to exercise its rights under this Section 19.5, and shall operate the Facility in the ordinary course of business following the date of issuance of an Option Preliminary Exercise Notice.

19.6 Memo of Option. In connection with the Parties’ execution and delivery of this PPA, the Parties are executing, and Company is recording a “Memorandum of Option” memorializing its Default Option rights under Section 12.1(E), its ROFO rights under Section 19.3, and its Option rights under Section 19.5.

Article 20 - Miscellaneous

20.1 Notices.

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(A) Notices required by this PPA shall be in writing and addressed to the other Party at the addresses noted in Exhibit D - Notices and Contact Information, as either Party updates such addresses from time to time by notice to the other Party. A notice shall be deemed to have been received as follows: (1) if it is delivered by email, when the recipient, by an email sent to the email address for the sender stated in Exhibit D - Notices and Contact Information or by a notice delivered by another method in accordance with this Section 20.1(A), acknowledges having received that email, with an automatic "read receipt" not constituting acknowledgment of an email for purposes of this Section 20.1(A); and, (2) If it is delivered in writing, when receipt is acknowledged in writing by the counterparty (or absent such acknowledgement, when delivered via third-party messenger or via FedEx or other reputable overnight courier service). Any notice shall be deemed to have been received by the close of the Business Day on which it was delivered. Real-time or routine communications concerning Facility operations shall be exempt from this Section 20.1(A).

(B) The Parties recognize the need for accurate communications between them. Each Party consents to the recording of telephone conversations between their employees and representatives, related to the performance and administration of this PPA.

20.2 Taxes.

(A) Company shall purchase all Energy on a wholesale basis, for resale to Company's wholesale and retail customers. Company shall obtain and provide Seller with any certificates required by any Governmental Authority or otherwise reasonably requested by Seller to evidence that the deliveries of Energy hereunder are sales for resale.

(B) As between the Parties, Company shall be solely responsible for the payment of (1) any sales, use or equivalent taxes imposed by Governmental Authorities, whether now in existence or hereafter enacted, on the purchase of Energy and any other products and services purchased by Company hereunder at or beyond the Point of Delivery, and (2) any taxes imposed by Governmental Authorities, whether now in existence or hereafter enacted, on the transmission of Energy beyond the Point of Delivery.

(C) Subject to Section 20.2(B), Seller shall be solely responsible for any and all present and future taxes and other impositions of Governmental Authorities relating to the construction, ownership or leasing, operation or maintenance of the Facility and the Site (including *ad valorem* taxes on the Facility and the Site), and any taxes imposed prior to the Point of Delivery with respect to the products and services to be sold and delivered to Company hereunder, whether calculated based upon cost, value, labor, capital, production, savings, green attributes or other parameters. Seller's prices under Article 8 - are inclusive of such taxes and impositions during the Term, and Seller assumes the risk of changes in such taxes after the Effective Date.

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(D) The Parties shall cooperate to minimize tax exposure, *provided, however*, that neither Party shall be obligated to incur any financial burden to reduce taxes for which the other Party is responsible hereunder.

20.3 Applicable Laws. Each Party shall comply with all Applicable Laws (including the Transmission Authority Tariff), except for any non-compliance that (individually or in the aggregate) could not reasonably be expected to have a Material Adverse Effect on the other Party or on such Party's ability to perform this PPA.

(A) As applicable, each Party shall give all required notices, shall procure and maintain all Permits necessary for performance of this PPA, and shall pay its respective charges and fees in connection therewith.

(B) Each Party shall promptly disclose to the other Party, any violation of any Applicable Laws arising out of their performance of this PPA.

(C) Upon permanent cessation of operation of the Facility, Seller shall decommission and remove the Facility and remediate the Site as, if and when required by Applicable Laws.

(D) Seller acknowledges that as a government contractor Company is subject to Applicable Laws regarding equal employment opportunity and affirmative action, including 41 C.F.R. § 60-1.4(a) (1-7). Such Applicable Laws may also be applicable to Seller as a subcontractor to Company. All such Applicable Laws shall be deemed to be incorporated herein as required by Applicable Law.

(E) Except as specifically set forth in this Section 20.3 and elsewhere in this PPA, each Party assumes the risk of changes in Applicable Laws following the Effective Date, that affect such Party's costs of ownership and operation of its assets, and its performance of this PPA, except as otherwise specifically set forth herein.

20.4 Fines and Penalties. Seller shall pay when due all fees, fines, penalties and costs incurred by Company, Seller and/or their agents, employees or contractors arising from noncompliance by Seller, its employees, or subcontractors with any provision of this PPA, or any contractual obligation, Permit or requirements of Applicable Law, except for such fines, penalties and costs that are being actively contested in good faith and with due diligence by Seller and for which adequate financial reserves have been set aside to pay such fines, penalties or costs in the event of an adverse determination.

20.5 Rate Changes.

(A) The terms and conditions and the rates for service specified in this PPA shall remain in effect for the Term hereof. Neither Party shall seek (nor support any third party seeking) any prospective or retroactive change to the rates or terms of service under this PPA pursuant to Sections §205, §206 or §306 of the Federal Power Act.

(B) The standard of review for changes to this PPA whether proposed

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by a Party, a non-party, or FERC acting *sua sponte* shall be the “public interest” standard of review set forth in *United Gas Pipe Line v. Mobile Gas Service Corp.*, 350 U.S. 332 (1956) and *Federal Power Commission v. Sierra Pacific Power Co.*, 350 U.S. 348 (1956) (aka the “Mobile-Sierra doctrine”), as interpreted in *Morgan Stanley Capital Group, Inc. v. Public Util. Dist. No. 1*, 128 S. Ct. 2733 (2008).

20.6 Certifications. Each Party shall deliver or cause to be delivered to the other Party certificates of its officers, accountants, engineers or agents as to matters as may be reasonably requested, and shall make available personnel and records relating to the Facility to the extent that the requesting Party requires the same in order to fulfill any regulatory reporting requirements, or to assist the requesting Party in litigation, including administrative proceedings before the MPUC/NDPSC.

20.7 Disclaimer of Third-Party Beneficiaries. In executing this PPA, Company does not and does not intend to extend its credit or financial support for the benefit of any Facility Lender or any other third party transacting with Seller. Nothing in this PPA shall be construed to create any duty to, or standard of care with reference to, or any liability to, any person not a party to this PPA.

20.8 Relationship of the Parties.

(A) This PPA shall not be interpreted to create an association, joint venture, or partnership between the Parties, nor to impose any partnership obligation or liability upon either Party. Except as specifically provided for in this PPA to the contrary, neither Party shall have any right, power, or authority to enter into any agreement or undertaking for, or act on behalf of, or to act as an agent or representative of, the other Party.

(B) Seller shall be solely liable for the payment of all wages, taxes, and other costs related to the employment of persons to perform such services, including all federal, state, and local income, social security, payroll, and employment taxes and statutorily mandated workers’ compensation coverage. None of the persons employed by Seller shall be considered employees of Company for any purpose; nor shall Seller represent to any person that he or she is or shall become a Company employee.

20.9 Survival of Obligations. Cancellation, expiration, or earlier termination of this PPA shall not relieve the Parties of obligations, including warranties, remedies, or indemnities, that by their nature should survive such cancellation, expiration, or termination, which obligations shall survive for the period of the applicable statute(s) of limitation.

20.10 Severability. In the event any of the terms, covenants, or conditions of this PPA, its Exhibits, or the application of any such terms, covenants, or conditions, shall be held invalid, illegal, or unenforceable by any court or administrative body having jurisdiction, all other terms, covenants, and conditions of this PPA and their application not adversely affected thereby shall remain in force and effect; *provided, however, that*

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Company and Seller shall negotiate in good faith to attempt to implement an equitable adjustment in the provisions of this PPA with a view toward effecting the purposes of this PPA by replacing the provision that is held invalid, illegal, or unenforceable with a valid provision the economic effect of which comes as close as possible to that of the provision that has been found to be invalid, illegal or unenforceable.

20.11 Complete Agreement; Amendments. The terms and provisions contained in this PPA constitute the entire agreement between Company and Seller with respect to the Facility and shall supersede all previous communications, representations, or agreements, either verbal or written, between Company and Seller with respect to the sale and delivery of the products and services required by this PPA. Any amendment of this PPA, or any waiver of any provision hereof, shall be evidenced by a writing signed by the Parties to be bound thereby.

20.12 Waiver. The failure of either Party to enforce or insist upon compliance with or strict performance of any of the terms or conditions of this PPA, or to take advantage of any of its rights hereunder, shall not constitute a waiver or relinquishment of any such terms, conditions, or rights, but the same shall be and remain at all times in full force and effect.

20.13 Binding Effect. This PPA is binding upon and shall inure to the benefit of the Parties hereto and their respective successors, legal representatives, and assigns.

20.14 Headings. Captions and headings used in this PPA are for ease of reference only and do not constitute a part of this PPA.

20.15 Counterparts and Electronic Signatures. This PPA may be executed in counterparts, and each executed counterpart shall have the same force and effect as an original instrument. A manually signed copy of this PPA, or a copy of this PPA signed with an electronic or digital signature, delivered by e-mail shall be deemed to have the same legal effect as delivery of an original signed copy of this PPA. No legally binding obligation shall be created with respect to a Party until such Party has delivered or caused to be delivered a signed copy of this PPA.

20.16 Press Release. Upon the request of either Party, the Parties shall develop a mutually agreed joint press release to be issued describing the location, size and nature of the Facility, the Term, and other relevant factual information about the relationship.

20.17 Exhibits. Either Party may change the information in Exhibit D - Notices and Contact Information at any time by notice without the approval of the other Party. All other Exhibits may be changed to the extent allowed by specific provisions of this PPA or with the mutual consent of both Parties.

20.18 Confidentiality.

(A) For purposes hereof, "Confidential Information" means:

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1. information specifically designated as Confidential Information in this PPA; and
2. written information delivered by one Party to the other from time to time during the Term, which information is labeled prominently as “Confidential,” “Proprietary” or the like and specifically references this PPA,
3. *provided, however*, that “Confidential Information” shall not include information that:
 - a. is publicly available as of the Effective Date, or becomes publicly available during the Term through no fault of the recipient Party;
 - b. can be documented was independently developed by the recipient Party; and/or
 - c. is disclosed to the recipient Party from an ultimate source other than the protected Party, without breach of this PPA by the recipient Party.

(B) The recipient Party shall (i) maintain the confidentiality of all Confidential Information of the protected Party, using the same degree of care used by the recipient Party to protect its own Confidential Information (and in any event not less than a reasonable degree of care), and (ii) shall use Confidential Information only in connection with its performance of this PPA. Confidential Information may be disclosed by the recipient Party to its agents, employees, directors, officers, consultants, auditors, lenders and equity investors, subject to their acceptance of the obligations of confidentiality imposed hereby and for whose violations of this Section 20.18 the recipient Party shall be responsible.

(C) In the event that Confidential Information is disclosed to the MPUC/NDPSC, their staff, parties, intervenors, participants or consumer counsel in any regulatory or administrative proceedings before the MPUC/NDPSC, or Confidential Information is disclosed to the MPUC/NDPSC, their staff, or consumer counsel outside of any regulatory or administrative proceedings before the MPUC/NDPSC, the disclosing Party shall submit such Confidential Information in accordance with applicable MPUC/NDPSC confidentiality rules and procedures, the MPUC/NDPSC protective order or signed non-disclosure agreement.

(D) In the event that Confidential Information must otherwise be disclosed by Applicable Law (e.g., pursuant to subpoena or civil discovery), the Party required to make disclosure shall notify the protected Party sufficiently in advance to allow the protected Party a reasonable opportunity to obtain a protective order or seek other remedies, prior to disclosure by the recipient Party.

20.19 Accounting Treatment.

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(A) If and when Company reasonably determines that Company must consolidate financial information of Seller into Company's financial statements under FASB ASC 810 or other accounting standard applicable to Company:

1. the Parties shall use Commercially Reasonable Efforts to amend this PPA and/or the Parties' protocols for operation of the Facility to avoid such treatment, at the least possible cost to the Parties, consistent with the intent of this PPA to the extent possible; or,

2. if such avoidance is not reasonably feasible, Seller shall provide to Company from time to time upon request such quarterly and annual financial information as may be needed for Company to comply with such standard, in such format and within such time frames as Company may reasonably request.

(B) If and when Company reasonably determines that Company must treat this PPA as a "finance lease" under FASB ASC 842 or other accounting standard applicable to Company, the Parties shall use Commercially Reasonable Efforts to amend this PPA and/or the Parties' protocols for operation of the Facility to avoid such treatment, at the least possible cost to the Parties, consistent with the intent of this PPA to the extent possible, if so requested by Company.

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Northern States Power Company [Wind] [Solar] + Storage Energy Purchase Agreement

IN WITNESS WHEREOF, the Parties have executed this PPA as of the date first set forth above.

Seller:

_____**[LLC]**

By: _____

[NAME]

[TITLE]

Company:

**Xcel Energy Services, Inc., authorized signatory for
Northern States Power Company, a [Minnesota or
Wisconsin] corporation**

By: _____

[]

[name and title]

Southwestern Public Service Company [Wind] [Solar]+ Storage Energy Purchase Agreement

Exhibit A- DEFINITIONS

The following terms shall have the meanings set forth herein:

“AC” shall have the meaning set forth in Section 1.1(D).

“Actual Damages” shall have the meaning set forth in Section 12.4(C).

“Affiliate” of any designated person or entity means any person or entity that directly or indirectly controls, is under the control of, or is under common control with, the designated person or entity by the power to direct or cause the direction of the management of the policies of designated person or entity, whether through ownership interest, by contract or otherwise.

“AGC” or “Automatic Generation Control” means the equipment and capability of an electric generation facility automatically to adjust the generation quantity within the applicable Balancing Authority with the purpose of interchange balancing and specifically, the Facility’s capability of accepting an AGC Set-Point electronically, and the automatic adjustment and regulation of the Facility’s Energy production via the SCADA System.

“AGC Protocols” means the protocols for AGC included in Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection, as such protocols may be modified from time to time in accordance with Section 10.8.

“AGC Remote/Local” means a handshake electronic signal sent from the Facility to the EMCC AGC system, and from the EMCC AGC system to the Facility, indicating the Facility is receiving AGC Set-Point locally (from the Facility) or remotely (EMCC AGC system) and is following that AGC Set-Point.

“AGC Set-Point” means the Company-generated analog or digital signal sent by the SCADA System to the Facility, representing the quantity of Energy to be generated by the Facility or stored by the Battery Storage System. The AGC Set-Point is calculated by the EMCC AGC system and communicated electronically to the Facility via the SCADA System.

“Ancillary Services” shall have the meaning set forth in Section 7.5(C).

“Annual Throughput Limit” means [as bid, shall be no less than 260 equivalent cycles] MWh.

“Annual State of Charge Limit” means fifty-one percent (51%) as calculated as a simple average of the State of Charge in each hour for the applicable Commercial Operation Year.

“Applicable Law” means all laws, statutes, treaties, codes, ordinances, regulations, standards, certificates, orders, licenses and permits of any Governmental Authority that are applicable to a Party, the business of a Party or the Facility, now in effect or hereafter enacted, including amendments to or interpretations of any of the

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foregoing by a Governmental Authority having jurisdiction, and all applicable judicial, administrative, arbitration and regulatory decrees, judgments, injunctions, writs, orders, awards and/or like actions, including, for the avoidance of doubt, electrical, building, fire, zoning, environmental, and occupational health and safety requirements.

“Arbitration Service” means Judicial Arbitration and Mediation Services, Inc. (aka JAMS).

“Availability Notice” shall have the meaning set forth in Section 7.3(B).

“Back-Up Metering” shall have the meaning set forth in Section 5.5(B).

“Balancing Authority” means the system of electrical generation, distribution and transmission facilities within which generation is regulated in order to maintain interchange schedules with other such systems.

“Battery Energy” means all electrical energy stored and discharged by the Battery Storage System during the Term.

“Battery Storage System” means that portion of the Facility that is required to store energy using the Battery Units, including step-up transformers, output breakers, facilities necessary to connect to the Interconnection Point, protective and associated equipment, improvements, and other tangible and intangible assets, contract rights, Permits, easements, rights of way, surface use agreements and other interests or rights in real estate, owned or used for construction, operation, maintenance, generation and delivery of the foregoing.

“Battery Storage System Electric Metering Devices” means revenue quality meters, metering equipment and/or data processing equipment used to measure, record and transmit data with respect to the Charging Energy delivered to and the Discharging Energy delivered from the Battery Storage System, including metering current transformers and metering voltage transformers. The Battery Storage System Electric Metering Devices must transmit to Company five-minute revenue quality meter data. All Charging Energy and Discharging Energy values measured by the Battery Storage System Electric Metering Devices will be normalized for electrical losses between the Battery Storage System Electric Metering Devices and the Point of Delivery.

“Battery Storage System Metering Point” means, with respect to Charging Energy, the point at the Battery Storage System set forth in Exhibit C - Facility Description and Site Maps.

“Battery Storage System Nameplate Capacity” shall have the meaning set forth in Section 3.2.

“Battery Storage System Operating Procedures” means those procedures applicable to the operation of the Battery Storage System, as developed by the

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Operating Committee in accordance with the procedure, and subject to the requirements, set forth in Exhibit O - Battery Storage System Operating Procedures.

“Battery Storage System Planned Outages” means a planned removal from service of the Battery Storage System, or some part thereof constituting not less than ten percent (10%) of the Battery Storage System Nameplate Capacity, that is required for inspection, or routine, preventive or corrective maintenance; provided that a Battery Storage System Planned Outage during any Commercial Operation Year may not exceed ninety-six (96) hours; *provided that* to the extent the total Battery Storage System Planned Outages in a Commercial Operation Year are less than ninety-six (96) hours, Seller shall be permitted to increase the number of permitted Battery Storage System Planned Outages in a subsequent Commercial Operation Year by such amount; *provided, further*, in no case during any Commercial Operation Year may the Battery Storage System Planned Outages exceed one hundred ninety-two (192) hours.

“Battery Units” means the batteries, power electronic systems, enclosures and other equipment necessary for the Battery Storage System to store electricity at the Site and transmit such electricity upon command. The manufacturer and model number of the Battery Units will be identified on Exhibit C - Facility Description and Site Maps.

“Building Trades CBA” shall have the meaning set forth in Section 4.5(C)1.n.

“Business Day” means any Day that is not a Saturday, a Sunday, or a NERC recognized holiday.

“Capacity” shall have the meaning set forth in Section 8.4(A).

“Capacity Availability Factor” or “CAF” shall have the meaning set forth in Section 8.4(A).

“Capacity Payment Rate” shall have the meaning set forth in Exhibit J - Energy Payment Rate; Committed Energy; Capacity Payment Rate.

“Change of Control” means the occurrence of any one of the following events with respect to Seller or any direct or indirect owner of a majority of the ownership interests in Seller: (a) a transfer of a majority of the ownership interests in Seller or such owner; (b) any consolidation or merger of Seller or such owner in which Seller or such owner, as the case may be, is not the continuing or surviving entity; or (c) a sale or conveyance of any direct or indirect ownership interest in Seller following which [REDACTED] (“Ultimate Parent”) is no longer the direct or indirect owner of at least fifty percent (50%) of the ownership interests of Seller, *provided, however*, that a Change of Control shall not be deemed to have occurred solely as a result of:

- (i) transactions exclusively among Affiliates of Seller;
- (ii) any exercise by the Facility Lender of its rights and remedies under the Financing Documents, *with respect to any Facility Debt secured only by*

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the Facility;

- (iii) a change of control of Ultimate Parent; or
- (iv) any change of economic and/or voting rights triggered in Seller's organizational documents arising from (a) a tax-equity financing of the Facility, or (b) a transaction in which interests in Seller or any direct or indirect owner are sold to or by a tax equity investor.

"Charging Energy" means all [Wind] [Solar] Charging Energy and Grid Charging Energy. Under no circumstances does Charging Energy include House Power.

"Charging Energy Price" means, if Company has joined a regional transmission organization or is participating in an organized market for which nodal prices can be determined, then the applicable market settlement price per MWh as determined by Company in its sole discretion, or, if not, then the applicable price per MWh as determined by Company in its sole discretion pursuant to its cost calculator

"COD Conditions" means all of the requirements that must be satisfied by Seller as a prerequisite to achieving Commercial Operation. The COD Conditions are set forth in Section 4.5.

"COD Delay" shall have the meaning set forth in Section 12.2(A).

"COD Liquidated Delay Damages" shall have the meaning set forth in Section 12.2(A).

"COD Notice" shall have the meaning set forth in Section 4.5(B).

"Commercial Operation" means the period beginning on the Commercial Operation Date and continuing through the balance of the Term of this PPA.

"Commercial Operation Date" or "COD" shall have the meaning set forth in Section 4.5.

"Commercial Operation Test" shall have the meaning set forth in Section 5.6(A).

"Commercial Operation Year" shall have the meaning set forth in Section 4.5(D).

"Commercially Reasonable" or "Commercially Reasonable Efforts" means, with respect to any action to be taken or attempted by a Party under this PPA, the level of effort in light of the facts known to such Party at the time a decision is made that: (a) can reasonably be expected to accomplish the desired action at a reasonable cost; (b) is consistent with Good Utility Practices; (c) is consistent with the terms in this PPA; and (d) takes into consideration the amount of advance notice required to take such action, the duration and type of action, and the competitive environment in which such action occurs.

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“Committed Energy” from the Facility for each Commercial Operation Year is set forth on Exhibit J - Energy Payment Rate; Committed Energy; Capacity Payment Rate hereto. The amount of Committed Energy shall be deemed Confidential Information for purposes of Section 20.18.

“Committed Energy Deficiency Adjustment” shall have the meaning set forth in Section 8.5(C).

“Company” shall have the meaning set forth in the introductory paragraph.

“Company Dispatched Test” shall have the meaning set forth in Section 5.6(D).

“Confidential Information” shall have the meaning set forth in Section 20.18(A).

“Construction Contracts” shall have the meaning set forth in Section 4.1(A).

“Construction Craft Employees” means employees engaged in on-Site construction and commencement of operations of the Facility, excluding (i) Specialty Vendors, (ii) management and supervisory employees, (iii) employees engaged in non-construction support services (including messengers, guards, safety personnel, medical and first-aid technicians, community relations or public affairs, etc.), and (iv) employees engaged in on-Site maintenance of installed equipment or systems but which maintenance occurs after installation of such equipment or system and is not directly related to construction services.

“Construction Milestones” means the dates set forth in Exhibit B - Construction Milestones.

“COVID” means SARS-CoV-2 or COVID-19, and any evolutions or mutations thereof or related or associated epidemics, pandemic, or disease outbreaks. “CPD Delay” shall have the meaning set forth in Section 12.2(A).

“CPD Liquidated Delay Damages” shall have the meaning set forth in Section 12.2(A).

“Credit Rating” of any person or entity means the lowest rating assigned to such person or entity’s long-term debt or deposit obligations (unenhanced by third-party support) by Standard & Poor’s and Moody’s. If such person or entity has no outstanding long-term debt or deposit obligations, or if no rating is assigned to such obligations, “Credit Rating” shall mean the lowest general corporate credit rating or long-term issuer rating assigned to such person or entity by Standard & Poor’s or Moody’s.

“Critical Path Development Milestone” or “CPD” shall have the meaning set forth in Section 4.1(B).

“Curtailment” shall have the meaning set forth in Section 8.3(A).

“Damage Cap” shall have the meaning set forth in Section 12.4.

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“Day” means a calendar day.

“DC” shall have the meaning set forth in Section 1.1(D).

“Default FMV” shall have the meaning set forth in Section 12.1(E)1.

“Default Option” shall have the meaning set forth in Section 12.1(E)3.

“Default Option Preliminary Exercise Notice” shall have the meaning set forth in Section 12.1(E).

“Delivery Period” shall be the period during which Energy is available to Company, commencing at 12:01 am on the Commercial Operation Date and continuing until midnight on the Scheduled Termination Date, subject to early termination as provided in this PPA.

“Discharging Energy” means all [Wind] [Solar] Discharging Energy and Grid Discharging Energy.

“Discharging Energy Price” means, if Company has joined a regional transmission organization or is participating in an organized market for which nodal prices can be determined, then the applicable real-time market settlement price per MWh as determined by Company in its Commercially Reasonable discretion, or, if not, then the applicable incremental system price per MWh as determined by Company in its Commercially Reasonable discretion.

“Dispatch Notice” means the operating instruction, and any subsequent updates, given by Company to Seller, directing the Battery Storage System to charge at a specified megawatt input or discharge at a specified megawatt output. Dispatch Notices may be communicated electronically, via SCADA System signal, via facsimile, telephonically or other verbal means. Telephonic or other verbal communications shall be documented (either recorded by tape, electronically or in writing) and such recordings shall be made available to both Company and Seller upon request. For the avoidance of doubt, Company shall be subject to the scheduling limitations of the Market Operator when updating any Dispatch Notice.

“Dispute” shall have the meaning set forth in Section 13.1(A).

“Dispute Notice” shall have the meaning set forth in Section 13.1(A).

“Distributed Network Protocol (DNP)” means a set of communications protocols used between components in process automation systems.

“Dollar”, “\$”, or “US\$” means the lawful currency of the United States of America.

“Effective Date” shall have the meaning set forth in the introductory paragraph.

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“Electric Metering Devices” means revenue quality meters, metering equipment and/or data processing equipment used to measure, record and transmit data with respect to the output of Energy from the Facility, including metering current transformers and metering voltage transformers. The Electric Metering Devices must be capable of storing five-minute revenue quality meter data for transmission to, and retrieval by, Company. Electric Metering Devices shall include Battery Storage System Electric Metering Devices.

“Eligible Energy Resource” means any generation resource eligible to be certified to generate, claim, own or use Renewable Energy Credits and green tags pursuant to the protocols and procedures developed and approved by applicable Government Authorities for the REC Registration Program.

“Emergency” means any event or occurrence during the Term that results in the declaration of an “Emergency Condition” under and as defined in the Interconnection Agreement.

“Energy” means all Renewable Energy and any other electrical energy stored and discharged by the Battery Storage System and delivered to Company at the Point of Delivery during the Term. “Energy” shall be deemed to include all Environmental Attributes associated with such electric energy.

“Energy Markets Control Center” or “EMCC” means Company's merchant representatives responsible for dispatch of the Facility.

“Energy Payment Rate” shall have the meaning set forth in Exhibit J – Energy Payment Rate; Committed Energy; Capacity Payment Rate.

“Environmental Attributes” shall have the meaning set forth in Section 7.4(C).

“Environmental Contamination” shall have the meaning set forth in Section 4.2(C).

“Equity Interest” shall have the meaning set forth in Section 19.5(A).

“Equity Interest Acquisition” shall have the meaning set forth in Section 19.5(A).

“Equity Purchase Price” shall have the meaning set forth in Exhibit L-1 – Equity Purchase Price Formula.

“Equivalent Availability Reporting Factor” shall have the meaning set forth in Exhibit I - AGC Protocols; Data Collection; Availability Reporting.

“ERO” means the Electric Reliability Organization certified by FERC pursuant to Section 215 of the Federal Power Act, which as of the Effective Date is NERC, or any successor organization. For purposes of this PPA, ERO also includes the Midwest Reliability Organization (MRO).

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“Escrow Account” shall have the meaning set forth in Section 11.3(B).

“Event of Default” shall have the meaning set forth in Article 12 -.

“Excess Energy” shall have the meaning set forth in Section 8.2(D).

“Excused Outage” means any Outage of the Battery Storage System resulting from: (i) a Battery Storage System Planned Outage; (ii) a Curtailment (but only to the extent such Curtailment does not result from Seller’s failure to perform under this PPA or the Interconnection Agreement or Seller’s failure to observe Good Utility Practices); (iii) Force Majeure or Emergency; (iv) a breach of this PPA by Company; (v) [Solar; insufficient solar irradiance] or insufficient stored energy not caused by any act or omission of Seller; (vi) an Outage resulting from a request by Company; (vii) any Outage where Seller failed to comply with a dispatch that was not in accordance with the Battery Storage System Operating Procedures.

“Facility” means the [Wind] [Solar] Facility, Battery Storage System, and all equipment necessary to interconnect to the Transmission Authority’s System, all as further described in Exhibit C - Facility Description and Site Maps, including Seller’s rights to the Site and all of the following: the [Wind Turbines] [Solar Units], the Battery Units, buildings, generators, step-up transformers, output breakers, facilities necessary to connect to the Interconnection Point, protective and associated equipment, improvements, and other tangible and intangible assets, contract rights, Permits, easements, rights of way, surface use agreements and other interests or rights in real estate, owned or used for construction, operation, maintenance, generation and delivery of the capacity and Energy subject to this PPA.

“Facility Acquisition” shall have the meaning set forth in Section 19.5(A).

“Facility Debt” means the obligations of Seller or its Affiliates to any lender or tax equity or other investor pursuant to the Financing Documents, including principal of, premium and interest on indebtedness, fees, expenses or penalties, amounts due upon acceleration, prepayment or restructuring, swap or interest rate hedging breakage costs and any fees or interest due with respect to any of the foregoing.

“Facility Lender” means, collectively, any lenders, tax equity investors or other investors providing Facility Debt, including any successors or assigns thereof.

“Facility Nameplate Capacity” means the Solar Nameplate Capacity and the Battery Storage System Nameplate Capacity.

“Federal Power Act” means the provisions of 16 U.S.C. §791(A) *et seq.* and amendments or supplements thereto.

“FERC” means the Federal Energy Regulatory Commission or any successor agency.

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“Financing Documents” means the loan and credit agreements, notes, bonds, indentures, security agreements, lease financing agreements, equity contribution agreements, mortgages, deeds of trust, interest rate exchanges, swap agreements and other documents relating to the development, bridge, construction, back-leverage or permanent debt financing and/or tax equity financing for the Facility, including any credit enhancement, credit support, working capital financing, or refinancing documents, and any and all amendments, modifications, or supplements to the foregoing that may be entered into from time to time at the discretion of Seller in connection with development, construction, ownership, leasing, operation or maintenance of the Facility.

“FMV” means the “fair market value.”

“Forced Labor Laws” shall have the meaning set forth in 15.2(B).

“Force Majeure” shall have the meaning set forth in Section 14.1.

“Forced Outage” means any condition at the Facility that requires the immediate and unplanned removal of at least ten percent (10%) or five (5) MW, whichever is less of the capacity of the [Wind] [Solar] Facility or the Battery Storage System from service, or that results in a material deviation from the Guaranteed Performance identified in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels, another Outage state, or a reserve shutdown state, resulting from immediate mechanical/electrical/hydraulic control system trips and operator-initiated trips in response to abnormal Facility conditions or alarms.

“Generation Limit” shall have the meaning set forth in Section 8.1(B).

“Good Utility Practices” means the practices, methods, standards and acts engaged in or approved by a significant portion of the applicable segment of the electric power generation industry pertaining to facilities of the type, similar size and location to the Facility that, at a particular time, in the exercise of Commercially Reasonable judgment, in light of the facts that are known (or reasonably should have been known) at the time a decision was made, would have been expected to accomplish the desired result in a manner consistent with Applicable Law, Permits, codes, standards, equipment manufacturer’s recommendations, reliability, safety, environmental protection, economy, and expedition. Good Utility Practices is not limited to the optimum practice, method, standard or act to the exclusion of all others, but rather to those practices, methods, standards and acts generally acceptable or approved by a significant portion of the applicable segment of the electric power generation industry in the relevant region, during the relevant period. *[Wind Only: “Good Utility Practices include adherence to the United States Fish and Wildlife Services’ Land Based Wind Energy Guidelines] [Solar Only: Good Utility Practices include adherence to any applicable current or future federal or state best management practices or guidelines for solar energy development.]*

“Governmental Authority” means any federal, state, local or municipal

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governmental body; any governmental, quasi-governmental, regulatory or administrative agency, commission, body or other authority exercising or entitled to exercise any administrative, executive, judicial, legislative, policy, regulatory or taxing authority or power; and/or any court or governmental tribunal. By way of example only, "Governmental Authorities" include, but are not limited to, NERC, the ERO, the Market Operator (if any), an applicable PUC, the Transmission Authority, FERC, and successor organizations. For the avoidance of doubt, Company is not a Governmental Authority for purposes of this PPA.

"GSU Transformer" means a power transformer that is contained within the Facility and that increases the AC voltage of the electrical energy produced by the Facility to the AC voltage at which such electrical energy is delivered to Company at the Interconnection Point.

"GSU Transformer Failure" means the failure of a GSU Transformer; *provided, however*, that such failure requires the replacement or substantial remanufacturing of such GSU Transformer to return to service.

"Grid Charging Capability" shall have the meaning set forth in Exhibit M - Battery Storage System Testing Protocols.

"Grid Charging Energy" means energy withdrawn from the Transmission Authority's electrical system and delivered at the Point of Delivery used to charge the Battery Storage System and discharged at a later time.

"Grid Charging Energy Price" means the applicable price per MWh as determined by Company in its sole discretion pursuant to its cost calculator or, if Company has joined a regional transmission organization or is participating in an organized market for which nodal prices can be determined, the applicable nodal price per MWh as determined by Company in its sole discretion.

"Grid Discharging Energy" means Grid Charging Energy discharged by the Battery Storage System and delivered to the Point of Delivery.

"Guaranteed Maximum Charging Rate" shall have the meaning set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

"Guaranteed Maximum Discharging Rate" shall have the meaning set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

"Guaranteed Minimum Charging Time" shall have the meaning set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

"Guaranteed Minimum Discharging Time" shall have the meaning set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

"Guaranteed Performance" shall have the meaning set forth in Exhibit M-1 -

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Battery Storage System Guaranteed Performance Levels.

“Guaranteed Response Time” shall have the meaning set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

“Guaranteed Round Trip Efficiency” shall have the meaning set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

“Guaranteed Storage Capacity” shall have the meaning set forth in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

“Guarantor” shall have the meaning set forth in Section 11.3(C).

“Hazardous Materials” shall have the meaning set forth in Section 4.2(C)

“House Power” shall have the meaning set forth in Section 1.2(B).

“Indemnified Party” shall have the meaning set forth in Section 17.1.

“Indemnifying Party” shall have the meaning set forth in Section 17.1.

“Independent Engineer” means a qualified and independent third party engineering firm.

“Interconnection Agreement” means the separate contract for interconnection of the Facility to the Transmission Authority’s System, as such agreement may be amended from time to time. For purposes of this PPA, the Interconnection Agreement shall be interpreted to include any third party facility construction agreement or other agreement required by the Transmission Authority to interconnect the Facility in accordance with the Transmission Tariff. For the avoidance of doubt, “Interconnection Agreement” excludes any temporary or provisional interconnection agreement or any agreement where the Transmission Provider may limit the operational output of the Facility.

“Interconnection Facilities” means those facilities designated in the Interconnection Agreement for the direct purpose of interconnecting the Facility at the Interconnection Point, along with any easements, rights of way, surface use agreements and other interests or rights in real estate reasonably necessary for the construction, operation and maintenance of such facilities, whether owned by Seller, the Transmission Authority or another entity. This equipment is conceptually depicted in Exhibit C - Facility Description and Site Maps to this PPA.

“Interconnection Point” means the physical point within the operational authority of the Transmission Authority as specified in the Interconnection Agreement as project [REDACTED], at which electrical interconnection is made between the Facility and the Transmission Authority’s System in accordance with the Transmission Tariff and the Interconnection Agreement.

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“Investment Grade” means a Credit Rating of both (a) Baa3 or higher by Moody’s, and (b) BBB- or higher by Standard & Poor’s.

“Issuer” shall have the meaning set forth in Section 11.3(A).

[if applicable] “ITCs” means Investment Tax Credits applicable to electricity produced from solar energy resources pursuant to 26 U.S.C. §48 as in effect as of the Effective Date and as administered and interpreted under Applicable Law as of the Effective Date.

[if applicable] “ITC Period” means the period starting on the Commercial Operation Date and ending on the ____ (____th) anniversary of the Commercial Operation Date.

“kW” means kilowatt.

“kWh” means kilowatt hour.

“Lender Consent” shall have the meaning set forth in Section 18.1.

“Lender Notice” shall have the meaning set forth in Section 18.2(A).

“Letter of Credit” shall have the meaning set forth in Section 11.3(A).

“Liquidated Delay Damages” shall have the meaning set forth in Section 12.2.

“Local Provider” shall have the meaning set forth in Section 1.2(B).

“Losses” shall have the meaning set forth in Section 17.1.

“Maintenance Schedules” shall have the meaning set forth in Section 10.2(A).

“Market Operator” means the entity that instructs market participants and/or generators to regulate generation assets (including the Facility) within any energy market in which Company participates, based on price-based offer curves for the purpose of matching generation output to system load demand while maintaining bulk electric system reliability. If such entity is the Transmission Authority, then “Market Operator” shall mean such entity acting in its capacity as such.

“Material Adverse Effect” means any effect (or effects taken together) that is materially adverse to the present or future business, operations, assets, liabilities, properties, results in operations or condition (financial or otherwise), prospects, or property of a Party, its business, or this PPA.

“Maximum Charging Rate” means the maximum rate of charging (expressed in MW).

“Maximum Discharging Rate” means the maximum rate of discharging

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(expressed in MW).

“Minimum Charging Time” means the minimum amount of time to charge the Battery Storage System Nameplate Capacity measured in MWh divided by the Round-Trip Efficiency (expressed in units of time).

“Minimum Discharging Time” means the minimum amount of time to discharge the Battery Storage System Nameplate Capacity measured in MWh (expressed in units of time).

“MIPSA” means “member interest purchase and sale agreement.”

“Monthly Capacity Payment” shall have the meaning set forth in Section 8.4(A).

“Monthly Energy Payment” shall have the meaning set forth in Section 8.1(B).

“MPUC” means the Minnesota Public Utilities Commission or any successor agency.

“MW” means megawatt or one thousand kW, and “MWh” means megawatt hours or one thousand kWh.

“NDPSC” means the North Dakota Public Service Commission or any successor agency.

“NERC” means the North American Electric Reliability Corporation or any successor organization.

[if applicable] “Network Resource Interconnection Service” means the type of interconnection service which allows Seller to connect the Facility to the transmission or distribution system, as applicable, as a “Network Resource” as defined by the Transmission Tariff and be eligible to deliver the Facility’s output in a manner comparable to that in which the Transmission Authority integrates its generating facilities to serve native load customers.

“Operating Committee” means one representative(s) each from Company and Seller, pursuant to Section 10.8.

“Operating Day” means a day within the Delivery Period on which the Battery Storage System operates.

“Operating Records” means all agreements associated with the Facility, operating logs, blueprints for construction, operating manuals, all warranties on equipment, and all documents, whether in printed or electronic format, that Seller uses or maintains for the operation of the Facility.

“Option” means Company’s rights to purchase the Facility on the terms and

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conditions set forth in Section 19.5.

“Option Preliminary Exercise Notice” shall have the meaning set forth in Section 19.5(A).

“Outage” means any period during which the capacity of the Battery Storage System is unavailable for any reason as reported by the SCADA System in accordance with Exhibit O - Battery Storage System Operating Procedures.

“Park Potential” means the number of MW that depicts Seller’s real time calculation of the Potential Energy capable of being provided by the [Wind] [Solar] Facility to Company at the Point of Delivery. Park Potential shall be calculated using the best-available data obtained through Commercially Reasonable methods; and shall be dependent upon [Solar] measured solar irradiance, power curves, [Wind Turbines] [Solar Units] availability, and derate(s) and transmission line losses, and any other adjustment necessary to accurately reflect the Potential Energy at the Point of Delivery; and, at any given moment in time, may not exceed the [Wind] [Solar] Nameplate Capacity. Park Potential should be provided to Company in real time through Company’s SCADA System in accordance with the AGC Protocols. Park Potential shall remain within a measured difference of plus or minus two percent (2%) between the metered Renewable Energy and Park Potential, during periods when generation is not curtailed.

“Party” and “Parties” shall have the meanings set forth in the introductory paragraph.

“Performance Criteria” mean the performance test elements set forth in Exhibit M - Battery Storage System Testing Protocols.

“Permits” shall have the meaning set forth in Section 4.3.

“Pending Facility Transaction” or “PFT” shall have the meaning set forth in Section 19.4(D).

“Periodic Test” shall have the meaning set forth in Section 5.6(B).

“PFT Notice” shall have the meaning set forth in Section 19.4.

“PI System” means the “plant information” system for the Facility or other data collection systems, as described and implemented in Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection.

“Point of Delivery” means the physical point within the operational authority of Transmission Authority at which (i) Seller makes available and delivers to Company the Energy and (ii) Company makes available and delivers to Seller the Grid Charging Energy being provided by Company to Seller under this PPA. The Point of Delivery is specified in Exhibit C - Facility Description and Site Maps.

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“Potential Energy” for any period of time means the MWh of Renewable Energy that the Facility is actually capable of delivering to the Point of Delivery by virtue of the Park Potential during such period; provided, that for the avoidance of doubt, the maximum net instantaneous output that the [Wind] [Solar] Facility shall be deemed to be able to deliver to the Point of Delivery for purposes of determining the Potential Energy shall not exceed the [Wind] [Solar] Nameplate Capacity.

“PPA” shall have the meaning set forth in the introductory paragraph.

“PSA” means purchase and sale agreement.

[if applicable] “PTCs” means Production Tax Credits applicable to electricity produced from certain wind energy resources pursuant to 26 U.S.C. §45, as in effect as of the Effective Date and as administered and interpreted under Applicable Law as of the Effective Date.

[if applicable] “PTC Period” means the period starting on the Commercial Operation Date and ending on the tenth (10th) anniversary of the Commercial Operation Date.

“PUC Approval” shall have the meaning set forth in Section 6.1(D).

“Purchase Price” shall have the meaning set forth in Section 19.5(G).

“Qualified Operator” means an operator of [wind] [solar] generation facilities that has sufficient experience to successfully operate the Facility, including (a) a minimum of three (3) years’ experience in the [wind] [solar] energy generation and operation business, and owns, controls or operates (or has owned, controlled or operated) a minimum of 300 MW of [wind] [solar] energy generation capacity in aggregate, and (b) a minimum of one (1) year of experience in the battery energy storage business, and owns, controls or operates a minimum of 20 MW and 40 MWh of battery energy storage capacity in aggregate with at least one facility that has at least 5 MW and 10 MWh of battery energy storage capacity.

“Ramp Rate” shall have the meaning set forth in Exhibit M - Battery Storage System Testing Protocols.

“Real Time Data” shall have the meaning set forth in Section 10.6(A).

“REC Registration Program” means the current or successor State, regional, or federal program established to register Eligible Energy Resources, and create and certify RECs arising from such Resources, including any rights associated with any renewable energy information or tracking system that exists or may be established by Applicable Law with regard to monitoring, registering, tracking, certifying, or trading such credits. For purposes of this PPA, the REC Registration program shall mean the Midwest Renewable Energy Tracking System (M-RETS).

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“Recovery Plan” means, with respect to Seller’s failure to achieve a Critical Path Development Milestone under Section 4.1(B), a plan (confirmed by a qualified consultant, vendor or expert reasonably acceptable to Company) indicating in sufficient detail, to Company’s reasonable satisfaction, the steps to be taken by Seller to achieve the missed Critical Path Development Milestone by a date certain, which date shall be the earliest reasonable date for achievement of the Critical Path Development Milestone, but shall not exceed ninety (90) days following the completion deadline set forth in Section 4.1(B) for such Critical Path Development Milestone. If the date certain identified in a Recovery Plan is later than the completion deadline(s) for any other Critical Path Development Milestone(s) (as those deadlines are set forth in Section 4.1(B)), then such Recovery Plan shall also describe the impacts, if any, to such other Critical Path Development Milestone(s); *provided, however*, that Seller shall remain responsible for achieving such other Critical Path Development Milestone(s), as set forth in Section 4.1(B), Section 12.2(A), and Section 12.2(B).

“Renewable Energy” means all electric energy generated by the Facility and delivered to Company at the Point of Delivery during the Term, including all Test Energy and any Excess Energy purchased by Company. “Renewable Energy” shall be deemed to include all Environmental Attributes associated with such electric energy.

“Renewable Energy Credits” or “RECs” means the right to all non-energy attributes (including economic, carbon and pollutant-related tags and credits, benefits, avoided or reduced emissions reductions, offsets, emission rate reductions, tags and allowances, howsoever titled) attributable to the capacity available and/or energy generated by the [Wind] [Solar] Facility, including environmental air quality credits, tags and allowances created by Applicable Law by virtue of the [Wind] [Solar] Facility’s environmentally favorable or renewable characteristics or attributes. “RECs” includes but is not necessarily limited to rights eligible for registration, trading and/or use under the REC Registration Program. In Minnesota and Wisconsin, “REC” shall include renewable energy credits (as used in §7835-5950 of the Minnesota Administrative Rules), and renewable energy certificates (as defined in PSC 118.02 of the Wisconsin Administrative Code) with respect to one MWh of Renewable Energy, as applicable. “Renewable Energy Payment Rate” shall have the meaning set forth in Exhibit J - Energy Payment Rate; Committed Energy; Capacity Payment Rate. “Repair Plan” shall have the meaning set forth in Section 10.3(A).

“Replacement Power Costs” for any period mean the costs incurred by Company to replace the products and services which Seller was required to provide under this PPA (but failed to so provide) during such period, less the sum of any payments from Company to Seller under this PPA that were eliminated with respect to such period as a result of such failure. Replacement Power Costs shall be determined on an hourly basis and shall equal the sum of the following for each hour where the following calculation achieves a positive number:

$$\text{Hourly Replacement Power Costs} = (A + B + C + D) - E, \text{ where}$$

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“A” = the product of (x) the number of MW of lost capacity, derived by subtracting the number of MW of capacity of the Facility that qualifies for capacity credit actually made available to Company from the amount of qualifying capacity associated with the entire Facility, and (y) the applicable market price for capacity made available to Company’s system, for such hour;

“B” = the price paid by Company for the MWh of energy purchased by Company to replace the Energy that was not delivered under this PPA during such hour;

“C” = the product of (x) the number of MWh of energy purchased by Company with respect to such hour, to replace the Energy that was not delivered under this PPA, and (y) the actual cost of registered RECs for that number of MWh, for such hour;

“D” = the actual cost of transmission, Ancillary Services, fuel and fuel transportation, other incremental costs, and any related penalties that could not be avoided or mitigated, and transaction charges to deliver reasonably available energy to Company in amounts equal to the number of MWh for which Replacement Power Costs are owed; and

“E” = the sum of all payments avoided by Company as a result of Seller’s breach, for such hour, including avoided payments under Article 8 -.

For the avoidance of doubt, Replacement Power Costs shall never be less than zero.

“Response Time” means the amount of time for the Battery Storage System to respond to Company’s Dispatch Notice.

“ROFO” means “Right of First Offer.”

“ROFO Notice” shall have the meanings set forth in Section 19.3(A).

“Round-Trip Efficiency” or “RTE” shall have the meaning set forth in Exhibit M - Battery Storage System Testing Protocols.

“Round-Trip Efficiency Adjustment” shall have the meaning set forth in Section 8.4

“Safety Requirements” means those requirements set forth in Exhibit P - Safety Requirements, in addition to any other safety-related practices required by Applicable Law and Good Utility Practices.

“SCADA System” or “SCADA” means supervisory control and data acquisition.

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“Scheduled Termination Date” shall have the meaning set forth in Article 2 -.

“Security Fund” shall have the meaning set forth in Section 11.1.

“Self-Discharge Rate” is defined as the loss of State of Charge within the Battery Storage System while idle.

“Seller” shall have the meaning set forth in the introductory paragraph.

“Seller Excuse Hours” means those hours during which Seller is unable to schedule or deliver Energy to Company as a result of (A) a Curtailment (but only to the extent such Curtailment does not result from Seller’s failure to perform under this PPA or the Interconnection Agreement or Seller’s failure to observe Good Utility Practices), (B) Force Majeure; (C) a GSU Transformer Failure, such GSU Transformer Failure not to exceed in the aggregate eighteen (18) months in duration for the Term, or (D) Company’s failure to perform. *For the avoidance of doubt*, for purposes of this definition, GSU Transformer Failure applies only to the [Wind] [Solar] Facility.

“Seller Initiated Test” shall have the meaning set forth in Section 5.6(D).

“Site” means the parcel of real property on which the Facility will be located, including any easements, rights of way, surface use agreements and other interests or rights in real estate necessary for the construction, operation and maintenance of the Facility. The Site is more specifically described in Exhibit C - Facility Description and Site Maps to this PPA.

“Scheduled Maintenance Energy or SME” shall have the meaning set forth in Section 8.4(A).

[place in proper alphabetical order] [Wind] [Solar] “[Wind] [Solar] Charging Energy” means the electric energy used to charge the Battery Storage System that is supplied by the output of the [Wind] [Solar] Facility.

[place in proper alphabetical order] [Wind] [Solar] “[Wind] [Solar] Discharging Energy” means Renewable Energy discharged by the Battery Storage System, less transformation and transmission losses, if any, and delivered to the Point of Delivery.

[place in proper alphabetical order] [Wind] [Solar] “[Wind] [Solar] Facility” means that portion of the Facility that is required to generate Renewable Energy using the [Wind Turbines] [Solar Units], including generators, step-up transformers, output breakers, facilities necessary to connect the [Wind] [Solar] Facility to the Interconnection Point, protective and associated equipment, improvements, and other tangible and intangible assets, contract rights, Permits, easements, rights of way, surface use agreements and other interests or rights in real estate, owned or used for construction, operation, maintenance, generation and delivery of the foregoing.

[place in proper alphabetical order] [Wind] [Solar] “[Wind] [Solar] Nameplate Capacity”

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of the [Wind] [Solar] Facility means the sum of the designed maximum outputs of each [Wind Turbine] [Solar Unit] comprising the [Wind] [Solar] Facility expressed in MWs, as designated by the manufacturer, as measured at the Interconnection Point, as set forth in Section 3.2. For the avoidance of doubt, the [Wind] [Solar] Nameplate Capacity may not be greater than the interconnection capacity specified in the Interconnection Agreement.

[solar only] “Solar Units” means the photovoltaic arrays, mirrors, lenses, tracking devices and other equipment necessary for the Solar Facility to collect sunlight at the Site and convert it into electricity or thermal energy. The manufacturer and model number of the Solar Units will be identified on Exhibit C - Facility Description and Site Maps.

“State of Charge” or “SOC” means the amount of electric energy in a Battery Unit expressed as a percent of the Storage Capacity.

“Storage Capacity” means the amount of energy that the Battery Storage System can hold, measured in MWh or MW, as applicable and measured at the Point of Delivery.

“Successful Repair” shall have the meaning set forth in Section 10.3(A).

“Target COD” shall have the meaning set forth in Section 4.5(A).

“TE Partnership” shall have the meaning set forth in Section 19.5(A).

“Technical Dispute” shall have the meaning set forth in Section 13.1(A).

“Term” means the period of time during which this PPA remains in full force and effect, as further defined in Article 2 -.

“Test” means the Commercial Operation Test, Periodic Test, and other discretionary testing identified in Section **Error! Reference source not found.** referred to individually as a “Test” and jointly as the “Tests”.

“Test Energy” shall have the meaning set forth in Section 4.6(C).

“Transmission Authority” means collectively those entities owning and/or operating the interconnected transmission system applicable to Seller and the Facility pursuant to a Transmission Tariff, including (i) Company operating under and in accordance with its Transmission Tariff, and (ii) all entity(ies) responsible under the Interconnection Agreement for providing the transmission lines, any Interconnection Facilities and other equipment and facilities with which the Facility interconnects at the Interconnection Point and transmission system.

“Transmission Authority’s System” means the contiguously interconnected electric transmission and sub-transmission facilities, over which the Transmission

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Authority has rights (by ownership or contract) to provide bulk transmission of capacity and energy from the Interconnection Point.

“Transmission Tariff” means the applicable Open Access Transmission Tariff of the Transmission Authority, as amended from time to time.

“UFLPA” means the Uyghur Forced Labor Prevention Act, Pub. L. 117-78 (2021).

“Ultimate Parent” shall have the meaning set forth in the definition of Change of Control.

[wind only] “Wind Turbine(s)” means the wind-energy generating devices that are included in the Facility. The manufacturer and model number of the Wind Turbines is identified on Exhibit C - Facility Description and Site Maps.

* * * * *

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Exhibit B - CONSTRUCTION MILESTONES

Construction

Milestone	Outcome
[Date]	Seller and all required counterparties shall have executed such Construction Contracts as are needed to construct the Facility.
[Date]	Seller and the Transmission Authority shall have executed the Interconnection Agreement.
[Date]	Seller shall have achieved closing on financing for the Facility or provided Company with proof of financial capability to construct the Facility.
[Date]	Commencement of construction of the Facility.
[Date]	Procurement of Battery Units.
[Date]	Seller shall have laid the foundation for all Facility buildings, generating facilities and step-up transformation facilities.
[Date]	The [Wind Turbines] [Solar Units], step-up transformer, and Battery Units shall have been delivered and installed at the Site.
[Date]	Seller has submitted to Company and obtained Company approval of serialized information for all Electric Metering Devices and Back-Up Metering.
[Date]	Seller's Interconnection Facilities shall have been constructed, and such facilities are capable of being energized.
[Date]	Seller has demonstrated to Company's reasonable satisfaction that all Electric Metering Devices and Back-Up Metering and communications equipment are functional and provide data integrity.
[Date]	Start-up testing of the Facility commences.
[Date]	Seller shall make all applications and/or filings required by Applicable Law for REC accreditation and for the assignment of such RECs to Company.

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Exhibit C - FACILITY DESCRIPTION AND SITE MAPS

[This Exhibit shall include a description of the Facility and all material components thereof, including map, aerial pictures, AC one-line diagram showing metering point(s), Point of Delivery and (if different) the Interconnection Point as well as the manufacturer and model numbers of the Battery Units and the [Wind Turbines] [Solar Units].

The Facility shall be located on the Site and shall be identified as Seller's [REDACTED] Generation Facility. Maps and one-line diagrams of the Facility and associated equipment are included as part of this Exhibit, as may be updated from time to time.

The address of the Facility is [REDACTED], Latitude: [REDACTED], Longitude: [REDACTED].

Point of Delivery located at [REDACTED].

The Facility and the Battery Storage System must include the following specific components:

- * Major equipment including PV modules, batteries, and grid-forming (GFM) inverters¹ without any inherent limitations for alignment and conformance with IEEE Std. 2800-2022².
- * Available panel space and 125VDC battery supplied voltage necessary to accommodate the metering, telemetering and communications equipment required by this PPA.
- * Communication circuits from the Facility to the EMCC for the purpose of telemetering, supervisory control/data acquisition, and voice communications as required by

¹ Grid-Forming (GFM) Control of Inverter-Based Resources (IBRs) refers to their ability to set up and control (i.e. "form") the grid voltage and frequency. GFM control sets an internal voltage waveform reference such that an IBR with GFM control shall be able to synchronize with the grid and regulate active and reactive power generation appropriately, regardless of the grid's strength. An IBR with GFM control shall immediately respond to grid disturbances to support stability of the grid and maintain its own control stability during the system disturbance.

² "IEEE Standard for Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power Systems," IEEE STD.2022.9762253.

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Company.

- * Equipment and software necessary to receive, accept and react to an AGC signal from the Company's SCADA System and to comply with the AGC Protocols as further specified on Exhibit I - AGC Protocols; Dispatch and Availability Reporting; Data Collection.
- * Ramping capability, reactive power - voltage control capability and active power - frequency response capability pursuant to NERC guidelines/requirements and applicable sections of IEEE Std. 2800-2022, including but not limited to Section 5 "Reactive power-voltage control requirements within the continuous operation region", and Section 6 "Active-power – frequency response requirements".
- * Facility has Low Voltage Ride-Through (LVRT) Capability described under FERC Order No. 661 and meets the requirements for Reactive Power Design Criteria under FERC Order No. 827.
- * Capability of sending real time data and OPC interface to Company's PI System.
- * [Solar only] DC and AC capacity of Facility (from Seller's bid)[_____ DC][_____ AC].
- *[wind – insert make, model and number of turbines.]
- *[wind] Each Wind Turbines equipped with meteorological measurement equipment (e.g., anemometers), individually linked to Seller's information system.
- * [wind] Facility is capable of operating at an ambient temperature down to -30° Celsius (-22° Fahrenheit).

The proposed Facility includes the components that are equivalent to, or better than, the following:

- [Additional Bid Specific information to be added]

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Exhibit D - NOTICES AND CONTACT INFORMATION

<u>Company</u>	<u>Seller</u>
Notices: Director, Purchased Power Xcel Energy Services Inc. 1800 Larimer Street, Suite 1000 Denver, CO 80202 E-mail: purchasedpowernotices@xcelenergy.com <i>with a cc to:</i> Purchased Power Consultant Xcel Energy Services Inc. 1800 Larimer Street, Suite 1000 Denver, CO 80202 E-mail: purchasedpowernotices@xcelenergy.com	Notices: Phone: E-mail: @ .com <i>with a cc to:</i> Phone: E-mail: @ .com
Operating Committee Representative: Director, Purchased Power Xcel Energy Services Inc. 1800 Larimer Street, Suite 1000 Denver, CO 80202 E-mail: purchasedpowernotices@xcelenergy.com Alternate: Purchased Power Consultant Xcel Energy Services Inc. 1800 Larimer Street, Suite 1000 Denver, CO 80202 E-mail: purchasedpowernotices@xcelenergy.com	Operating Committee Representative: Phone: E-mail: @ .com Alternate: Phone: E-mail: @ .com
Real-Time Contact Information <u>EMCC</u> (24-hour coverage): Phone: 303-571-7426	Real-Time Contact Information <u>[Operations Command Center]</u> (24-hour coverage):

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E-mail: dlrtelectricmarketersnsp@xcelenergy.com <u>Transmission Ops:</u> Phone: 303-273-4811 E-mail: AGCOpr@xcelenergy.com	Phone: E-mail:

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Exhibit E - INSURANCE COVERAGE

Type of Insurance	Minimum Limits of Coverage
Commercial General Liability (CGL) and commercial umbrella	\$11,000,000 combined single limit each occurrence and the aggregate, where applicable. If CGL insurance contains a general aggregate limit, it shall apply separately to the Facility.

CGL insurance shall be written on ISO occurrence form CG 00 01 01 96 (or a substitute form providing equivalent coverage) and shall cover liability arising from premises, operations, independent contractors, products/completed operations, contracts, property damage, personal injury and advertising injury, and liability assumed under an insured contract (including the tort liability of another assumed in a business contract), all with limits as specified above. CGL insurance shall include ISO endorsement CG 24 17 (or an equivalent endorsement) which modifies the definition of "Insured contract" to eliminate the exclusion of easement or license agreements in connection with construction or demolition operations on or within 50 feet of a railroad. There shall be no endorsement or modification of the CGL insurance limiting the scope of coverage for liability arising from explosion, collapse, or underground property damage.

Company shall be included as an insured under the CGL policy, using ISO additional insured endorsement CG 20 10 (or a substitute providing equivalent coverage), and under the commercial umbrella insurance. The commercial umbrella insurance shall provide coverage over the top of the CGL insurance, the Business Automobile Liability insurance, and the Employers Liability insurance. The CGL and commercial umbrella insurance to be obtained by or on behalf of Seller shall be endorsed as follows:

Such insurance as afforded by this policy for the benefit of Company shall be primary as respects any claims, losses, damages, expenses, or liabilities arising out of this PPA, and insured hereunder, and any insurance carried by Company shall be excess of and noncontributing with insurance afforded by this policy.

Business Automobile Liability	\$2,000,000 combined single limit (each accident), including all Owned, Non-Owned, Hired and Leased Autos.

Business Automobile Liability insurance shall be written on ISO form CA 00 01, CA 00 05, CA 00 12, CA 00 20, or a substitute form providing equivalent liability coverage. If necessary, the policy shall be endorsed to provide contractual liability coverage equivalent to that provided in the 1990 and later editions of CA 00 01.

Workers Compensation	Statutory Requirements. Seller may comply with these requirements through the use of a

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	qualified self-insurance plan.

Type of Insurance	Minimum Limits of Coverage

Employers Liability	\$2,000,000 each accident for bodily injury by accident, or \$2,000,000 each employee for bodily injury by disease.

Builder's Risk	Replacement value of the Facility.

Builder's Risk insurance, or an installation floater, shall include coverage for earthquake and flood, collapse, faulty workmanship, materials and design, testing of machinery or equipment, freezing or changes in temperature, debris removal, and partial occupancy.

Environmental Impairment Liability	\$5,000,000 each occurrence.

All-Risk Property insurance covering physical loss or damage to the Facility	Full replacement value of the Facility. A deductible may be carried which deductible shall be the absolute responsibility of Seller.

All-Risk Property insurance shall include: (i) coverage for fire, flood, wind and storm, tornado and earthquake with respect to facilities similar in construction, location and occupancy to the Facility, with sublimits of no less than \$10,000,000 each for flood and earthquake; and (ii) Boiler and Machinery insurance covering all objects customarily subject to such insurance, including boilers and turbines, in an amount equal to their full replacement value.

Business Interruption insurance	Amount required to cover Seller's continuing or increased expenses, resulting from full interruption, for a period of 12 calendar months.

Business Interruption insurance shall cover loss of revenues or the increased expense to resume operations attributable to the Facility by reason of total or partial suspension or delay of, or interruption in, the operation of the Facility as a result of an insured peril covered under Property insurance as set forth above, to the extent available on Commercially Reasonable terms as determined by Company, subject to a Commercially Reasonable deductible that shall be the responsibility of Seller. Notwithstanding any other provision of this PPA, Seller shall not be required to have Business Interruption insurance until the Commercial Operation Date.

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Exhibit F - SELLER'S NEEDED PERMITS

[Bid Specific]

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Exhibit G - FORM OF LETTER OF CREDIT

[LETTERHEAD OF ISSUING BANK]

Irrevocable Standby Letter of Credit No: _____ Date of Issuance: _____

Beneficiary: Northern States Power
Company a [Minnesota or Wisconsin]
corporation

Initial Expiration Date: [Must be at least
one year after date of issuance]

Applicant:

As the Issuing Bank ("Issuer"), we, [Name of Issuing Bank], hereby establish this irrevocable Standby Letter of Credit No. _____ (this "Letter of Credit") in favor of the above-named beneficiary ("Beneficiary") for the account of the above-named applicant ("Applicant") in the amount of US\$_____ (_____ Million U.S. Dollars).

Beneficiary may draw all or any portion of this Letter of Credit at any time and from time to time, and Issuer will make funds immediately available to Beneficiary upon presentation of Beneficiary's draft(s) at sight in substantially the form attached hereto as Exhibit "A" ("Sight Draft"), drawn on Issuer and accompanied by this Letter of Credit. All Sight Drafts must be signed on behalf of Beneficiary, and the signator must indicate his or her title or other official capacity. No other documents will be required to be presented. Issuer will effect payment under this Letter of Credit within twenty-four (24) hours after presentment of any Sight Draft. Payment shall be made in U.S. Dollars with Issuer's own funds in immediately available funds.

Issuer will honor any Sight Draft presented in substantial compliance with the terms of this Letter of Credit at the Issuer's letterhead office, the office located at _____ or any other full service office of the Issuer on or before the above-stated expiration date, as such expiration date may be extended hereunder. Partial and multiple draws and presentations are permitted on any number of occasions. Following any partial draw, Issuer will endorse this Letter of Credit and return the original to Beneficiary.

This Letter of Credit is issued pursuant to the provisions of that certain [Wind] [Solar] Generating and Battery Storage Energy Purchase Agreement between Beneficiary and Applicant dated as of _____, 20__ (as the same may have been or may be amended from time to time, the "PPA"). Notwithstanding any reference in this Letter of Credit to this PPA or any other documents, instruments or agreements, or references in this PPA or any other documents, instruments or agreements to this Letter of Credit, this Letter of Credit contains the entire agreement between Beneficiary and Issuer relating to the obligations of Issuer hereunder.

This Letter of Credit will be automatically extended each year without amendment for a period of one (1) year from the expiration date hereof, as extended, unless at least thirty

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(30) days prior to the expiration date, Issuer notifies Beneficiary by registered or certified mail that it elects not to extend this Letter of Credit for such additional period. Notice of non-extension will be given by Issuer to Beneficiary at Beneficiary's address set forth herein or at such other address as Beneficiary may designate to Issuer in writing at Issuer's letterhead address.

This Letter of Credit is freely transferable by Beneficiary in whole or in part, and the number of transfers is unlimited. Issuer shall effect any transfers immediately upon presentation to Issuer of this Letter of Credit and a completed written transfer request substantially in the form attached hereto as Exhibit "B." Such transfer will be effected at no cost to Beneficiary. Any transfer fees assessed by Issuer will be payable solely by Applicant, and the payment of any transfer fees will not be a condition to the validity or effectiveness of the transfer of this Letter of Credit.

Issuer waives any rights it may have, at law or otherwise, to subrogate to any claims which Beneficiary may have against Applicant or Applicant may have against Beneficiary.

This Letter of Credit is subject to the uniform customs and practice for documentary credits (2007 Revision), International Chamber of Commerce publication No. 600 (the "UCP"), except to the extent that the terms hereof are inconsistent with the provisions of the UCP, including but not limited to Articles 14(b) and 36 of the UCP, in which case the terms of this Letter of Credit shall govern. With respect to Article 14(b) of the UCP, Issuer shall have a reasonable amount of time, not to exceed three (3) banking days following the date of Issuer's receipt of documents from Beneficiary (to the extent required herein), to examine the documents and determine whether to take up or refuse the documents and to inform Beneficiary accordingly.

In the event of an act of God, riot, civil commotion, insurrection, war or any other cause beyond Issuer's control that interrupts Issuer's business and causes the place for presentation of this Letter of Credit to be closed for business on the last day for presentation, the expiry date of this Letter of Credit will be automatically extended without amendment to a date thirty (30) calendar days after the place for presentation reopens for business.

ISSUER:

By: _____
Authorized Signature

EXHIBIT "A"
TO LETTER OF CREDIT

SIGHT DRAFT

Draft Number _____
\$ _____

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At sight, pay to the order of [Name of Beneficiary to be inserted], the amount of USD \$ _____ (_____ and 00/100ths U.S. Dollars).

Value received and charged to the account of: [Name of Issuer and address].
Drawn under [Name of Issuer to be inserted] Standby Letter of Credit No. _____.

Dated: _____

Northern States Power Company,
a [Minnesota or Wisconsin] corporation

By: _____
[name and title]

Account: [Applicant to be inserted]

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EXHIBIT "B"
TO LETTER OF CREDIT

FORM OF TRANSFER REQUEST

Irrevocable Standby Letter of Credit No. _____

Current Beneficiary:

Applicant:

To: [Name of Issuer] ("Issuer")

The undersigned, as the current "Beneficiary" of the above-referenced Letter of Credit, hereby requests that you reissue the Letter of Credit in favor of the transferee named below [insert transferee name and address below]:

From and after the date this transfer request is delivered to Issuer, the transferee shall be the "Beneficiary" under the Letter of Credit for all purposes and shall be entitled to exercise and enjoy all of the rights, privileges and benefits thereof.

Dated: _____

Northern States Power Company,
a [Minnesota or Wisconsin] corporation

By: _____

Name: _____

Title: _____

[Notary Acknowledgement]

To be signed by a person purporting to be an authorized representative of Beneficiary and indicating his or her title or other official capacity, and acknowledged by a notary public.

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Exhibit H - FORM OF GUARANTY

GUARANTY

This Guaranty is executed and delivered as of this ____ day of _____, 20__ by _____, a _____ [corporation] ("Guarantor"), in favor of Northern States Power Company, a [Minnesota or Wisconsin] corporation ("Company"), in connection with the performance by _____, a _____ [limited liability company] ("Seller") of a [Wind] [Solar] Generating and Battery Storage Energy Purchase Agreement dated _____, 20__ between Seller and Company (the "PPA").

- RECITALS -

A. Seller proposes to construct, own and operate a [Wind] [solar] power electric generation and Battery Storage System having a [Wind] [Solar] Nameplate Capacity of approximately ____ MW and a Battery Storage System Nameplate Capacity of approximately ____ MW located in _____ County, _____ (the "Facility").

B. Seller and Company have entered into this PPA for the purchase and sale of electrical energy from the Facility on the terms and conditions set forth therein.

C. Seller is controlled by Guarantor. Guarantor expects to derive substantial benefits from the performance of this PPA by Seller and Company. To induce Company to enter into and continue this PPA and to consummate the purchase and sale of electrical energy contemplated by this PPA, Guarantor has agreed to guarantee the obligations of Seller as provided in this Guaranty.

NOW, THEREFORE, in consideration of the foregoing, Guarantor agrees as follows:

- AGREEMENT -

1. Guaranty. Subject to the provisions of this Guaranty, Guarantor hereby absolutely, irrevocably, unconditionally, and fully guarantees to Company the due, prompt, and complete observance, performance, and discharge of each and every payment obligation of Seller under this PPA, whether incurred before or after the date of delivery of this Guaranty (the "Obligations"). This is a guaranty of payment, not of collection, and as such, Company shall not be required to institute, pursue, or exhaust any remedies against Seller before instituting suit, obtaining judgment, and executing thereon against Guarantor under this Guaranty. This Guaranty shall survive termination of this PPA to the extent necessary to enforce and complete the rights, duties and obligations of Company and Seller thereunder.

2. Maximum Liability. Notwithstanding anything herein to the contrary,

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Guarantor's maximum liability under this Guaranty shall be limited to _____ Dollars (US\$_____) plus costs of collection under Section 10 below.

3. Rights of Company. Guarantor hereby grants to Company, in Company's discretion and without the need to notify or obtain any consent from Guarantor, and without termination, impairment, or any other effect upon Guarantor's duties hereunder, the power and authority from time to time:

(a) to renew, compromise, extend, accelerate, or otherwise change, substitute, supersede, or terminate the terms of performance of any of the Obligations, in each case in accordance with this PPA;

(b) to grant any indulgences, forbearances, and waivers, on one or more occasions, for any length of time, with respect to Seller's performance of any of the Obligations; and

(c) to accept collateral, further guaranties, and/or other security for the Obligations, and, if so accepted, then to impair, exhaust, exchange, enforce, waive, or release any such security.

4. Performance. If any of the Obligations are not performed according to the tenor thereof, and any applicable notice and cure period provided by this PPA has expired ("Default"), Guarantor shall immediately upon receipt of written demand by Company (a) perform or cause Seller to perform the Obligation in Default, and (b) pay, reimburse, and indemnify Company against any liabilities, damages, and related costs (including attorneys' fees) incurred by Company as a result thereof, all in such manner and at such times as Company may reasonably direct.

5. Satisfaction. Satisfaction by Guarantor of any duty hereunder incident to a particular Default or the occurrence of any other Default shall not discharge Guarantor except with respect to the Default satisfied, it being the intent of Guarantor that this Guaranty be continuing until such time as all of the Obligations have irrevocably been discharged in full, at which time this Guaranty shall automatically terminate. If at any time the performance of any Obligation by Seller or Guarantor is rescinded or voided under the U.S. Bankruptcy Code or otherwise, then Guarantor's duties hereunder shall continue and be deemed to have been automatically reinstated, restored, and continued with respect to that Obligation, as though the performance of that Obligation had never occurred, regardless of whether this Guaranty otherwise had terminated or would have been terminated following or as a result of that performance.

6. Notice of Acceptance. Guarantor waives and acknowledges notice of acceptance of this Guaranty by Company.

7. Waivers by Guarantor. Guarantor hereby waives and agrees not to assert or take advantage of:

(a) all set-offs, counterclaims, and, subject to Section 4 above, all

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presentments, demands for performance, notices of non-performance, protests, and notices of every kind that may be required by Applicable Laws;

(b) any right to require Company to proceed against Seller or any other person, or to require Company first to exhaust any remedies against Seller or any other person, before proceeding against Guarantor hereunder;

(c) any defense based upon an election of remedies by Company;

(d) any duty of Company to protect or not impair any security for the Obligations;

(e) the benefit of any laws limiting the liability of a surety;

(f) any duty of Company to disclose to Guarantor any facts concerning Seller, this PPA or the Facility, or any other circumstances, that would or allegedly would increase the risk to Guarantor under this Guaranty, whether now known or hereafter learned by Company, it being understood that Guarantor is capable of and assumes the responsibility for being and remaining informed as to all such facts and circumstances; and

(g) until all Obligations in Default have been fully paid and/or performed, any rights of subrogation, contribution, reimbursement, indemnification, or other rights of payment or recovery for any payment or performance by it hereunder. For the avoidance of doubt, if any amount is paid to Guarantor in violation of this provision, such amount shall be held by Guarantor for the benefit of, and promptly paid to, Company.

8. Cumulative Remedies. The rights and remedies of Company hereunder shall be cumulative and not alternative to any other rights, powers, and remedies that Company may have at law, in equity, or under this PPA. The obligations of Guarantor hereunder are independent of those of Seller and shall survive unaffected by the bankruptcy of Seller. Company need not join Seller in any action against Guarantor to preserve its rights set forth herein.

9. Representations and Warranties. Guarantor represents and warrants to Company as follows:

(a) Guarantor is a corporation, duly organized, validly existing, and in good standing under the laws of the state of its incorporation. Seller is a direct or indirect wholly-owned subsidiary of Guarantor. Guarantor has all necessary corporate power and authority to execute and deliver this Guaranty and to perform its obligations hereunder.

(b) The execution, delivery and performance of this Guaranty has been duly and validly authorized by all corporate proceedings of Guarantor and is not in violation of any law, judgment of court or government agency. This Guaranty has been duly and validly executed and delivered by Guarantor and constitutes a legal, valid and binding obligation of Guarantor, enforceable against Guarantor in accordance with its

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terms.

10. Collection Costs. Guarantor shall pay to Company, upon demand, and in addition to the maximum liability set forth in Section 2 hereof, all reasonable attorneys' fees and other expenses which Company may expend or incur in enforcing the Obligations against Seller and/or enforcing this Guaranty against Guarantor, whether or not suit is filed, including, without limitation all attorneys' fees, and other expenses incurred by Company in connection with any insolvency, bankruptcy, reorganization, arrangement, or other similar proceedings involving Seller that in any way affect the exercise by Company of its rights and remedies hereunder.

11. Severability. Should any one or more provisions of this Guaranty be determined to be illegal or unenforceable, all other provisions nevertheless shall be effective.

12. Waiver or Amendment. No provision of this Guaranty or right of Company hereunder can be waived, nor can Guarantor be released from Guarantor's duties hereunder, except by a writing duly executed by Company. This Guaranty may not be modified, amended, revised, revoked, terminated, changed, or varied in any way whatsoever except by the express terms of a writing duly executed by Company.

13. Successors and Assigns. This Guaranty shall inure to the benefit of and bind the successors and assigns of Company and Guarantor.

14. Governing Law. This Guaranty shall be governed by and construed in accordance with the law of the State of [Minnesota or Wisconsin] without regard to the principles of conflicts of law thereof. Venue for any dispute hereunder shall be as set forth in Section 13.5 of this PPA.

15. Notices. All notices, requests, claims, demands, and other communications hereunder shall be in writing and shall be given (and shall be deemed to have been duly given upon receipt) by delivery in the manner contemplated by this PPA, addressed as follows:

(a) if to Company: as provided in this PPA

(b) if to Guarantor: _____

Attn:

with a copy to: _____

Attn:

or to such other address (es) as the person to whom notice is given may have previously

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Exhibit I - AGC PROTOCOLS; DISPATCH AND AVAILABILITY REPORTING; DATA COLLECTION

AGC

1. **AGC communications between Company and Seller.** Company will receive and send AGC Set-Point and related data over a secure analog or digital line. The data points covered under this PPA, as described below, may overlap data requirements for the Transmission Authority or Company's applicable forecasting group. Latitude and longitude coordinates for the location of the AGC communications at the facility are: [REDACTED].

2. **AGC data points to be sent from Seller to Company via SCADA.** The following data points will be transmitted via SCADA from Seller to Company and represent the [Wind] [Solar] Facility level data:

Facility-Level Data Description	Unit
Actual Real Power [[wind] [solar] portion only]	MW
AGC Status	Remote/Local
AGC Set-Point (echo)	MW
Park Potential	MW
[Wind only] Number of Turbines online and running. [wind only] Number of Turbines online and running. [Solar only] Number of inverters online	

3. **Response times and limitations of Facility in regard to AGC.** The following protocols outline the expectations for responding to the AGC Set-Point. Except in the case of the frequency changes, these protocols will be generally bound by the manufacturers' specifications for the equipment that Seller has chosen for the Facility.

a. Allowable Variances in Excess of AGC Set-Point. Once the Facility (includes the [Wind] [Solar] and the Battery Storage System) has reached the AGC Set-Point, the Facility output may not exceed the AGC Set-Point by more than two percent (2%) on average as measured during a five (5)-minute period.

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[Wind and Solar only] Allowable Variances in Excess of Park Potential. Park Potential shall remain within a measured difference of plus or minus two percent (2%) between the metered Renewable Energy and Park Potential, during periods when generation is not curtailed.

b. [Wind only] Frequency of Changes. Company may send a new AGC Set-Point to the Facility as frequently as the Wind Turbine manufacturer specifications allow.

c. Range of AGC Set-Point. The range of set-point values can be between 0% and 100% of Park Potential.

4. **Backup Communications.** In the event of an AGC failure, Company and Seller shall communicate via telephone in order to correct the failure.

[solar]

DATA COLLECTION

Seller shall install at least two (2) meteorological stations, spaced such that all panels of the facility are located within a 5km maximum radius from a station. Each station shall provide the data points set forth below.

One meteorological station must be 10 meters in height and must be located as close to the geographic center of the Facility as possible, unshaded and unblocked by any Solar Panels. This meteorological station must measure wind speed, wind direction, ambient air temperature, back of panel temperature, barometric pressure, direct irradiance and plane of array irradiance.

All other meteorological stations must measure direct irradiance, plane of array irradiance and back panel temperature.

Each inverter shall be capable of transmitting the following data to Company: Inverter generation (kW); and Inverter availability.

At least two months prior to the Commercial Operation Date, Seller shall deliver to Company a report showing (i) manufacturer, model and year of all panels, inverters and meteorological instrumentation, (ii) the latitude and longitude of the center of the solar panels for every inverter and every meteorological station, and (iii) the locations, latitude and longitude of each pedestal, so as to allow Company to correlate the data Company receives to each individual station and inverter.

Beginning upon COD, Seller shall transmit and provide to Company from each meteorological station the real-time data set forth above, refreshed as frequently as allowed by the SCADA System, not to exceed sixty (60) second intervals.

Beginning upon COD, Seller shall transmit and provide to Company the following data

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from each inverter:

Six data points from each Inverter:

1. Inverter generation (kW)
2. Inverter Availability
3. Temperature – Back panel.
4. Temperature – Inverter (Celsius)
5. Potential Power
6. Power by Pedestal or logical location

The data stream from the meteorological station to the Company must be transmitted to Company via a dedicated communications link that is separate from the communications link used to transmit the data from the inverters. The data stream must be capable of being transmitted during an Outage or any Curtailment and must include battery back-up at the meteorological station and a local source of electricity to power the interconnectivity between the Facility and Company during such Outages and Curtailments.

Seller's system used to communicate the Facility's real time panels, inverters, or meteorological data shall be a dedicated communication interface installed on a dedicated Windows-based server, that is separate of the real time AGC data. Such interface shall be either (a) PI to PI, (b) OPC, (c) DNP3, (d) Modbus, or (e) such other interface approved by Company.

AVAILABILITY REPORTING REQUIREMENTS

a. Two (2) Days prior to COD, the availability reporting requirements shall go into effect.

The schedule of available generating capacity at the solar Facility shall be posted by 4:00 AM Mountain Prevailing Time ("MPT") the Day prior to each Day and shall be applicable through the end of such Day. For example, at 4 AM MPT on Monday, an availability schedule is required for Wednesday (midnight to midnight). On Tuesday, the schedule for Thursday, Wednesday the schedule for Friday, and so on. The schedule shall be submitted through an availability forecast system as specified by Company to Seller. Prior to the Commercial Operation Date, Company shall provide Seller with the information necessary for Seller to access the chosen availability forecast system.

b. If any events or circumstances reduce the forecasted availability of the Facility Nameplate Capacity by ten percent (10%) or 5 MW, whichever is lesser, such reduction shall be (1) communicated to the real-time operator via telephone with (2) immediate update to the availability schedule in the availability forecast system.

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c. Seller shall pay to Company any charges imposed on Company by the Market Operator to the extent such charges result from Seller's failure to submit an accurate and/or timely forecast of available generating capacity for the Facility.

EQUIVALENT AVAILABILITY REPORTING FACTOR

During each Commercial Operation Year, Seller shall achieve an Equivalent Availability Reporting Factor of not less than ninety percent (90%).

"Availability Percentage" means, during any given Outage, the percentage obtained by dividing the available capacity by the Facility Nameplate Capacity.

"Equivalent Availability Reporting Factor" shall be calculated as follows: $(\text{Hours} - \text{Total Equivalent Unreported Unavailable Hours} - \text{Total Equivalent Reported Unavailable Hours}) / (\text{Hours} - \text{Total Equivalent Reported Unavailable Hours})$.

"Equivalent Unavailable Hours" (Reported or Unreported) means, for any Outage, the product of (x) the number of hours during such Outage multiplied by (y) one minus the Availability Percentage during such Outage.

"Total Equivalent Unreported Unavailable Hours" means the sum of the number of Equivalent Unavailable Hours which are not reported by Seller to Company via the Company's availability forecast system and by telephone, if applicable, during the applicable month.

"Total Equivalent Reported Unavailable Hours" means the sum of the number of Equivalent Unavailable Hours which are reported by Seller to Company via the Company's availability forecast system and by telephone, if applicable, during the applicable month.

"Hours" means the total number of hours in such Commercial Operation Year.

* * * * *

[wind]

DATA COLLECTION

At least two months prior to the Commercial Operation Date, Seller will deliver to Company a report showing (i) manufacturer, model, and year of all Wind Turbines and meteorological instrumentation and (ii) the latitude, longitude and hub height at every Wind Turbine and meteorological station.

Beginning upon COD, Seller shall transmit and provide to Company the real-time data set forth below, refreshed in approximately four-ten (4-10) second intervals with regard to

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its generation of Renewable Energy at the Facility:

Six data points from each Wind Turbine:

1. Turbine generation (kW)
2. Wind Speed (meters per second - mps)
3. Turbine Availability
4. Wind Direction (in degrees relative to true north)
5. Ambient Temperature (Celsius)
6. Park Potential for each Turbine

Seller shall provide a map and key for each Wind Turbine sufficient to allow Company to correlate the data received through the PI System to each individual Wind Turbine.

In addition to any other requirements for data collection, Seller shall install, maintain and operate at least one meteorological station that is installed at hub height and is placed upstream of the prevailing wind path.

Beginning upon COD, Seller shall transmit and provide to Company the real-time data set forth below, refreshed in approximately four-ten (4-10) second intervals with regard to its generation of Renewable Energy at the Facility:

Seven data points from each Meteorological Station:

1. Wind Speed** (mps)
2. Wind Direction** (degrees relative to true north)
3. Temperature (Celsius)
4. Pressure (mb)
5. Air Density (kg/m³)
6. Relative Humidity
7. Present Weather Status/Ice Condition Metering

** = at all metered heights.

A second meteorological station is required to measure barometric pressure, temperature, wind speed and direction. The second meteorological station may be co-located on the primary meteorological station. The height of the second station should be approximately 30 meters below the average hub height.

The data stream from the meteorological stations to the Company's PI System must be transmitted to Company via a dedicated communications link that is separate from the communications link used to transmit the data from the wind turbines. The data stream must be capable of being transmitted during an Outage or any Curtailment and must include battery back-up at the meteorological station and a local source of electricity to power the PI System and interconnectivity between the Facility and Company during such Outages and Curtailments.

Seller's system used to communicate the Facility's real time panels, inverters, or

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meteorological data shall be a dedicated communication interface installed on a dedicated Windows-based server, that is separate of the real time AGC data. Such interface shall be either (a) PI to PI, (b) OPC, (c) DNP3, (d) Modbus, or (e) such other interface approved by Company.

AVAILABILITY REPORTING REQUIREMENTS

Two (2) Days prior to COD, the availability reporting requirements shall go into effect.

The schedule of available generating capacity at the wind Facility shall be posted by 4:00 AM Mountain Prevailing Time ("MPT") the Day prior to each Day and shall be applicable thorough the end of such Day. For example, at 4 AM MPT on Monday, an availability schedule is required for Wednesday (midnight to midnight). On Tuesday, the schedule for Thursday, Wednesday the schedule for Friday, and so on. The availability schedule shall be submitted through an availability forecast system as specified by Company to Seller. Prior to the Commercial Operation Date, Company shall provide Seller with the information necessary for Seller to access the chosen availability forecast system.

If any events or circumstances reduce the forecasted availability of the Facility Nameplate Capacity by ten percent (10%) For 5 MW, whichever is lesser, such reduction shall be (1) communicated to the real-time operator via telephone with (2) immediate update to the availability schedule in the availability forecast system.

Seller shall pay to Company any charges imposed on Company by the Market Operator to the extent such charges result from Seller's failure submit an accurate and/or timely forecast of available generating capacity for the Facility.

EQUIVALENT AVAILABILITY REPORTING FACTOR

During each Commercial Operation Year, Seller shall achieve an Equivalent Availability Reporting Factor of not less than ninety percent (90%).

"Availability Percentage" means, during any given Outage, the percentage obtained by dividing the available capacity by the Facility Nameplate Capacity.

"Equivalent Availability Reporting Factor" shall be calculated as follows: $(\text{Hours} - \text{Total Equivalent Unreported Unavailable Hours} - \text{Total Equivalent Reported Unavailable Hours}) / (\text{Hours} - \text{Total Equivalent Reported Unavailable Hours})$.

"Equivalent Unavailable Hours" (Reported or Unreported) means, for any Outage, the product of (x) the number of hours during such Outage multiplied by (y) one minus the Availability Percentage during such Outage.

"Total Equivalent Unreported Unavailable Hours" means the sum of the number of

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Equivalent Unavailable Hours which are not reported by Seller to Company via the Company's availability forecast system and by telephone, if applicable, during the applicable month.

"Total Equivalent Reported Unavailable Hours" means the sum of the number of Equivalent Unavailable Hours which are reported by Seller to Company via the Company's availability forecast system and by telephone, if applicable, during the applicable month.

"Hours" means the total number of hours in such Commercial Operation Year.

* * * * *

[Battery Storage System]

AVAILABILITY REPORTING REQUIREMENTS

- a. The Battery Storage System availability schedule shall be posted at 4:00 AM two (2) Business Days prior to the applicable Day and shall be applicable through the end of such Day. For example, on Monday, an availability schedule is required for Wednesday (midnight to midnight). On Tuesday, the schedule for Thursday. On Wednesday, the schedule for Friday, and so on. The schedule shall be submitted through an availability scheduling system as specified by Company to Seller. Prior to the Commercial Operation Date, Company shall provide Seller with the information necessary for Seller to access the chosen availability scheduling system.
- b. If any events or circumstances reduce the scheduled availability of the Battery Storage System by ten percent (10%) or more (or the current requirements of the applicable ERO if less than ten percent (10%), such reduction shall be (1) communicated to the real-time operator via telephone with (2) an immediate update to the availability schedule in the availability scheduling system.
- c. Seller shall pay to Company any charges imposed on Company by the Market Operator to the extent such charges result from Seller's failure to submit an accurate and/or timely forecast of available generating capacity for the Facility.

* * * * *

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**Exhibit J - ENERGY PAYMENT RATE; COMMITTED ENERGY; CAPACITY
PAYMENT RATE**

[The "Committed Energy" values in Exhibit J shall be the P50 value as set forth in Seller's bid.]

This entire Exhibit shall be deemed Confidential Information subject to Section 20.18.

PART I. APPLICABLE PAYMENT RATES AND COMMITTED ENERGY

Commercial Operation Year (Year)	Committed Energy (MWh)	Energy Payment Rate (\$/MWh)	Capacity Payment Rate (\$/kW-month)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

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Exhibit K - LENDER CONSENT PROVISIONS

In the event Seller collaterally assigns its rights hereunder to a Facility Lender as security, any related Lender Consent will contain provisions substantially as follows:

1. Seller and Company will neither modify nor terminate this PPA in any material respect, without the prior written consent of the Facility Lender.
2. The Facility Lender shall have the right, but no obligation, to do any act required to be performed by Seller under this PPA, and any such act performed by the Facility Lender shall be as effective to prevent or cure a default as if done by Seller itself.
3. If Company becomes entitled to terminate this PPA due to an Event of Default by Seller, Company shall not terminate this PPA unless it has first given notice of such Event of Default to the Facility Lender and has given the Facility Lender the same cure period afforded to Seller under Article 12 - of this PPA, plus an additional thirty (30) Days beyond Seller's cure period to cure such Event of Default; *provided*, that the total cure period shall in no event exceed one-hundred eighty (180) Days. If the Facility Lender requires possession of the Facility in order to cure the Event of Default, and if the Facility Lender diligently seeks possession, the Facility Lender's additional thirty (30)-Day cure period shall not begin until foreclosure is completed, a receiver is appointed, any bankruptcy stay is removed, or possession is otherwise obtained by or on behalf of the Facility Lender.
4. The Facility Lender shall provide to Company a copy of any notices of default and/or intent to exercise remedies delivered to Seller under the Financing Documents.
5. Upon any foreclosure, deed-in-lieu or other exercise of the rights and remedies of the Facility Lender that results in a successor owner or operator of the Facility, the Facility Lender shall require and cause the successor (i) to assume all of Seller's prospective obligations under this PPA, (ii) to cure any then-existing defaults by Seller that are capable of cure by performance or the payment of money damages, (iii) to have substantial experience in the operation of power generation facilities akin to the Facility, either directly, through its Affiliates or through an operator acceptable to Company, and (iv) to enjoy (together with its parents and Affiliates) an Investment Grade Credit Rating or other creditworthiness satisfactory to Company. Except for the foregoing, the Facility Lender shall not be obligated to perform or be liable for any obligation of Seller under this PPA.
6. Upon any rejection or other termination of this PPA in connection with any bankruptcy or insolvency of Seller, the Facility Lender (or its successor) and Company shall enter into a new power purchase agreement on the same terms and conditions as this PPA and for the period that would have been remaining under this PPA but for such termination.

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Exhibit L -1 – EQUITY PURCHASE PRICE FORMULA

The “Equity Purchase Price” shall be determined in a manner substantially similar to the determination of the Purchase Price in Section 19.5(G), modified as required to take into account the structure of the sale as an equity purchase.

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Exhibit L-2 - PSA PROVISIONS

Any PSA executed to implement exercise of Company's ROFO or Option rights will include provisions substantially as follows:

Type of Transaction

The transaction will be structured as an asset acquisition. Company ("Buyer") shall purchase and Seller shall sell 100% of the assets ("Assets") of a completed, commercially operational, integrated [wind-powered] /solar-powered with battery storage electricity generating plant with Nameplate Capacity of [XX] MW [solar AC] and all facilities [including energy storage facilities] and all other assets and rights relating to the project including any permits or other instruments necessary to operate and maintain the plant as designed and constructed (the "Project"), free and clear of all encumbrances and liabilities, except for permitted encumbrances and assumed liabilities as defined in the PSA.

Purchase Price and Payment Terms

Buyer shall pay Seller the "Purchase Price" which is determined pursuant to Section 19.5(G) of this PPA.

Buyer shall be entitled to withhold from the payment of the Purchase Price a total amount not to exceed 20% of the Purchase Price in the event of certain breaches of Seller's representations, warranties or covenants pending Seller's cure of any such breach.

Seller shall be responsible for all taxes relating to the pre-closing period and all transfer taxes and any sales, use or other taxes related to the purchase and sale of the Assets and any purchase or conveyance of real or personal property to be used in the Project.

Seller's Closing Deliverables:

Upon the terms and conditions to be defined within the PSA, the obligations of Buyer to consummate the transactions contemplated are subject to the satisfaction by Seller of certain closing conditions, including:

- Transfer of all of the Assets of the Project, which include all rights and title to assets necessary for the commercial operation of the Project, to Buyer or its designated Affiliate.
- An opinion of legal counsel that each material discretionary permit required for the Project has been obtained and is valid, binding, in full force and effect and non-appealable.
- Evidence that any liens on the Project, real property or any other assets or interests of the Project have been removed as of the closing other than permitted liens which have been scheduled or liens which have been scheduled and bonded to Buyer's reasonable satisfaction.
- Certain conditions do not exist at the time of closing including, but not limited to, the existence of a material adverse effect. A material adverse effect would be

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defined in the PSA and would include, in addition to other terms, a change in tax law that could have a negative impact on Buyer's business or the economic viability of the Project.

- All certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Seller pertaining to the closing.

Buyer's Closing Deliverables:

Upon the terms and conditions to be defined within the PSA, the obligations of Seller to consummate the transactions contemplated are subject to the satisfaction by Buyer of certain closing conditions, including:

- Delivery of the Purchase Price.
- All certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Buyer pertaining to the closing.

Required Approvals

The transaction is subject to obtaining specified approvals, authorizations, or orders, including but not limited to the following (to the extent necessary):

- Approval of the board of directors of Buyer and the board of directors or similar governing body of Seller shall be obtained prior to execution of the PSA.
- Third party consents.
- Applicable governmental and regulatory approvals prior to closing, including to the extent necessary, any applicable state agencies or commissions regulating utility activities and any government agencies having approval, consent or authority over the transactions contemplated by the PSA, including but not limited to the MPUC, the NDPSC, the IRS, the FERC, the Department of Justice, the US Fish and Wildlife Service and the FAA.

Representations and Warranties

The transaction is subject to customary representations and warranties to be made by Buyer and Seller as of the execution date or the effective date of the PSA and the closing thereunder, including the following:

- Corporate existence and powers – Seller is a limited liability company validly existing and in good standing and has the power and authority to conduct its business as now conducted.
- Authority (execution and delivery)
- No conflicts - the transaction does not create any conflicts.
- Consents and approvals – no consent, approval or authorization is required in connection with the execution and performance of the PSA.
- Legal proceedings of Buyer– there are no legal proceedings pending, or to

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Buyer's knowledge, threatened in writing, against Buyer, that affect the consummation of the transaction contemplated by the PSA.

- Legal proceedings of Seller and the Project – there are no legal proceedings pending, or to Seller's knowledge, threatened in writing, against the Seller or the Project or affecting Seller's ability to sell the Project.
- Sufficient funds – Buyer has available, or will maintain sufficient sources of, funds to complete the transaction.
- Compliance with Laws – Seller is in compliance with all laws applicable to the Seller, Project and the transactions contemplated by the PSA.
- Environmental – Seller and its Affiliates have no environmental liabilities and are in compliance with environmental requirements. Seller and its Affiliates have not received any notice of an alleged violation of environmental law pertaining to the Project from any governmental entity. There are no facts, circumstances, conditions or occurrences relating to the Project that could reasonably be expected to form the basis of a claim, requirement or obligation imposed by any governmental entity under any environmental law on Seller or its Affiliates.
- Contracts – Schedule of material contracts binding on the Seller or to which the Project is subject and Seller has furnished to Buyer true, correct and complete copies of all material contracts. Each scheduled contract, including but not limited to the Generator Interconnection Agreement, is in full force and effect and neither Seller nor the Project is in material violation or default under such contracts.
- Land Contracts – The land contracts and real property owned by the Project are in full force and effect, and shall comprise all of the real property interests necessary in connection with the interconnection, operation and maintenance of the Project, all in accordance with all laws, and are sufficient to enable the Project to be commercially operable as contemplated in the PSA, including legal and physical ingress and egress rights to and from public right-of-way for operation, and maintenance of the Project.
- Data – Seller has delivered to Buyer true, correct and complete copies of all [wind/solar] and battery data related to the Project.
- Permits - All permits required to own, operate and maintain the Project are held by Seller or an Affiliate, are final and non-appealable, are scheduled, and Seller has obtained and furnished to Buyer true, correct and complete copies of such permits. Such permits are in full force and effect and are legal, valid, binding and enforceable in accordance with their respective terms.
- Title – Seller or an Affiliate is in possession of and has good and marketable title to the Project free and clear of all encumbrances, except for permitted encumbrances. Seller and its Affiliates have no legal obligation or non-binding agreement in principle with any other person to sell or affect a sale of all, or any portion of, the Project.
- Other representation and warranties customary in a transaction of this nature,

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including those pertaining to taxes, title, finders, intellectual property, brokers and insurance.

Termination Provisions

The PSA may be terminated prior to the closing upon written notice by the terminating party (as described below) in the event of certain occurrences, including:

- By either party, in the event the closing has not occurred by a date to be negotiated, regardless of the reason for such termination, provided that the terminating party is not in breach of the PSA.
- By either party in the event regulatory approvals for the transaction are not obtained on terms reasonably acceptable to Buyer.
- By Buyer in the event any authority has issued an order or taken any other action that restrains, enjoins, or otherwise prohibits the consummation of the transactions contemplated by the PSA, and such order or action is nonappealable.
- By Buyer in the event of material breach of the PSA by Seller.
- Security: Seller shall fund and maintain security in favor of Buyer, or a parent guaranty acceptable to Buyer, to secure Seller's obligations under the PSA including the indemnification provision below.

Indemnification

Each party shall indemnify and hold harmless the other party and its respective employees, representatives, officers, directors and agents from and against any and all damages arising out of the result of any breach or violation of any representation, warranty, covenant, inaccuracy within the PSA, or any liability not assumed as part of the PSA, or any fraud, willful misconduct, or negligence in performance of this PSA. Seller shall indemnify Buyer for any environmental (including hazardous material) claims arising prior to the closing date other than environmental claims resulting from Buyer's negligence. No claim for indemnification shall be brought against the Indemnifying Party until the total damages for which such party is liable exceeds in the aggregate a threshold amount to be negotiated, at which point indemnification may be sought for the full aggregate amount of damages, including those amounts that do not exceed the threshold. The aggregate damages to which the Indemnified Parties are entitled shall not exceed the indemnity cap, which shall be at least 30% of the Purchase Price. Such threshold and indemnity cap shall not apply to damages to the extent they arise from a breach of covenants required to be performed after the closing or from breach of certain "fundamental" representations (as applicable to each party) such as corporate existence, power, authority, conflicts, title, land contracts, real property, environmental, intellectual property or tax matters and shall not apply to liabilities arising prior to the closing date, which shall be the responsibility of Seller.

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Exhibit L-3 – MIPS A PROVISIONS

Any MIPS A executed to implement exercise of Company's ROFO or Option rights will include provisions substantially as follows:

Type of Transaction

The transaction will be structured as an entity acquisition. Company ("Buyer") shall purchase and Seller shall sell 100% of its direct and indirect equity ownership interests of the project company ("Project Company") (including, if applicable, Seller's (or its Affiliates) direct and indirect equity ownership interest in any tax equity partnership (the "TE Partnership") that owns, directly or indirectly, equity ownership interests of the Project Company, together, the "Equity Interests"), which owns a completed, commercially operational, integrated [wind-powered/solar-powered] with battery storage electricity generating plant with Nameplate Capacity of [XX] MW AC and all facilities [including energy storage facilities] and all other assets and rights relating to the project including any permits or other instruments necessary to operate and maintain the plant as designed and constructed (the "Project"), free and clear of all encumbrances and liabilities, except for permitted encumbrances and assumed liabilities as defined in the PSA.

Purchase Price and Payment Terms

Buyer shall pay Seller the "Purchase Price" which is determined pursuant to Section 19.5(C) of this PPA.

Buyer shall be entitled to withhold from the payment of the Purchase Price a total amount not to exceed 20% of the Purchase Price in the event of certain breaches of Seller's representations, warranties or covenants pending Seller's cure of any such breach, with Buyer's aggregate holdback amount not to exceed 20% of the Purchase Price

Seller shall be responsible for all taxes relating to the pre-closing period and all transfer taxes and any sales, use or other taxes related to the purchase and sale of the Equity Interests and any purchase or conveyance of real or personal property to the Project Company to be used in the Project.

Seller's Closing Deliverables:

Upon the terms and conditions to be defined within the PSA, the obligations of Buyer to consummate the transactions contemplated are subject to the satisfaction by Seller of certain closing conditions, including:

- Transfer of the Equity Interests, which include all rights and title to assets necessary for the commercial operation of the Project, to Buyer or its designated Affiliate.
- An opinion of legal counsel that each material discretionary permit required for the Project has been obtained and is valid, binding, in full force and effect and non-appealable.

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- Evidence that any liens on the Equity Interests, Project Company, Project, real property or any other assets or interests of the Project Company have been removed as of the closing other than permitted liens which have been scheduled or liens which have been scheduled and bonded to Buyer's reasonable satisfaction.
- Certain conditions do not exist at the time of closing including, but not limited to, the existence of a material adverse effect. A material adverse effect would be defined in the PSA and would include, in addition to other terms, a change in tax law that could have a negative impact on Buyer's business, the Equity Interests, or the economic viability of the Project.
- All certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Seller pertaining to the closing.

Buyer's Closing Deliverables:

Upon the terms and conditions to be defined within the PSA, the obligations of Seller to consummate the transactions contemplated are subject to the satisfaction by Buyer of certain closing conditions, including:

- Delivery of the Purchase Price.
- All certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Buyer pertaining to the closing.

Required Approvals

The transaction is subject to obtaining specified approvals, authorizations, or orders, including but not limited to the following (to the extent necessary):

- Approval of the board of directors of Buyer and the board of directors or similar governing body of Seller shall be obtained prior to execution of the PSA.
- Third party consents.
- Applicable governmental and regulatory approvals prior to closing, including to the extent necessary, any applicable state agencies or commissions regulating utility activities and any government agencies having approval, consent or authority over the transactions contemplated by the PSA, including the MPUC, the NDPSC, the IRS, the FERC, the Department of Justice, the US Fish and Wildlife Service and the FAA.

Representations and Warranties

The transaction is subject to customary representations and warranties to be made by Buyer and Seller as of the execution date or the effective date of the PSA and the closing thereunder, including the following:

- Corporate existence and powers – Seller is a [corporation] validly existing and in

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good standing and has the power and authority to conduct its business as now conducted.

- Project Company existence and powers – the Project Company is a limited liability company validly existing and in good standing and has the power and authority to operate and own the Project and has been engaged in no other business since its formation.
- (If applicable) The TE Partnership existence and powers – the TE Partnership is a limited liability company validly existing and in good standing and has the power and authority to own and manage the Project Company and the Project and has been engaged in no other business since its formation.
- Authority (execution and delivery)
- No conflicts - the transaction does not create any conflicts.
- Consents and approvals – no consent, approval or authorization is required in connection with the execution and performance of the PSA.
- Legal proceedings of Buyer– there are no legal proceedings pending, or to Buyer's knowledge, threatened in writing, against Buyer, that affect the consummation of the transaction contemplated by the PSA.
- Legal proceedings of Seller, TE Partnership (if applicable) and Project Company – there are no legal proceedings pending, or to Seller's knowledge, threatened in writing, against the Seller relating to the Project or affecting Seller's ability to sell the Equity Interests and there are no legal proceedings pending, or to Seller's knowledge, threatened in writing, against the Project Company or the TE Partnership (if applicable).
- Sufficient funds – Buyer has available, or will maintain sufficient sources of, funds to complete the transaction.
- Compliance with Laws – Seller, the TE Partnership (if applicable) and the Project Company are in compliance with all laws applicable to such entity and the transactions contemplated by the PSA.
- Environmental – Seller, the TE Partnership (if applicable), the Project Company and their respective Affiliates have no environmental liabilities (solely in the case of Seller relating to the Project) and are in compliance with environmental requirements (solely in the case of Seller relating to the Project). Seller and its Affiliates (including the TE Partnership, if applicable, and the Project Company) have not received any notice of an alleged violation of environmental law pertaining to the Project from any governmental entity. There are no facts, circumstances, conditions or occurrences relating to the Project, the TE Partnership, if applicable, or the Project Company that could reasonably be expected to form the basis of a claim, requirement or obligation imposed by any governmental entity under any environmental law on Seller or its Affiliates (including the TE Partnership, if applicable, and the Project Company) or Buyer.
- Contracts – Schedule of material contracts binding on the (x) Seller relating to

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the TE Partnership, if applicable, the Project Company or the Project), (y) TE Partnership, if applicable, the Project Company or the Project, or the assets of any of the TE Partnership, if applicable, or the Project Company, has been provided and Seller has furnished to Buyer true, correct and complete copies of all such contracts. Each scheduled contract, including but not limited to the Generator Interconnection Agreement, is in full force and effect and neither Seller, the TE Partnership, if applicable, nor the Project Company, nor to the knowledge of Seller any other counterparty thereto, is in material violation or default under such contracts.

- Land Contracts – The land contracts and real property owned by the Project Company are in full force and effect, and shall comprise all of the real property interests necessary in connection with the interconnection operation and maintenance of the Project, all in accordance with all laws, and are sufficient to enable the Project to be commercially operable as contemplated in the PSA, including legal and physical ingress and egress rights to and from public right-of-way for operation, and maintenance of the Project.
- Data – Seller has delivered to Buyer true, correct and complete copies of all [wind/solar] and battery data related to the Project.
- Permits - All permits required to own, operate and maintain the Project are held by the Project Company, are scheduled, and Seller has obtained and furnished to Buyer true, correct and complete copies of such permits. Such permits are non-appealable, in full force and effect and are legal, valid, binding and enforceable in accordance with their respective terms.
- Title – The Project Company is in possession of and has good and marketable title to the Project free and clear of all encumbrances, except for permitted encumbrances. Seller has good and marketable title to the Project Company's equity interests, free and clear of all encumbrances. Seller and its Affiliates have no legal obligation or non-binding agreement in principle with any other person to sell or affect a sale of all, or any portion of, the Project or the Project Company.
- Other representation and warranties customary in a transaction of this nature, including those pertaining to taxes, title, finders, intellectual property, brokers and insurance.

Termination Provisions

The PSA may be terminated prior to the closing upon written notice by the terminating party (as described below) in the event of certain occurrences, including:

- By either party, in the event the closing has not occurred by a date to be negotiated, regardless of the reason for such termination, provided that the terminating party is not in breach of the PSA.
- By either party in the event regulatory approvals for the transaction are not obtained on terms reasonably acceptable to Buyer.
- By Buyer in the event any authority has issued an order or taken any other action that restrains, enjoins, or otherwise prohibits the consummation of the transactions contemplated by the PSA, and such order or action is nonappealable.

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- By Buyer in the event of material breach of the PSA by Seller.
- Security: Seller shall fund and maintain security in favor of Buyer, or a parent guaranty acceptable to Buyer, to secure Seller's obligations under the PSA including the indemnification provision below.

Indemnification

Each party shall indemnify and hold harmless the other party and its respective employees, representatives, officers, directors and agents from and against any and all damages arising out of the result of any breach or violation of any representation, warranty, covenant, inaccuracy within the PSA, or any liability not assumed as part of the PSA, or any fraud, willful misconduct, or negligence in performance of this PSA. Seller shall indemnify Buyer for any environmental (including hazardous material) claims arising prior to the closing date other than environmental claims resulting from Buyer's negligence. No claim for indemnification shall be brought against the Indemnifying Party until the total damages for which such party is liable exceeds in the aggregate a threshold amount to be negotiated, at which point indemnification may be sought for the full aggregate amount of damages, including those amounts that do not exceed the threshold. The aggregate damages to which the Indemnified Parties are entitled shall not exceed the indemnity cap, which shall be at least 30% of the Purchase Price. Such threshold and indemnity cap shall not apply to damages to the extent they arise from a breach of covenants required to be performed after the closing or from breach of certain "fundamental" representations (as applicable to each party) such as corporate existence, power, authority, conflicts, title, land contracts, real property, environmental, intellectual property or tax matters and shall not apply to liabilities arising prior to the closing date, which shall be the responsibility of Seller.

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Exhibit M - BATTERY STORAGE SYSTEM TESTING PROTOCOLS

This Exhibit M sets forth the Performance Criteria and protocols for any testing of the Battery Storage System under this PPA. The Commercial Operation Test, Periodic Test, and other discretionary testing identified in Section 5.6 are sometimes referred to in this Exhibit individually as a “Test” and jointly as the “Tests.”

PART I. GENERAL.

The Tests shall be conducted in accordance with Good Utility Practices and the provisions of this Exhibit M.

PART I. REQUIREMENTS APPLICABLE TO THE TESTS.

A. Test Parameters.

During any Test, at a minimum, the following parameters shall be measured and recorded simultaneously for the Battery Storage System at the level of granularity necessary to assess the measured criteria:

- (i) Time;
- (ii) Net electrical energy output to the Point of Delivery (kWh);
- (iii) Net electrical energy input from the Point of Delivery (kWh);
- (iv) State of Charge (MWh);

B. Performance Test Showing. Seller must demonstrate to Company's reasonable satisfaction, that the Battery Storage System:

- (i) is capable of storing and delivering the MW and MWh amount identified by Seller as the maximum rated power and energy;
- (ii) can deliver full rated power (MW) to the Point of Delivery for [insert as-bid storage duration] consecutive hours, totalling to the Guaranteed Storage Capacity, inclusive of identified Round-Trip Efficiency losses.

C. Performance Test Conditions.

- (i) At all times during a Test, the Battery Storage System, including all auxiliary equipment, shall be operated in compliance with the Test Plan, Good Utility Practices and all operating protocols and conditions recommended, required, or established by the manufacturer, and all operating protocols, conditions, constraints, settings, parameters or the equivalent that are or would be in place during normal operations of the Facility.
- (ii) Company in its sole discretion may elect to shorten the run periods or waive a particular portion of a Test at any time. Such election or waiver during one Test does not shorten any run period or waive any portion of any subsequent Test.

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- (iii) Abnormal Conditions. If abnormal operating conditions occur during a Test, Company may postpone or reschedule all or part of such Test in its reasonable discretion in accordance with PART I.F. or PART I.G., below.
 - (iv) Applicable Laws. The Battery Storage System shall be operated in compliance with all Applicable Laws, including those governing safety, noise, air, and water emissions during any Test.
 - (v) Instrumentation and Metering. Permanently installed instruments shall include but not be limited to revenue metering devices located in the switchyard where the Facility is located.
- D. Test Records. Seller shall provide all records associated with PART I.A. with the Final Report described below in PART I.H. The records shall include copies of the raw data taken during the Test. This information will be provided in a format reasonably acceptable to Company. Collectively, the records and data provided with the Final Report shall be "Test Records".
- E. Incomplete Test. If any Test is not completed in accordance herewith, Company may in its sole discretion: (i) accept the Test results up to the time the Test stopped (other than in the case such Test is a Commercial Operation Test); (ii) require that the portion of the Test not completed, be completed within a reasonable specified time period; or (iii) require that the Test be entirely repeated.
- F. Retest. After the successful completion of a Test, Seller has the right, for any reason, to conduct a retest at Seller's sole expense, including the cost of charging the Battery Storage System.

If the Test Records provided by Seller to Company in accordance with PART I.D. are not in accord with the records and notes of the Company, Company may require the Test to be repeated. If the retest determines that the Test Records provided by Seller to Company are correct, then such retest will be deemed to be a Company Dispatched Test. If the retest determines that the Test Records provided by Seller to Company are incorrect, then such retest will be deemed to be a Seller Initiated Test. The records from any retest shall be used to determine Battery Storage System performance as of the date of the original Test being repeated.
- G. Final Report. Within fifteen (15) Business Days after the completion of a Test (including a retest), Seller shall prepare and submit to Company a written report of the Test in a format reasonably acceptable to Company. At a minimum, the report shall include:
 - (i) a record of the personnel present during all or any part of the Test, whether serving in an operating, testing, monitoring or other such

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- participatory role;
- (ii) a record verifying that inspections took place and the results were acceptable prior to testing initiation;
- (iii) a record of the test conditions (e.g., weather conditions) and test set up (e.g., equipment type and placement used);
- (iv) a record of any unusual or abnormal conditions or events that occurred during the Test and any actions taken in response thereto;
- (v) the Test Records;
- (vi) the system performance in relation to the Performance Criteria identified in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels, either by direct measurement or via agreed to calculation; and
- (vii) Seller's statement of either Seller's acceptance of the Test or Seller's rejection of the Test results and reason(s) therefore.

Within ten (10) Business Days after receipt of such report, Company shall notify Seller in writing of either Company's acceptance of the Test results or Company's rejection of the Test and reason(s) therefore.

If Company rejects the results of any Test or retest, or Seller rejects the results of the initial Commercial Operation Test, such Test shall be repeated in accordance with PART I.F.

PART II. TEST PROCEDURES.

Any Test shall be performed according to the provisions of this Exhibit M, and the Test Plan below.

A. GENERAL:

- (i) This document provides the procedure for Test and evaluation of the Battery Storage System for the Facility.
- (ii) The sole purpose of the Test will be the determination of Maximum Charging Rate, Maximum Discharging Rate, Minimum Discharging Time, Minimum Charging Time, Storage Capacity, and Round Trip Efficiency of the Battery Storage System for comparison to the Guaranteed Performance values provided in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.
- (iv) Data shall be recorded by the SCADA System data logging functions. The use of alternative means for data acquisition shall be used only with prior written consent of Company.
- (v) Prior to the start of testing the Battery Storage System, the control settings (tuning and constants) shall be verified.
- (vi) Any alteration or modifications to test measurement devices, or to the Battery Storage System, which could reasonably be expected to influence the outcome of the applicable Test or would not be present during normal operations of the Facility, shall not be permitted, without prior written consent of Company, and if accepted

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by Company, shall be fully documented by Seller and Company.

B. RESPONSIBILITIES:

- (i) Specific responsibilities for this Test program are as follows:
 - a. Seller:
 - i. Perform commissioning.
 - iii. Support Company with testing and interface with the Utility/ISO as required to schedule and perform testing.
 - b. Company:
 - i. Support Seller with testing and interface with the Utility/ISO as required to schedule and perform testing.
 - ii. Perform energy testing through SCADA.
 - iii. Provide energy for the Test.

C. MEASUREMENTS & INSTRUMENTATION:

- (i) Instrumentation for the Test will consist of Battery Storage System instruments. Calibration certificates will be provided with the instruments.
- (ii) The State of Charge during all tests shall be read from the Battery Management System.
- (iii) The charge rate and discharge rates shall be measured using the Electric Metering Devices.

D. TEST PROCEDURE TO MEASURE THE PERFORMANCE CRITERIA:

- (i) A Test shall be performed to determine Maximum Charging Rate, Maximum Discharging Rate, Minimum Discharging Time, Minimum Charging Time, Storage Capacity, and Round Trip Efficiency of the Battery Storage System.
- (ii) The Battery Storage System shall be discharged to zero percent (0%) SOC and held for a period of at least five (5) minutes.
- (iii) The Battery Storage System shall be charged at the Guaranteed Maximum Charging Rate specified in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels until the Guaranteed Storage Capacity specified in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels is achieved and available for discharge, as measured at the POI. The maximum AC power charging rate achieved for a period of [insert bid duration in hours] continuous hours during this charge cycle shall be recorded and used for satisfaction of the Guaranteed Maximum Charging Rate. The total AC energy input into the Battery Storage System and the time until the Battery Storage System reaches a SOC of one hundred percent (100%) shall be measured, recorded, and used for satisfaction of the Guaranteed Minimum Charging Time.
- (iv) The system shall be left at rest in an active standby state for five (5)

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- minutes.
- (v) The Battery Storage System shall be discharged at the Guaranteed Maximum Discharging Rate specified in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels until the SOC reaches zero percent (0%). The maximum AC power discharging rate achieved for a minimum of [insert bid duration in hours] continuous hours shall be recorded and used for satisfaction of the Guaranteed Maximum Discharging Rate. The total AC energy discharged from the Battery Storage System and the time until the Battery Storage System reaches a SOC of zero percent (0% shall be measured and recorded. The total AC energy discharged from the Battery Storage System will be used for satisfaction of the Guaranteed Storage Capacity. The time period until the system has supplied the Guaranteed Storage Capacity will be used for satisfaction of Guaranteed Minimum Discharging Time.
 - (vi) The total AC energy input and the total AC energy output from the system recorded in steps D.(iii) and D.(v) shall be used to determine Round Trip Efficiency for conformance to the Guaranteed Round Trip Efficiency defined in Exhibit M-1 - Battery Storage System Guaranteed Performance Levels.

(E) Renewable Charging Capability Test (During COD Test):

- (i) If the Battery Storage System is paired with another resource such that would allow direct charging capabilities, then Company may elect to perform any tests using the paired facility as the sole Charging Energy source to determine the charging capabilities to its reasonable satisfaction. For the avoidance of doubt, the charging rate will be subject to the energy available from such paired facility for charging purposes.

* * * *

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Exhibit M-1 - BATTERY STORAGE SYSTEM GUARANTEED PERFORMANCE LEVELS

This Exhibit M-1 - Battery Storage System Guaranteed Performance Levels sets forth the guaranteed performance levels ("Guaranteed Performance") for certain Performance Criteria.

Guaranteed Round Trip Efficiency:

The Guaranteed Round Trip Efficiency shall be as set forth in the table below:

Year	RTE
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

<u>Performance Metric</u>	<u>Guaranteed Level</u>	<u>Point of Measurement</u>
Guaranteed Storage Capacity	[] MWh	Point of Delivery
Self-Discharge Rate	[]/month	

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		Point of Delivery
Guaranteed Minimum Charging Time	Guaranteed Storage Capacity in MWh/[]/Guaranteed Maximum Charging Rate in MW /RTE)	Point of Delivery
Guaranteed Maximum Charging Rate	[] MW	Point of Delivery
Guaranteed Minimum Discharging Time	[] hours	Point of Delivery
Guaranteed Maximum Discharging Rate	[] MW	Point of Delivery
Maximum Ramp Rate	[] MW/second	Point of Delivery
Guaranteed Response Time	[] seconds	Point of Delivery
Grid Charging Capability	Pass	Point of Delivery

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Exhibit N - [RESERVED]

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Exhibit O - BATTERY STORAGE SYSTEM OPERATING PROCEDURES

The Battery Storage System Operating Procedures will include the provisions set forth in this Exhibit O - Battery Storage System Operating Procedures. If requested by Company, then no later than ninety (90) Days prior to the Commercial Operation Date, the Operating Committee shall develop the Battery Storage System Operating Procedures in accordance with Section 10.8. The Battery Storage System Operating Procedures can be reviewed annually (date and time to be mutually agreed) to optimize operations for both Parties. Parties shall cooperate to integrate the systems and controls necessary to implement the Battery Storage System Operating Procedures.

I. Operational limitations:

The operation of the Battery Storage System shall be subject to the following limitations:

- (a) The Annual Throughput and Annual State of Charge as defined in this PPA.
- (b) The requirements and limitations set forth in Section 5.2(D).

II. Data points to be sent from Seller to Company Via SCADA

The following data points will be transmitted via SCADA from Seller to Company and represent energy storage level data:

Table 1

<u>Energy Storage</u>	
<u>Description</u>	<u>Units</u>
Real Power Set-Point (echo)	MW
Actual Real Power	MW
Battery State of Charge	% & MWh
Charge Capacity	MW
Discharge Capacity	MW
Remaining Throughput (Commercial Operation Year)	MWh
YTD Average SOC (Commercial Operation Year)	%
Storage Capacity	MWh
Additional Data Points Reserved for Future Use	

The following data points will be transmitted via SCADA from Company to Seller and

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represent energy storage level data:

Table 2

<u>Energy Storage</u>	
<u>Description</u>	<u>Units</u>
Charge Power Set-Point*	MW
Discharge Power Set-Point*	MW
Duration of Charge/Discharge Set-Point**	minutes
Target State of Charge*	%
Control Mode (target time or target SOC)	Boolean
Additional Data Points Reserved for Future Use	

* Parties will resolve any conflicts in priority of signal in the Battery Storage System Operating Procedures

**System will observe either time entry or SOC target depending on Control Mode

Data points transmitted via SCADA from Seller to Company are subject to Battery Storage Operating Procedures.

1. **Response times of Battery Storage System.** The Battery Storage System Operating Procedures will include protocols that outline the expectations for responding to the Company's set points.

2. **Backup communications.** In the event of a communications failure, Company and Seller shall communicate via telephone in order to correct the failure.

* * * * *

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Exhibit P - SAFETY REQUIREMENTS

Seller shall design and construct the Facility in compliance with all Applicable Laws and shall ensure the Facility is operated in compliance with Good Utility Practices. Seller shall identify codes and standards that are applicable to the design of the Facility and ensure that upon substantial completion the Facility meets applicable codes and standards. [Technology specific codes and standards] Only non-occupiable Battery Storage System enclosures shall be considered and seller shall have the Battery Storage System enclosures certified to UL 9540 [or appropriate code]. Seller shall design, construct, and install the Facility under the guidance of NFPA 855 [or appropriate code] and shall comply with all applicable portions of that standard. Seller is solely responsible for maintaining the Facility in compliance with all Applicable Laws. Seller will provide Company with an independent registered professional engineer's certification stating that the Facility has been completed in all material respects (including compliance with all Applicable Laws) prior to COD.

Prior to COD, Seller will provide documentation submitted as part of the permitting process and, if not otherwise submitted as part of such permitting process, the following additional documents:

1. Operations and maintenance documentation, including an operations manual and maintenance manual, and schedule for planned maintenance;
2. Safety procedures for personnel (may be included within the operations or maintenance manual), and supplier safety manual;
3. Training materials for local first responders, identifying known hazards and failure modes, and methods for approach and action, if appropriate;
4. Emergency management plan, including instructions on how to interpret alarms and faults, location of emergency stops, egress pathways, known hazards, and emergency contact information for a subject matter expert who can be available on site within 2 hours; and
5. System drawings and documentation, including all physical, electrical, mechanical, and communications diagrams for all Facility sub-components, to allow for confirmation of claimed safety features including but not limited to, respectively, sufficient spacing, security, and signage; appropriate electrical ratings, grounding, and interconnections; foundations and construction materials; awareness of system operation and alarms; and fault ranges and emergency stops, but excluding any vendor proprietary drawings. As applicable, certifications for all claimed standards compliance should be provided.

* * * * *

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Exhibit Q - METHODOLOGY FOR ADJUSTING COMMITTED ENERGY

To determine whether a default by Seller has occurred under Section 12.1(A) or a Committed Energy Deficiency Adjustment should be imposed under Section 8.5, Committed Energy shall be adjusted as follows:

A. Periods when the Facility is incapacitated in whole or in part due to Force Majeure shall be excluded from the calculation of Committed Energy. Seller Excuse Hours shall also be excluded for the calculation of Committed Energy. The Committed Energy required from Seller for such Commercial Operation Year shall be reduced by the quantity of MWhs that Seller can demonstrate, to Company's reasonable satisfaction, were specifically attributable to such Force Majeure or Seller Excuse Hours. Such quantity shall be calculated using Commercially Reasonable methods using measurable inputs at an hourly minimum granularity. For the avoidance of doubt, for any periods when metering or measuring equipment at the Site affecting such inputs is inoperable or mis-calibrated, for purposes of determining a default by Seller under Section 12.1(A), Parties shall exclude such data from the calculation unless agreed to otherwise by the Company.

B. The Committed Energy required from Seller for such Commercial Operation Year shall be reduced by the quantity of MWhs that Seller can demonstrate, to Company's reasonable satisfaction, were specifically attributable to such curtailed Renewable Energy pursuant to Sections 8.3(A)1 through 4.

Northern States Power Company [Wind] [Solar] + Storage Energy Purchase Agreement

Exhibit R - EXAMPLE ADJUSTMENT CALCULATIONS

Example of Round Trip Efficiency Adjustment

Example of Round Trip Efficiency Adjustment based on the following assumed facts:

- (a) Seller's Guaranteed Round Trip Efficiency (RTE_G) = 87%.
- (b) Seller's actual Round Trip Efficiency as determined by latest test (RTE) = 85%.
- (c) Amount of Discharging Energy delivered to the Point of Delivery for the affected hour ($Discharging\ MWh_{Actual}$) = 100 MWh.
- (d) Discharging Energy Price for the affected hour (Discharging LMP) = \$50/MWh.

Given these assumed facts, Seller calculates the Energy Payment Reduction due to Company as follows:

Round Trip Efficiency Adjustment

$$\begin{aligned}
 &= [1 - (RTE_{test} / RTE_G)] \times [(Discharging\ MWh_{Actual} * Discharging\ LMP)] \\
 &= [1 - (85\% / 87\%)] \times [(100\ MWh \times \$50/MWh)] \\
 &= 2.3\% \times \$5,000 \\
 &= \$115
 \end{aligned}$$

Example of CAF Calculation

Example of Capacity Availability Factor calculation based on the following assumed facts:

- (a) Seller's Guaranteed Storage Capacity = 400 MWh.
- (b) Seller's Scheduled Maintenance Energy = 7,200 MWh as reflected on an approved Maintenance Schedule delivered pursuant to Section 10.2(A) and calculated assuming:
 - (i) Approved Maintenance Schedule included 24 hours of planned outages/deratings meeting the definition of Battery Storage System Planned Outages. Outages/derates during the period were actually in accordance with the approved Maintenance Schedule.
 - (ii) The most recently completed Test reflected a 300 MWh Storage Capacity.

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- (c) Seller's Available Capacity = 178,560 MWh as reported by the by the Facility's SCADA System in accordance with Exhibit O – Battery Storage System Operating Procedures for such period.
- (d) Period Energy = Assumes 31 Days in the calculation period and calculated as (31 Days X 24 hours per Day X 300 MWh)

Given these assumed facts, the Capacity Availability Factor is calculated as follows:

Capacity Availability Factor

$$= (AC + SME) / PE$$

$$= [178,560 \text{ MWh} + 7,200 \text{ MWh}] / (31 \text{ Days} \times 24 \text{ hours per Day} \times 300 \text{ MWh})$$

$$= 245,280 \text{ MWh} / 223,200 \text{ MWh}$$

$$= 0.8323$$

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Exhibit S - METER AND COMMUNICATIONS REQUIREMENTS

These meter requirements shall apply to all Electric Metering Devices.

- Electric Metering Devices shall meet requirements set forth in American National Standards Institute (ANSI) C12.1 and 12.20. Current transformers and voltage transformers supplying this meter should meet requirements of IEEE/ANSI C57.13 and ANSI C57.13.6. In addition to meeting these requirements the current transformers should be high accuracy extended range transformers with at least 0.15% accuracy from 1% to full rating factor, and high voltage transformers should be at least 0.3% accuracy from 90% to 110% of rated voltage. Prior to the purchase of Electric Metering Devices, current transformers and potential transformers and associated communication equipment, Seller must submit relevant information such that Company can review and verify that the equipment meets Company requirements. For Company-owned meters, potential transformers will utilize nominal secondary voltages of 115 volts or 120 volts. Backup meters may utilize current transformers with a lower accuracy class than 0.15% upon mutual agreement of the Parties.
- No later than ninety (90) Days prior to generating any Test Energy, Seller shall provide to Company in mutually agreeable format all necessary specifications related to the Electric Metering Devices and/or communication therewith including, but not limited to, the make, model, port configuration, connection assignments, electronic security definitions, firewall definitions, and physical locations.
- Company may inspect and verify that the equipment was approved and properly installed. In addition, Company may elect to test the Electric Metering devices for accuracy, current transformers and potential transformers and verify that the communication circuits to Company are operational.
- Upon prior written notice sufficiently in advance, Company shall have the right to make requests in regard to reasonable modifications to Seller's metering equipment and configurations in order to ensure accurate telemetering and communication.
- Company shall have the right to install any telemetering and communication equipment Company deems reasonably necessary for purposes related to this PPA. Seller shall, upon prior written notice sufficiently in advance, cooperate with any such installation.
- Electric Metering Devices shall be programmed to, at any time of remote electronic communications and access, provide a time and date stamp of downloaded delivery information.

Electric Metering Devices shall be programmed to, at any time of manual read of the meter's display, provide the time and date of the information gathered. The Seller shall

Northern States Power Company [Wind] [Solar] + Storage Energy Purchase Agreement

provide the communication channels for the Company's remote terminal unit and the Company's Itron Enterprise Edition Meter Data Management Agent. The implementation of these communication paths and RTU shall follow Company's latest standard. The Seller must have these communication paths installed, tested, and functional prior to generating Test Energy.

- Company shall have the right, via read-only access, and upon prior reasonable written notice to Seller, to independently audit Seller's meters and any records pertaining to the amount of energy generated by the Facility and any associated losses. Any audit shall be performed at the Facility or if applicable, other location within the same state as the Facility which is mutually agreed upon by both Company and Seller. Records related to such audits, inspections, testing or adjustments shall be maintained and subject to audit by Company for a period of twenty-four (24) months. Company shall further have the right to request and receive in physical or electronic form any and all records or data files related to such audits, inspections, testing or adjustments.
- Seller shall provide secure and reliable communication from the Electric Metering Devices as follows:
 - Distributed Network Protocol ("DNP") output from the meter to Company's EMCC via a remote terminal unit located near the Electric Metering Devices and hardwired from the meter to the remote terminal unit.
 - Time stamped meter register and interval data from the meter to Company's Itron Enterprise Edition Meter Data Management Agent with servers located in [insert current server location] [or] [Denver, CO] or successive data software package and servicer as Company defines. Electric Metering Devices must have an Itron approved Translation Interface Module to facilitate correct data transmission over this communication path.
 - Prior to generating Test Energy, Seller shall provide to Company one-line electrical drawings of the Facility showing the electrical location of the Electric Metering Devices for Company's review and approval.

Northern States Power Company [Wind] [Solar] Energy Purchase Agreement

[WIND] [SOLAR] ENERGY PURCHASE AGREEMENT

BETWEEN

NORTHERN STATES POWER COMPANY

AND

[REDACTED]



- [date] -

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EXHIBIT O - METER AND COMMUNICATIONS REQUIREMENTS

Northern States Power Company [Wind] [Solar] Energy Purchase Agreement

[WIND] [SOLAR] ENERGY PURCHASE AGREEMENT
BETWEEN
NORTHERN STATES POWER COMPANY
AND
[REDACTED], LLC

This [Wind] [Solar] Energy Purchase Agreement (this “PPA”) is made as of this [REDACTED] day of [REDACTED], 20[REDACTED], (“Effective Date”) by and between (i) Northern States Power Company, a [Minnesota or Wisconsin] corporation with a principal place of business at [414 Nicollet Mall, Minneapolis, MN 55401/1414 W Hamilton Ave, Eau Claire, WI 54701-7252] (“Company”), and (ii) [REDACTED], LLC, a [REDACTED] [limited liability company] with a principal place of business at [REDACTED] (“Seller”). Company and Seller are hereinafter referred to individually as a “Party” and collectively as the “Parties.”

WHEREAS Seller desires to develop, design, construct, interconnect, own, operate and maintain the Facility as defined herein; and

WHEREAS Seller desires to sell and deliver, and Company desires to accept and receive certain products and services, including but not limited to the Renewable Energy (including all Environmental Attributes) and Ancillary Services attributable to and delivered from the Facility to the Point of Delivery at the prices and on the terms and conditions set forth in this PPA.

NOW THEREFORE, in consideration of the mutual covenants herein contained, the sufficiency and adequacy of which are hereby acknowledged, the Parties agree to the following:

Article 1 - Rules of Interpretation

1.1 Interpretation.

(A) Capitalized terms listed in this PPA shall have the meanings set forth in Exhibit A - Definitions or as otherwise defined in this PPA, whether in the singular or the plural or in the present or past tense. Words not otherwise defined in this PPA shall (i) have meanings as commonly used in the English language, (ii) be given their generally accepted meaning consistent with Good Utility Practices, and (iii) be given their well-known and generally accepted technical or trade meanings.

(B) The following rules of interpretation shall apply: (1) The masculine shall include the feminine and neuter; (2) references to “Articles,” “Sections” or “Exhibits” shall be to articles, sections, or exhibits of this PPA except as the context may otherwise require; (3) all Exhibits are incorporated into this PPA (*provided, however*, that in the event of a conflict with the terms of this PPA, this PPA shall control); and (4) use of the words “include” or “including” or similar words shall be interpreted as “include without limitation” or “including, without limitation.”

(C) This PPA was negotiated and prepared by both Parties with the advice and participation of counsel. None of the provisions hereof shall be construed

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against one Party on the ground that such Party is the author of this PPA or any part hereof.

(D) [Solar] Unless specifically designated as DC, each reference to “MW” or “kW” herein shall be AC MW or AC kW, as applicable. “AC” means alternating electric current; “DC” means direct electric current.

1.2 Interpretation with Other Agreements.

(A) This PPA does not provide Seller authorization to interconnect the Facility or inject power into the Transmission Authority’s System. Seller shall contract for interconnection services in accordance with the applicable Transmission Tariff. Seller acknowledges that the Interconnection Agreement is/will be a separate contract and that (i) this PPA is not binding on the Transmission Authority, (ii) this PPA does not create any rights between Seller and the Transmission Authority, and (iii) the Interconnection Agreement does not modify the Parties’ rights and obligations under this PPA. The applicable Transmission Authority shall be deemed to be a separate and unaffiliated contracting party for purposes of this PPA, regardless of whether such Transmission Authority is Company or an Affiliate of Company.

(B) This PPA does not provide for the supply of retail power for purposes of operating the Facility, including start-up, shutdown, [turbine] [panel] adjustment, lighting, HVAC or any other purpose (“House Power”). Seller shall contract with the utility providing House Power to the Site (the “Local Provider”) for the supply of House Power. Seller acknowledges that (i) Seller must obtain House Power independently, (ii) this PPA is not binding on the Local Provider, (iii) this PPA does not create any rights between Seller and the Local Provider, and (iv) Seller’s contract for House Power does not affect the Parties’ rights and obligations under this PPA. For purposes of this PPA, the Local Provider shall be deemed to be a separate and unaffiliated contracting party regardless of whether the Local Provider is Company or an Affiliate of Company; *provided* that, if (and only if) the Local Provider is Company or an Affiliate of Company, Seller may obtain House Power by self-generating and netting such self-generation from the Renewable Energy provided to Company unless prohibited by Applicable Law.

1.3 Good Faith and Fair Dealing. The Parties shall act reasonably and in accordance with the principles of good faith and fair dealing in the performance of this PPA. Unless expressly provided otherwise in this PPA, (a) when this PPA specifically references the consent, approval, or similar action by a Party, such consent or approval shall not be unreasonably withheld, conditioned or delayed, and (b) wherever this PPA specifically gives a Party a right to determine, require, specify or take similar action with respect to a matter, such determination, requirement, specification or similar action shall be Commercially Reasonable.

Article 2 - Term and Termination

2.1 This PPA shall become effective as of the date of its execution, and shall remain in full force and effect until 11:59 pm on the last Day of the calendar month during which occurs the []th anniversary of the Commercial Operation Date (the “Scheduled Termination Date”), subject to early termination as provided in this PPA. Applicable

Northern States Power Company [Wind] [Solar] Energy Purchase Agreement

provisions of this PPA shall continue in effect after termination to the extent necessary to (i) provide for final billings, payments and adjustments, (ii) enforce or complete the duties, obligations or responsibilities of the Parties (including under Section 12.1(B)-(E), Section 12.2(C), Section 12.3(B)-(C), Article 13 - and Article 17 - below), and (iii) address any remedies or indemnifications arising prior to termination.

Article 3 - Facility Description

3.1 Description. Seller shall construct, interconnect, own, operate, and maintain the Facility, as further described in Exhibit C - Facility Description and Site Maps. A scaled map that identifies the Site, the location of the Facility, the Interconnection Point and Interconnection Facilities, the Point of Delivery, and other important facilities, is included in Exhibit C - Facility Description and Site Maps.

3.2 General Design of the Facility.

(A) Seller shall design, construct, operate and maintain the Facility according to Good Utility Practices and the Interconnection Agreement.

(B) The Facility shall include all equipment specified in Exhibit C - Facility Description and Site Maps and otherwise necessary to fulfill Seller's obligations under this PPA, including all equipment necessary (i) to meet the requirements of Exhibit I - AGC Protocols; Data Collection; Availability Reporting and (ii) to interconnect successfully with the Transmission Authority's System for the delivery of Renewable Energy to the Point of Delivery. [Solar] The DC capacity of the Facility shall be the aggregate maximum design output for each Solar Unit without giving effect to any limitation on the interconnection capacity specified in the Interconnection Agreement for the Facility. The DC capacity of the Facility shall not exceed the amount specified in Exhibit C - Facility Description and Site Maps.

(C) The Nameplate Capacity of the Facility shall be [] MW. [solar: add "AC"] +/- 0.5%. Seller shall certify to Company the final actual Nameplate Capacity of the Facility promptly following COD.

Article 4 - Implementation

4.1 Project Development.

(A) Seller shall enter into and perform at its expense all contracts, including any equipment procurement contracts, required for (i) the engineering, procurement, construction, acquisition, manufacture, delivery and installation of the Facility, including any equipment procurement contracts, and (ii) the generation and delivery of Renewable Energy from the Facility to the Point of Delivery (generally, the "Construction Contracts") with qualified and experienced contractors. Upon written request by Company, Seller shall promptly provide copies of any or all Construction Contracts to Company. At Company's sole discretion, Seller may also provide a memorandum of agreement executed by Seller and the contracting party related to a Construction Contract. Such memorandum of agreement shall set forth the basic terms of such contract, including the names of the parties thereto, the date of such contract, a summary of any products or services to be provided and other information reasonably

Northern States Power Company [Wind] [Solar] Energy Purchase Agreement

sufficient for Company to determine that the Construction Contract contains those obligations necessary for Seller to satisfy the Construction Milestones. All Construction Contracts or memorandum of agreements obtained by Company shall be deemed Confidential Information subject to Section 20.18 below.

(B) In its efforts to achieve COD, Seller shall use Commercially Reasonable Efforts to achieve the milestones set forth in Exhibit B - Construction Milestones and shall notify Company promptly following achievement of each such Construction Milestone. In addition, Seller shall achieve each milestone set forth in the table below (the “Critical Path Development Milestone”) on or before the applicable deadline for achieving such Critical Path Development Milestone specified in the table below. Seller shall provide to Company, on or before the applicable deadline to achieve each Critical Path Development Milestone, evidence reasonably satisfactory to Company that the Critical Path Development Milestone has been achieved. Seller shall also provide any additional evidence reasonably requested by Company that the Critical Path Development Milestone has been achieved, including certifications from an officer of Seller.

Critical Path Development Milestone	To be completed no later than (completion deadline):
Acquisition of all Seller’s Needed Permits required to construct the Facility	<i>[To be based on bid submission and RFP requirements]</i>
Execution of all Construction Contracts	<i>[To be based on bid submission and RFP requirements]</i>
Closing of project financing for the Facility or providing the Company with proof of financial capability to construct the Facility	<i>[To be based on bid submission and RFP requirements]</i>

If Seller anticipates a CPD Delay because it is unable, using Commercially Reasonable Efforts, to achieve any of the Critical Path Development Milestones by the applicable deadline, then Seller may extend the timeframe to achieve such Critical Path Development Milestones as set forth in Section 12.2(A) subject to the payment of Liquidated Delay Damages so long as the following conditions are satisfied:

1. At least thirty (30) Days prior to the applicable completion deadline set forth above, Seller shall submit to Company (a) a written description of the reason for the expected failure; and (b) a Recovery Plan for completing all necessary work to achieve completion of the missed Critical Path Development Milestone by a date certain (which plan may contemplate the payment of Liquidated Delay Damages).

2. Seller shall commence the work contemplated by the Recovery Plan within five (5) Days after submitting such Recovery Plan to Company.

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3. Seller shall be solely responsible for any costs or expenses incurred by Seller as a result of the formulation and implementation of the Recovery Plan.

Nothing in this Section 4.1(B) shall be construed to: (i) relieve Seller of its obligations under this PPA; (ii) modify the deadlines for achieving the remaining Critical Path Development Milestones, including the Target COD, as applicable (except for the update to the milestone schedule pursuant to Section 12.2(B) and the missed Critical Path Development Milestone which Seller is attempting to cure under this Section 4.1(B) or (iii) extend the applicable cure period set forth in Section 12.2(B) or impair the Company's right to terminate this PPA pursuant to Section 12.2(D). For clarity, failure to cure a CPD Delay within the applicable cure period set forth in Section 12.2(B) shall be subject to termination as set forth in Section 12.2(D).

(C) Prior to the Commercial Operation Date, Seller shall (i) submit monthly progress reports to Company in a form agreed to by the Parties, advising Company of the current status of each Construction Milestone and Critical Path Development Milestone, any significant developments or delays (along with an action plan for making up delays), and Seller's best estimate of the Commercial Operation Date; (ii) provide copies of reports submitted to the Facility Lender relating to status, progress and development of the Facility, and (iii) invite Company to participate in monthly meetings to discuss the progress reports, answer questions, and assess the schedule. Seller shall make all relevant counterparties under the Construction Contracts available to Company, upon request, in order to keep Company fully informed on the status of development.

(D) Upon request, Company shall have the right to monitor the construction, start-up, testing, and operation of the Facility at the Site to verify compliance with this PPA, *provided, however*, that Company shall comply with all of Seller's applicable safety and health rules and requirements.

(E) Neither Company's review of any Construction Contracts, memoranda thereof and Seller's reports, nor its discussions with Seller and its contractors, nor its monitoring of development and construction of the Facility, shall be construed as endorsement by Company of the design, engineering, construction or testing thereof nor as any express or implied warranty as to the performance, safety, durability, or reliability of the Facility.

4.2 Environmental Matters.

(A) No later than sixty (60) Days following PUC Approval, Seller shall complete and provide to Company a valid and comprehensive independent "Phase I" environmental site assessment of the Site that is conducted in compliance with ASTM E1527-21 or E2247-16, as applicable (including associated raw data, if requested by Company), which report shall have been prepared within a reasonably proximate time such that it reflects the then-current conditions of the Site. Seller shall notify Company promptly (i) if (and to what extent) any Environmental Contamination on the Site will preclude or interfere with Seller's ability to perform its obligations under this PPA, and (ii) Seller's plan for remediation thereof that would allow Seller to perform under this PPA as and when due. The Phase I report delivered to Company under this paragraph shall be

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deemed Confidential Information for purposes of Section 20.18.

(B) Throughout the Term, Seller promptly shall

1. disclose to Company and remediate, at Seller's sole cost and expense, any Environmental Contamination identified at the Site;
2. provide to Company copies of any further environmental assessments or investigations of the Site (including associated raw data, if requested by Company); and
3. disclose to Company the existence of any enforcement, legal, or regulatory action or proceeding relating to any alleged presence of Environmental Contamination and/or the alleged violation of any Applicable Law related to protection of human health, the environment, or natural resources including protected species.

(C) For purposes hereof:

1. "Environmental Contamination" means the introduction or presence of Hazardous Materials at such levels, quantities or location, or of such form or character, that (i) requires remediation under Applicable Law, (ii) presents a material risk that the Site will not be available or usable for the purposes contemplated by this PPA, and/or (iii) will preclude or interfere with Seller's ability to perform its obligations under this PPA as and when due.

2. "Hazardous Materials" means any substance, contaminant, chemical, material, gas, or particulate matter that is regulated by any Governmental Authority as an environmental pollutant or which is deemed or may be deemed hazardous, dangerous, damaging or toxic to public health, public welfare, or the natural environment (including protection of non-human forms of life, land, water, groundwater, and air), including any material or substance that is (i) defined as "toxic," "polluting," "hazardous waste," "hazardous material," "hazardous substance," "extremely hazardous waste," "solid waste" or "restricted hazardous waste" under any provision of Applicable Law; (ii) petroleum, including any fraction, derivative or additive; (iii) asbestos; (iv) polychlorinated biphenyls; (v) per- and polyfluoroalkyl substances; (vi) radioactive material; (vii) designated as a "hazardous substance" pursuant to the Clean Water Act, 33 U.S.C. §1251 *et seq.* (33 U.S.C. §1251); (viii) defined as a "hazardous waste" pursuant to the Resource Conservation and Recovery Act, 42 U.S.C. §6901 *et seq.* (42 U.S.C. §6901); (ix) defined as a "hazardous substance" pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §9601 *et seq.* (42 U.S.C. §9601); (x) defined as a "chemical substance" under the Toxic Substances Control Act, 15 U.S.C. §2601 *et seq.* (15 U.S.C. §2601); or (xi) defined as a pesticide under the Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. §136 *et seq.* (7 U.S.C. §136).

4.3 Permits.

(A) Seller shall obtain and pay for all Permits necessary under Applicable Law or advisable pursuant to Good Utility Practices for the construction, ownership, operation and maintenance of the Facility and the generation and delivery of the products and services required by this PPA. Seller shall keep Company informed as to the status

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of its permitting efforts and shall provide Company the opportunity to review and comment on major applications for draft and final Permits. Seller shall promptly inform Company of (i) any Permits that Seller is unable to obtain, which are delayed, limited, suspended, terminated or otherwise constrained, along with a statement of whether and to what extent this circumstance may limit or preclude Seller's ability to perform under this PPA, and (ii) Seller's plan to overcome such issue(s) to allow Seller to perform this PPA as and when due. Company shall have the right to inspect and obtain copies of all Permits held by Seller.

(B) Seller represents and warrants to Company that, (i) except for those Permits identified in Exhibit F - Seller's Needed Permits (each of which Seller anticipates will be obtained by Seller in the ordinary course of business), all Permits and other actions required or recommended by applicable Governmental Authorities to authorize Seller's execution, delivery and performance of this PPA [wind] (including Permits with respect to protected species)] have been duly obtained and are in full force and effect; (ii) no event has occurred which allows, or after notice of lapse of time would allow, revocation or termination by the issuer thereof or which results in any other material impairment of the rights of the holder of any such Permit; and (iii) Seller has no reason to believe that any Governmental Authority is considering limiting, suspending or revoking any such Permit.

(C) Throughout the Term, Seller shall promptly disclose to Company the existence of any enforcement, legal, or regulatory action or proceeding relating to the alleged violation of any Permit held by Seller, which proceeding (if successful) could materially interfere with Seller's performance of this PPA.

(D) For purposes hereof, "Permits" means all applicable licenses, permits, certificates of authority, authorizations, approvals, registrations, and similar consents and orders issued or granted by a Governmental Authority for construction, ownership, operation and maintenance of the Facility and the generation and delivery of Renewable Energy therefrom.

4.4 Safety Requirements; Governmental Inspections. Seller shall, and shall cause its Affiliates and contractors to, design and construct the Facility and conduct all work or cause all work in connection therewith to be conducted in accordance with Exhibit N - Safety Requirements. Seller shall, and shall cause its Affiliates and contractors to, take all actions to comply with Exhibit N - Safety Requirements. Seller shall notify Company (i) sufficiently in advance of any known upcoming significant inspections by any Governmental Authority relating to the Facility, to allow Company the opportunity to attend, and (ii) promptly after any unscheduled or impromptu inspection with a description of the nature and outcome of such inspection.

4.5 Commercial Operation.

(A) Seller shall cause COD to occur no later than [REDACTED], 20[REDACTED] (the "Target COD"). Company shall not be obligated to accept and establish a Commercial Operation Date earlier than [REDACTED], 20[REDACTED] [insert date that is 90 days prior to Target COD].

(B) Seller shall notify Company of the date on which Seller believes the Facility has achieved Commercial Operation in writing (a "COD Notice"). A COD Notice

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shall include all necessary supporting documentation of the satisfaction or occurrence of all COD Conditions. Company shall have ten (10) Business Days to review a COD Notice and raise any Commercially Reasonable objection to Seller's satisfaction of any of the COD Conditions, *provided, however*, that Seller's COD Notice shall be deemed accepted by Company if Company fails to object within such time period. Seller may notify Company of completion of one or more COD Conditions on an individual and incremental basis prior to COD, *provided, however*, that Company shall in all cases have up to ten (10) Business Days to review and object to each such notice.

(C) For purposes hereof:

1. the "Commercial Operation Date" or "COD" means 12:01 am on the Day after which Seller's COD Notice has been accepted by Company or deemed accepted by Company pursuant to Section 4.5(B); and

2. the "COD Conditions" are:

a. an officer of Seller, authorized to bind Seller and who is familiar with the Facility, has confirmed in writing that (1) all necessary and material Permits have been obtained, are in full force and effect and the entity granting the Permit has not placed any temporary or conditional restrictions or limitations on the Facility or its operation, (2) Seller is in compliance with this PPA in all material respects, (3) Seller has made all necessary arrangements to obtain and pay the Local Provider for House Power, and (4) the Facility is available to commence normal operations in accordance with Seller's operating agreements, Construction Contracts, and applicable manufacturers' warranties;

b. Seller has proven to Company's reasonable satisfaction that (1) Seller and the Transmission Authority have executed the Interconnection Agreement, and Seller has received no notice of breach thereof from the Transmission Authority, (2) the Facility is interconnected to the Transmission Authority's System, and has been fully tested, achieved initial synchronization, and been successfully operated at a generation level acceptable to the Transmission Authority, without experiencing any abnormal or unsafe operating conditions on any interconnected system, (3) Seller has or is capable of declaring commercial operation under the Interconnection Agreement, and (4) Seller has made all other arrangements necessary to deliver Renewable Energy during the Term;

c. Seller has obtained and provided to Company an independent registered professional engineer's certification stating that the Facility has been completed in all material respects, except for "punch list" items that do not have a Material Adverse Effect on the ability of the Facility to operate for its intended purpose and are not required for the safe operation of the Facility or otherwise affect the capacity, efficiency, reliability, operability, safety or mechanical or electrical integrity of the Facility;

d. Seller has demonstrated the functionality and reliability of the Facility's communications systems and AGC interface with Company's EMCC, the capability of the Facility to receive and respond to signals from Company's SCADA System;

e. [Wind Turbines] [Solar Units] comprising not more or less than

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one hundred percent (100%) of the Nameplate Capacity of the Facility, and associated equipment sufficient to allow such [Wind Turbines] [Solar Units] to generate and deliver Renewable Energy to the Point of Delivery have been installed and become operable;

f. Seller has demonstrated the accuracy and reliability of the Real Time Data, including Park Potential required by Section 10.5 and completed a comprehensive check of the AGC data points to be sent from Seller to Company via the SCADA System to the Company's satisfaction, all in accordance with Exhibit I - AGC Protocols; Data Collection; Availability Reporting;

g. Seller has demonstrated the accuracy of the electric Metering Devices and their ability to communicate with the Company in accordance with Exhibit O - Meter and Communications Requirements;

h. Seller has demonstrated the ability to fulfill the forecasting requirements including the usage of the availability forecast system as described in Exhibit I - AGC Protocols; Data Collection; Availability Reporting;

i. Seller has provided to Company all documentation submitted consistent with Exhibit N - Safety Requirements;

j. Seller has executed and delivered to Company all documents or instruments required under Article 16 -; and,

k. Seller has provided evidence reasonably satisfactory to Company that it is compliant with and has adopted and implemented the appropriate policies pertaining to, the Forced Labor Laws consistent with Section 15.2(B). Seller shall also provide any additional evidence or certifications reasonably requested by Company that the requirements of this subsection have been met, including certifications from an officer of Seller or third-parties, certificates of origin documentation or importer statements.

l. an officer of Seller, authorized to bind Seller and who is familiar with the Facility, shall certify in writing that all Construction Craft Employees were covered by a collective bargaining agreement with a union affiliated with the local council of North America's Building Trades Unions ("Building Trades CBA"). If Seller cannot provide such certification as to a specified portion of the work, then an officer of Seller, authorized to bind Seller and who is familiar with the Facility shall certify in writing that Seller met and conferred, in good faith, with the local council of North America's Building Trades Unions and attempted to find and hire those trade(s) of Construction Craft Employee(s) covered by a Building Trades CBA for that portion of the work, and, if such Construction Craft Employee(s) covered by a Building Trades CBA were not available, that Seller (or Seller's construction contractor) entered into a site-specific building trades collective bargaining agreement covering that portion of the work.

(D) For purposes hereof, the first "Commercial Operation Year" shall mean the period starting at 12:01 a.m. on the Commercial Operation Date and ending at 11:59 pm on the last Day of the calendar month in which the first anniversary of COD occurs, and each successive "Commercial Operation Year" shall mean the twelve (12) month period following the prior Commercial Operation Year. The applicable Committed

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Energy amount for the first Commercial Operation Year shall be prorated to reflect the number of Days by which the first Commercial Operation Year exceeds three hundred sixty-five (365) Days.

(E) Prior to COD, should Seller require Company's assistance in meeting the COD Conditions because the Transmission Authority considers Company to be the market participant for the Facility, Company shall use Commercially Reasonable Efforts to cooperate with and provide assistance to Seller, so long as Seller provides any security the Transmission Authority requires and reimburses Company for all expenses, including fees of counsel, Company may incur in providing such cooperation and assistance.

4.6 Test Energy.

(A) Seller shall provide Company and Transmission Authority with the information necessary to have the Facility registered with the Transmission Authority for inclusion in any generation modeling maintained by the Transmission Authority, sufficiently in advance to allow the Facility to be registered in such model at least four months [NSP - six (6) months if Transmission Owner is not NSP] prior to generating any Test Energy. Company shall cooperate reasonably to assist in the registration of the Facility to allow generation of Test Energy.

(B) Seller shall coordinate the production and delivery of Test Energy with Company, with not less than seven (7) Business Days' prior written notice, or such other Commercially Reasonable prior written notice as Company may reasonably request.

(C) For purposes hereof, "Test Energy" means Renewable Energy generated by the Facility prior to COD that is required to satisfy the COD Conditions or as otherwise determined by the Company in the exercise of its reasonable discretion.

Article 5 - Delivery

5.1 Arrangements.

(A) Seller shall be responsible for arranging, maintaining and paying the costs associated with the interconnection of the Facility to the Transmission Authority's System. Seller shall comply with the Transmission Authority's requirements for interconnection and shall comply with all requirements set forth in the applicable Transmission Tariff.

(B) Seller's interconnection application shall request that the Transmission Authority study the Facility for Network Resource Interconnection Service under the Transmission Tariff. The resulting Interconnection Agreement must be Network Resource Interconnection Service.

(C) Seller hereby authorizes Company to contact, discuss and obtain information concerning the Facility and the Interconnection Facilities directly with/from the Transmission Authority. Promptly upon request by Company, Seller shall confirm such authorization in writing to the Transmission Authority and any applicable transmission owners in such form as may be requested by Company or the Transmission Authority.

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(D) To the extent required, Company shall arrange and be responsible for scheduling and transmission services beyond the Point of Delivery with respect to the output of the Facility. To the extent applicable, Company shall be the market participant with respect to the output of the Facility, as defined by the Transmission Authority.

(E) Seller shall be responsible for all interconnection, electric losses, transmission and ancillary service arrangements and costs required to deliver the Renewable Energy. Company shall be responsible for all electrical losses, transmission and ancillary service arrangements and costs required to transmit and deliver Renewable Energy beyond the Point of Delivery.

5.2 Market Changes.

(A) If at any time during the Term, the Transmission Authority changes or the facilities at the Point of Delivery cease to be subject to the Transmission Tariff, the Parties shall cooperate in good faith to facilitate the delivery of Renewable Energy, at the least possible cost to the Parties, consistent with this PPA to the extent possible.

(B) If and to the extent that changes to the rules of the Market Operator require Company to change the manner in which Company schedules and dispatches the Facility, the Parties shall cooperate in good faith to change their protocols for operation of the Facility accordingly, at the least possible cost to the Parties, consistent with this PPA to the extent possible.

(C) In addition, if as a result of any change in Applicable Law the Company is not able to realize the capacity and Ancillary Services products that the Facility is able to provide to the Company as of the Effective Date and such capacity and Ancillary Services products can be provided by the Facility subject to the Seller making capital expenditures to comply with such change in Applicable Law, then Seller agrees that it shall make all such required capital expenditures so that the Facility is able to provide such capacity and Ancillary Services products to the Company.

5.3 Electric Metering Devices.

(A) All Electric Metering Devices used to measure Renewable Energy located and installed at the Point of Delivery shall be owned and maintained by Company or the Transmission Authority, unless otherwise agreed to by Company; and all electrical Metering Devices located at or within the Facility shall be owned and maintained by Seller, at no cost to Company, unless the Company requests otherwise. All Electric Metering Devices shall meet the requirements of Exhibit O - Meter and Communications Requirements:

1. Meter readings will be adjusted to reflect losses from the Electric Metering Devices to the Point of Delivery in accordance with applicable manufacturers' parameters or as otherwise agreed by the Parties.

2. Seller shall arrange any necessary authorization to provide Company access to all Electric Metering Devices via electronic remote communications and via physical access for purposes related to this PPA and shall provide Company the opportunity to be present at any time when any such Electric Metering Device is to be

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inspected, tested or adjusted.

(B) Seller shall configure Electric Metering Devices, installed in accordance with and conforming to the Local Provider's electrical service and tariff requirements, as necessary, to separately account for all House Power.

(C) Either Party may elect to install and maintain, at its own expense, backup Electric Metering Devices ("Back-Up Metering"), *provided, however*, that the specifications, installation and testing of any such Back-Up Metering shall be consistent with the requirements for the Electric Metering Devices. Upon written request from the other Party, the installing Party shall test the Back-Up Metering. The actual cost of any such test shall be borne by the Party requesting the test, unless, upon such test, Back-Up Metering is inaccurate by more than one percent (1%), in which case the cost of the retest shall be borne by the installing Party. If requested in writing, the installing Party shall provide copies of any inspection or testing reports to the requesting Party.

(D) If an Electric Metering Device or Back-Up Metering fails to register, or if the measurement is inaccurate by more than one percent (1%), if requested by Company, an adjustment shall be made correcting all measurements as follows:

1. If the Electric Metering Device is found to be defective or inaccurate, the Parties shall use Back-Up Metering, if installed, to determine the amount of such inaccuracy, *provided, however*, that Back-Up Metering has been tested and maintained and adjusted for losses on the same basis as the Electric Metering Device. If Back-Up Metering is not installed, or Back-Up Metering is also found to be inaccurate by more than one percent (1%), the Parties shall use the best available information for the period of inaccuracy, adjusted for losses to the Point of Delivery in accordance with applicable manufacturers' parameters or as otherwise agreed by the Parties.

2. If the Parties cannot agree on the actual period during which inaccurate measurements were made, the period shall be the shorter of (i) the last one-half of the period from the last previous test of the Electric Metering Device to the test that found the Electric Metering Device to be defective or inaccurate, or (ii) one hundred eighty (180) Days immediately preceding the test that found the Electric Metering Device to be defective or inaccurate.

3. To the extent that an adjustment period covers a period of deliveries for which payment has already been made by Company, Company shall use the corrected measurements as determined in accordance with this Article 5 - to re-compute the amount due for the period of the inaccuracy and shall subtract or add the previous payments made by Company for this period from such re-computed amount. The net difference shall be reflected as an adjustment on the next regular invoice in accordance with Article 9 -.

5.4 Communication Protocols.

To facilitate the exchange of information between the Parties, the Parties shall follow the communication protocols set forth in Exhibit I - AGC Protocols; Data Collection; Availability Reporting.

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Article 6 - Conditions Precedent

6.1 PUC Approval.

(A) No later than forty-five (45) Days after the Effective Date, Company may apply to the MPUC/NDPSC for PUC Approval. If Company fails to apply for PUC Approval within forty-five (45) Days following the Effective Date, Company shall be deemed to have waived its right to obtain PUC Approval and to terminate this PPA under this Section 6.1, and this PPA shall remain in full force and effect thereafter.

(B) If Company applies for PUC Approval, Company shall use Commercially Reasonable Efforts to obtain PUC Approval as soon as reasonably practicable. Seller shall cooperate with Company's efforts to obtain PUC Approval.

(C) If Company applies for PUC Approval, Company shall have the right to terminate this PPA, without any further financial or other obligation to Seller as a result of such termination, by notice to Seller;

1. at any time within thirty (30) Days following issuance of a written order by the MPUC and/or the NDPSC (as applicable) rejecting PUC Approval, or granting PUC Approval with conditions unacceptable to Company in its sole discretion;

2. at any time between the one-hundred eightieth (180th) and two hundred fifteenth (215th) Day following Company's application for PUC Approval, if prior to the date of such termination the MPUC and/or the NDPSC (as applicable) has not issued a written order granting or rejecting PUC Approval; **[if applicable as specified in the RFP]**

3. at any time within thirty (30) Days following timely request for reconsideration (in whole or in any material part) by any third party with standing, of a written order of the MPUC or the NDPSC (as applicable) granting PUC Approval; and/or

4. at any time within thirty (30) Days following timely appeal by any party with standing, of a written order of the MPUC or the NDPSC (as applicable) granting PUC Approval.

If Company is eligible but fails to terminate this PPA by the applicable date, Company shall be deemed to have waived its right to terminate this PPA under this Section 6.1(C), and this PPA shall remain in full force and effect thereafter.

(D) For purposes of this PPA, "PUC Approval" means a written order of the MPUC and/or an Advance Determination of Prudence from the NDPSC, which alone or in combination make(s) an affirmative determination that all costs incurred under this PPA are recoverable from Company's retail customers pursuant to Applicable Law, subject only to the requirement that the MPUC and NDPSC (as applicable) retain ongoing prudency review of Company's performance and administration of this PPA, as determined by Company in its sole discretion.

6.2 Other Company CPs. **[if any].**

6.3 Seller CPs. **[if any - bid specific].**

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6.4 Return of Security Fund. Following a termination pursuant to Section 6.1 [or Section 6.2] [or Section 6.3], the Company will return to Seller the undisputed amount of the remaining initial Security Fund within five (5) Business Days of such termination.

Article 7 - Sale and Purchase

7.1 General Obligation.

(A) Subject to the provisions of this PPA, beginning on the Commercial Operation Date, Seller shall generate from the Facility, deliver to the Point of Delivery, and sell to Company, and Company shall receive and purchase at the Point of Delivery, the Renewable Energy, Ancillary Services and other products and services required by this PPA. Seller shall not curtail or interrupt deliveries of Renewable Energy to Company for economic reasons of any type.

(B) Seller shall not sell any products or services required by this PPA to any third party.

(C) Title and risk of loss of the products and services transacted by this PPA shall transfer from Seller to Company at the Point of Delivery.

7.2 AGC. Beginning on the Commercial Operation Date, Company shall dispatch the Facility through the EMCC AGC system in accordance with Exhibit I - AGC Protocols; Data Collection; Availability Reporting. Seller shall ensure that, throughout the Term:

(A) the SCADA System signal is capable of functioning on all AGC Set Points within the margin of error specified in the manufacturer's energy set point margin of error; and

(B) the Facility AGC Remote/Local status is in "Remote" set-point control during normal operations.

7.3 Environmental Attributes. The Parties acknowledge that existing and future Applicable Laws create significant value in the ownership, use and allocation of Environmental Attributes. To the full extent allowed by Applicable Law, Seller hereby assigns to Company (and Company shall own and be entitled to claim) all Environmental Attributes existing or created during the Term associated with the Facility and the Renewable Energy, at no additional charge to Company under this PPA.

(A) Seller hereby irrevocably assigns to Company all rights, title and authority for Company to register the Facility as an Eligible Energy Resource and own, hold and manage the Environmental Attributes associated with the Facility in Company's own name and to Company's account, including any rights associated with any renewable energy information or tracking system that exists or may be established (including participation in any applicable REC Registration Program) with regard to monitoring, registering, tracking, certifying, and/or trading such Environmental Attributes. Seller hereby authorizes Company to act as its agent for the purposes of registering the Facility as an Eligible Energy Resource, and tracking, certifying, registering and reporting such Environmental Attributes. Seller grants to Company full authority to hold, use, sell and/or trade such Environmental Attributes for the Company's own account in all applicable

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renewable energy information or tracking systems. Upon the request of Company, at no cost to Company, (i) Seller shall deliver or cause to be delivered to Company appropriate attestations/certifications of such Environmental Attributes, and (ii) Seller shall cooperate with Company's tracking, registration, reporting and certification of such Environmental Attributes.

(B) Prior to the Commercial Operation Date, Seller shall complete and return to Company all applications and forms and provide all supporting documentation required by Applicable Law for accreditation and assignment of all Environmental Attributes. Such applications, forms and supporting documentation include but are not limited to: (i) Assignment of Registration rights, (ii) Schedule A Form, (iii) EIA 860 Verification, (iv) the Interconnection Agreement, (v) Manufacturer's specifications for the [turbines] [panels], (vi) revenue meter number and (vii) COD Notice.

(C) For purposes hereof, "Environmental Attributes" includes but is not limited to existing and future, (i) Renewable Energy Credits, (ii) environmental credits, benefits or attributes, (iii) emissions reductions, (iv) avoided emissions and reporting rights for avoided emissions of pollutants to the air, soils or waters, such as sulfur oxides (SO_x), nitrogen oxides (NO_x), carbon monoxide (CO), greenhouse gases (such as carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆) that have been or may in the future be determined by the United Nations Intergovernmental Panel on Climate Change or by Applicable Law to contribute to the threat of climate change; (v) avoidances (including emission rate credits), offsets, allowances and green tags, and (vi) zero-emission electricity credits, that are attributable to the Facility during the Term and/or Renewable Energy under this PPA, recognized by Applicable Law, including any rights to compensation therefor.

(D) For the avoidance of doubt, Environmental Attributes exclude: (i) PTCs, ITCs and other local, state or federal tax credits providing a tax benefit to Seller based on ownership of the Facility or energy production therefrom, including the [wind] PTCs] or [solar] ITCs] that may be available to Seller with respect to the Facility under IRC §[wind] 45] [solar] 48], and (ii) depreciation and other tax benefits arising from ownership or operation of the Facility.

7.4 Ancillary Services.

(A) During the Term, Seller shall make available to Company and Company shall own, all Ancillary Services associated with the Facility, including but not limited to the sole right to sell Ancillary Services associated with the Facility and to retain all revenues therefrom. Seller shall use Commercially Reasonable Efforts to maximize the Ancillary Services available from the Facility.

(B) Any compensation Seller receives under the Interconnection Agreement or otherwise from third parties for Ancillary Services shall be provided to Company at no additional cost to Company under this PPA. To implement the foregoing, Seller shall credit Company, as a reduction to Seller's monthly invoice or other mutually-agreed mechanism, for any compensation that Seller receives from third parties for such Ancillary Services; *provided*, that if a Governmental Authority or Transmission Authority

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implements new or revised requirements for generators to create, modify, or supply Ancillary Services, requiring Seller to install additional equipment after the Effective Date to meet such requirements, then Seller, after consultation with Company shall, if requested to do so by Company, install any such additional equipment and shall be allowed to reduce the amount to be credited to Company for Ancillary Services by an amount sufficient to recover the cost of such additional equipment (up to the amount of any cap agreed to by the Parties for such work). Any cost not so recovered by Seller in any billing period shall be carried forward as a reduction of the amount of the credit in subsequent billing periods. The invoice for the final billing period of the Term shall include any costs not yet recovered by Seller pursuant to this Section 7.4(B).

(C) For purposes hereof, “Ancillary Services” mean any service associated, directly or indirectly, with the reliable generation and/or transmission of energy from the Facility from time to time, including but not limited to: operating reserves, ramp capability, reactive supply, reactive supply capability, voltage control, voltage control capability, and any rights to compensation for any of these services. “Ancillary Services” also includes any other service identified as an “ancillary service” or “other ancillary service” in the Transmission Tariff. For the avoidance of doubt, “Ancillary Services” include any service associated, directly or indirectly, with the reliable generation and/or transmission of energy from the Facility, regardless of whether the Facility, the Transmission Authority or the Company is deemed to be the service provider for the service.

Article 8 - Payment Calculations

8.1 Payment for Renewable Energy.

(A) Company shall pay Seller [] [Number derived by multiplying 70% by the Renewable Energy Payment Rate for the first Commercial Operation Year. Can be deleted if there is only one Renewable Energy Payment Rate] for all Test Energy delivered to Company.

(B) Subject to the reduction as set forth in Section 8.4, commencing on the Commercial Operation Date, Company shall pay the Renewable Energy Payment Rate to Seller for all Renewable Energy delivered by the Facility to the Point of Delivery, up to one hundred fifteen percent (115%) of the Committed Energy, in each Commercial Operation Year (such payment in any given month, the “Monthly Energy Payment”), *provided* that, Company shall never be required to pay for net instantaneous output of the Facility (as measured at the Point of Delivery) in excess of the Generation Limit. For purposes of this PPA the “Generation Limit” shall be the lesser of the (i) Nameplate Capacity or (ii) the power transfer limit as established in the Interconnection Agreement. Without the express written consent of Company, Seller shall not permit the aggregate amount of the net instantaneous output of the Facility delivered to the Point of Delivery at any given moment in time to exceed the Generation Limit.

(C) The Renewable Energy Payment Rate shall be deemed Confidential Information for purposes of Section 20.18 below.

8.2 Excess Energy.

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(A) Seller shall notify Company promptly upon Seller's delivery of Renewable Energy that exceeds one hundred ten percent (110%) of the Committed Energy for a Commercial Operation Year. Within ten (10) Business Days of any such notice, Company shall elect by notice to Seller either to accept or to decline any Excess Energy generated by the Facility through the balance of such Commercial Operation Year. Failure by Company to deliver such notice shall be deemed an election by Company to decline any Excess Energy for that Commercial Operation Year.

(B) If Company elects to accept Excess Energy, Company shall pay Seller the full Renewable Energy Payment Rate for all Excess Energy for the balance of that Commercial Operation Year.

(C) If Company declines Excess Energy, Company's purchases of Renewable Energy with respect to the applicable Commercial Operation Year shall cease when Renewable Energy reaches one hundred fifteen percent (115%) of the Committed Energy for such Commercial Operation Year.

(D) For purposes hereof, "Excess Energy" means all Renewable Energy generated by the Facility in any Commercial Operation Year in excess of one hundred fifteen percent (115%) of the Committed Energy for such Commercial Operation Year, measured at the Point of Delivery.

8.3 Curtailment.

(A) For purposes of this PPA, a "Curtailment" shall be defined as a curtailment of the output of the Facility arising out of:

1. The Transmission Authority, or any Governmental Authority directing a curtailment, reduction, or re-dispatch of generation to the extent that such action results in a curtailment of the output of the Facility under Applicable Law, including planned maintenance outages on any part of the transmission system or any testing of the transmission system, any declaration of an "Emergency Condition" or "Force Majeure" (as such terms are defined in the Interconnection Agreement), or any non-dispatch or reduction in dispatch of the Facility as a result of the tags, offers, bids, plans or schedules for the Facility submitted by Company.

2. A forced or unscheduled interruption or outage (including as a result of interruption or curtailment of electric transmission service), but (without limiting the other sub-clauses and clause of this Section 8.3) only for so long and only to the extent necessitated by such forced or unscheduled interruption or outage.

3. Company, subject to Section 5.1(C), and Section 7.1(A) or Transmission Authority requiring Seller, by telephonic communication or through use of the AGC Set Point, to curtail the delivery of Renewable Energy from the Facility. Seller shall promptly comply with each such notification.

4. The lack of available transmission from the Facility to the Point of Delivery.

(B) No payment shall be due to Seller from Company for Renewable Energy curtailed as a consequence of a Curtailment.

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8.4 Energy Payment Reduction.

(A) Beginning at COD should Seller fail to deliver to Company at least ninety percent (90%) of the Committed Energy in either two (2) consecutive Commercial Operation Years, or three (3) non-consecutive out of six (6) consecutive Commercial Operation Years (as adjusted pursuant to Exhibit M - Methodology for Adjusting Committed Energy), the Monthly Energy Payment Company makes to Seller during the Commercial Operation Year following such failure shall be reduced by ten percent (10%).

(B) Beginning with the [Insert Term minus five (5) years] Commercial Operation Year, should Seller fail to deliver to Company at least ninety percent (90%) of the Committed Energy in either two (2) consecutive Commercial Operation Years, or three (3) non-consecutive out of six (6) consecutive Commercial Operation Years (as adjusted pursuant to Exhibit M - Methodology for Adjusting Committed Energy), the Monthly Energy Payment Company makes to Seller during the Commercial Operation Year following such failure shall be reduced by fifteen percent (15%).

(C) Beginning with the third (3rd) Commercial Operation Year, should Seller fail to deliver to Company at least eighty-five percent (85%) of the Committed Energy in either two (2) consecutive Commercial Operation Years, or three (3) non-consecutive out of six (6) consecutive Commercial Operation Years (as adjusted pursuant to Exhibit M - Methodology for Adjusting Committed Energy), the Monthly Energy Payment Company makes to Seller during the following Commercial Operation Year shall be reduced by fifteen percent (15%).

(D) Beginning with the [Insert Term minus five (5) years] Commercial Operation Year, should Seller fail to deliver to Company at least eighty-five percent (85%) of the Committed Energy in either two (2) consecutive Commercial Operation Years, or three (3) non-consecutive out of six (6) consecutive Commercial Operation Years (as adjusted pursuant to Exhibit M - Methodology for Adjusting Committed Energy), the Monthly Energy Payment Company makes to Seller during the following Commercial Operation Year shall be reduced by twenty percent (20%).

(E) Beginning with the third (3rd) Commercial Operation Year, should Seller fail to deliver to Company at least eighty percent (80%) of the Committed Energy in either two (2) consecutive Commercial Operation Years, or three (3) non-consecutive out of six (6) consecutive Commercial Operation Years (as adjusted pursuant to Exhibit M - Methodology for Adjusting Committed Energy), the Monthly Energy Payment Company makes to Seller during the following Commercial Operation Year shall be reduced by twenty percent (20%).

(F) Beginning with the [Insert Term minus five (5) years] Commercial Operations Years, should Seller fail to deliver to Company at least eighty percent (80%) of the Committed Energy in either two (2) consecutive Commercial Operation Years, or three (3) non-consecutive out of six (6) consecutive Commercial Operation Years (as adjusted pursuant to Exhibit M - Methodology for Adjusting Committed Energy), the Monthly Energy Payment Company makes to Seller during the following Commercial Operation Year shall be reduced by twenty-five percent (25%).

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(G) For the avoidance of doubt, should more than one Energy Payment Reduction percentage under this Section apply to the same Commercial Operation Year, only the largest payment reduction shall apply to that Commercial Operation Year.

Article 9 - Billing and Payment

9.1 Billing.

(A) The billing period under this PPA shall be the calendar month.

(B) As soon as practicable and in any event within twenty (20) Days after the end of each month, Company shall provide to Seller a statement containing Company's calculation of the amount due to Seller for such month, including the applicable billing parameters based upon Company's reading of the Electric Metering Devices consistent with Section 5.2.

(C) No later than fifteen (15) Business Days following receipt of Company's billing statement, Seller shall submit an invoice to Company in a form and by a method to be agreed by the Parties, showing the amount due Seller for the relevant month, specifying the products and services provided, billing meter register reads for relevant measurement quantities, total usage in kWh being billed, date and time at which accumulated and billed production was read by the Electric Metering Devices, all billing parameters, rates and factors, and any other data relevant to the calculation of payments due to Seller. Such invoice shall include an explanation of any items in dispute, as well as all supporting documentation upon which Seller relies.

9.2 Payment. All payments shall be remitted via check or electronic funds transfer, as designated by the owed Party, on or before the fifteenth (15th) Business Day following receipt of the invoice described in Section 9.1(C). Remittances received by mail will be considered to have been paid when due if the postmark indicates the payment was mailed on or before the fifteenth (15th) Business Day following receipt of the billing invoice.

(A) If a payment is late, a late payment charge shall be applied to the unpaid balance for the number of Days the payment was late and shall be added to the next billing statement. Late payment charges shall include interest calculated using the prime rate of interest as published on the date of the invoice in *The Wall Street Journal* (or, if unavailable, an equivalent publication on or about that date).

(B) Company at any time may offset against amounts owed to Seller, any liquidated amounts, accrued damages and other payments, and undisputed billing errors and adjustments, which are owed by Seller to Company.

(C) Seller and Company may net their obligations to each other under this PPA, and payment of the net amount shall discharge all mutual undisputed obligations between the Parties.

9.3 Billing Disputes. Either Party may dispute invoiced amounts pursuant to Section 13.1, shall pay to the other Party at least the portion of invoiced amounts that is not disputed, on or before the invoice due date. When the billing dispute is resolved, the amount owed shall be netted in the monthly billing period's invoice following the date of such resolution, with late payment interest charges calculated on the amount owed in

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accordance with Section 9.2(A).

Article 10 - Operations and Maintenance

10.1 Operation and Administration.

(A) Seller shall staff, control, and operate the Facility consistent with Good Utility Practices, Exhibit I - AGC Protocols; Data Collection; Availability Reporting and this PPA. Personnel of Seller shall be available 24x7 via telephone or other electronic means with (i) the capability of remotely starting, operating and stopping the Facility within ten (10) minutes, and (ii) the ability to be present at the Site within thirty (30) minutes or sooner, to the extent required in accordance with Good Utility Practices and subject to Exhibit N - Safety Requirements.

(B) Seller shall comply with Good Utility Practices, its obligations under this PPA, the Interconnection Agreement, and the requirements of all Governmental Authorities and all reasonable requirements of Company in the operation of the Facility. By way of example only, Seller shall perform all capacity testing of the Facility and related reporting, as and when required by Governmental Authorities.

(C) Seller shall provide to Company a two (2) Business Day-ahead availability schedule in accordance with Exhibit I - AGC Protocols; Data Collection; Availability Reporting and any other reporting requirements required for compliance with NERC reliability standards. Company shall forward Seller's forecast to the applicable local reliability coordinator on Seller's behalf, *provided, however*, that Seller shall remain responsible to ensure the timeliness and accuracy of forecasts and any changes to the real-time or forecast availability of the Facility. If and to the extent that the ERO modifies the forecasting or other reporting requirements imposed on Company or the Facility, Seller shall timely provide required data to Company or the ERO, as applicable.

(D) Seller shall, and shall cause its Affiliates and contractors to operate, and maintain the Facility and conduct all work or cause all work in connection therewith to be conducted in accordance with Exhibit N - Safety Requirements. Seller shall and shall cause its Affiliates and contractors to take all actions to comply with Exhibit N - Safety Requirements.

10.2 Facility Maintenance.

(A) Seller shall maintain the Facility in accordance with Good Utility Practices. Seller shall coordinate its regular maintenance requirements for the Facility with Company ("Maintenance Schedules"). Seller shall provide Maintenance Schedules, including planned outages, to Company in writing and sufficiently in advance for Company's Commercially Reasonable review, and shall be subject to Company's Commercially Reasonable approval. Seller shall coordinate with Company and the Transmission Authority on the timing and duration of planned outages. Company has the right to not permit a planned outage if it conflicts with the requirements of the ERO or if the ERO rejects the planned outage request.

(B) Seller shall minimize the amount of scheduled maintenance during the months of January, February, June, July, August, September and December to the maximum extent consistent with Good Utility Practices. Seller shall coordinate with Company and the

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Transmission Authority on the timing and duration of planned outages.

(C) When Forced Outages occur, Seller shall notify Company's EMCC of the existence, nature, start time, and expected duration of the Forced Outage as soon as practical, but in no event later than one hour after the Forced Outage occurs. Seller shall immediately inform Company's EMCC of changes in the expected duration of the Forced Outage except to the extent relieved of this obligation by Company's EMCC with respect thereto.

(D) Seller shall develop and provide Company with a copy of its Facility cold weather policy. In the event of a Facility Forced Outage or derate, Company may request that Seller shall conduct a root cause analysis, take corrective action(s) as are reasonable under the circumstances to prevent reoccurrences and provide a copy of such analyses and corrective action(s) to Company.

10.3 Books and Records.

(A) Seller shall maintain an accurate and up-to-date operating log at the Facility, in electronic format, with records of production for each clock hour; changes in operating status; Forced Outages; information required by Governmental Authorities in the prescribed format; and other information reasonably requested by Company. Seller shall deliver the operating log to Company electronically when reasonably requested.

(B) Seller and Company shall each keep complete and accurate records and all other data required by each of them for the purposes of proper administration of this PPA, including metering, billing and payment records, and such records as may be required by Governmental Authorities. Originals or copies of all Operating Records shall be maintained at the Site or such other [Minnesota or Wisconsin] location as may be specified by Seller from time to time. Company may examine and make copies of such Operating Records from time to time upon request, during normal business hours.

10.4 Access to Facility. Representatives of Company shall have access to the Facility from time to time, on Commercially Reasonable prior written notice, to read meters, perform inspections and take such other actions as may be appropriate to facilitate Company's performance of this PPA. While at the Facility, such representatives shall observe Seller's standard safety precautions and shall conduct themselves in a manner that will not interfere with operation of the Facility.

10.5 Real Time Data.

(A) Seller shall communicate all data necessary for Company to integrate the Facility into Company's EMCC in real time ("Real Time Data") through the Facility's SCADA System in accordance with Exhibit I - AGC Protocols; Data Collection; Availability Reporting. Seller shall maintain the Facility's SCADA System and communications system so that they are capable of interfacing with and reacting to Company's AGC Set-Point and responding to signals from the Company's EMCC in accordance with the AGC Protocols.

(B) Seller shall use Commercially Reasonable Efforts to maintain and, when necessary, adjust the real time Park Potential of the Facility when Company communicates to Seller a measured difference of plus or minus two percent between the

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metered Renewable Energy and Park Potential, during periods when generation is not curtailed.

(C) From and after the Commercial Operation Date, Seller shall provide Company, at Seller's expense, real time performance and meteorological data for all [Wind Turbines] [Solar Units] and meteorological stations at the Facility in accordance with Exhibit I - AGC Protocols; Data Collection; Availability Reporting for the Term. Seller shall maintain Seller-owned data collection systems that are compatible with Company's PI System. Seller shall ensure that real time communications capabilities are available and maintained for transmission to Company's PI System. Seller shall ensure that all meteorological equipment at a minimum meets the specifications set forth in Exhibit I - AGC Protocols; Data Collection; Availability Reporting. Company shall have the right to disclose data gathered through the Company's PI System publicly; *provided, however*, that such data is (i) masked to obscure the origin of the data and (ii) aggregated so that the data cannot be correlated and used by competitors of Seller and/or the supplier of the [Wind Turbines] [Solar Units], except as otherwise provided in Section 20.18.

10.6 Accreditation. Seller shall perform from time to time, at its expense, any reporting and testing (including capacity testing) of the Facility required by Governmental Authorities.

10.7 Operating Committee and Operating Procedures.

(A) Company and Seller shall each appoint one representative and one alternate representative to act as the Operating Committee in matters relating to the Parties' performance obligations under this PPA and to develop operating arrangements for the generation, delivery and receipt of the Renewable Energy from the Facility. The Parties' initial representatives on the Operating Committee are set forth in Exhibit D - Notices and Contact Information.

(B) The Operating Committee may develop mutually agreeable written Operating Procedures consistent with the requirements of this PPA, to address matters such as day-to-day communications; key personnel; operations-center interface; metering, telemetering, telecommunications, and data acquisition procedures; operations and maintenance scheduling and reporting; reports; operations log; testing procedures; and such other matters as may be mutually agreed upon by the Operating Committee.

(C) The Operating Committee shall review the requirements for AGC and data collection from time to time after the Effective Date and may agree on modifications thereto to the extent necessary or convenient for operation of the Facility in accordance with this PPA.

(D) The Operating Committee shall have authority to act in all technical and day-to-day operational matters relating to performance of this PPA and to attempt to resolve potential disputes, *provided, however*, that except as explicitly provided herein, the Operating Committee shall have no authority to amend or waive any provision of this PPA.

Article 11 - Security for Performance

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11.1 Security Fund.

(A) During the Term of this PPA, Seller shall fund and maintain security in favor of Company, at Seller's expense, to secure Seller's obligations to Company under this PPA (the "Security Fund"), in accordance with this Article 11 -.

(B) Seller shall establish and fund the Security Fund in the amount of [insert \$200/kW] multiplied by the number of kW in the Facility Nameplate Capacity, no later than thirty (30) Days following the Effective Date. Within five (5) Business Days following COD, the amount of the Security Fund shall be reduced to [insert \$75/kW multiplied by the number of kW in the Facility Nameplate Capacity].

(C) Without notice to Seller, Company may draw from the Security Fund such amounts as are necessary to recover amounts owing to Company pursuant to this PPA, including any Liquidated Delay Damages, Actual Damages, liquidated damages for failure to achieve COD, and any amounts for which Company is entitled to indemnification under this PPA. Company may, in its sole discretion, draw all or any part of such amounts from any form of security to the extent available pursuant to this Article 11 - and in any sequence Company may select. Company's failure or delay to draw any amount from the Security Fund in any instance shall not prejudice Company's rights to subsequently recover such amount from the Security Fund or in any other manner.

(D) Company shall notify Seller within five (5) Business Days following any draw on the Security Fund by Company, including the amount thereof and the basis therefor.

11.2 Replenishment. Seller shall replenish the Security Fund to the applicable levels set forth in Section 11.1(B) within fifteen (15) Business Days after Company makes a draw on the Security Fund; *provided however*, following COD such replenishment shall not exceed the amount remaining under the Damage Cap (as provided in Section 12.4(A)). Notwithstanding the foregoing, within fifteen (15) Business Days after Company makes a draw on the Security Fund associated with the damages described in Section 12.4(B), Seller shall replenish all amounts drawn from the Security Fund.

11.3 Form.

(A) The Security Fund may be in the form of an irrevocable standby letter of credit substantially in the form of Exhibit G - Form of Letter of Credit (a "Letter of Credit") from a financial institution acceptable to Company ("Issuer").

1. The Letter of Credit must be issued by a bank or other financial institution that is acceptable to Company, with a minimum rating of A- by Standard & Poor's and A3 from Moody's (unenhanced by third-party support). No letters of credit will be accepted from banks which are rated below A-/A3 by one or more rating agencies. (If there are split ratings amongst rating agencies, the Company will use the lowest of the different ratings within the same rating agency and amongst different rating agencies). The Letter of Credit must be issued by a U.S. branch/office and such branch/office must have an acceptable minimum rating of A-/A3 on its own by at least one of the rating agencies. If such rating is equivalent to A-/A3, the Issuer must not be on credit watch or have a negative outlook by any rating agency. The above ratings are defined as follows

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(if available): Long term issuer rating, Long Term Senior Unsecured rating or Long Term Counterparty Risk Assessment/Rating (for Moody's).

2. The Letter of Credit must be for a minimum term of three hundred sixty (360) Days. Seller shall give Company at least thirty (30) Days advance notice prior to any expiration or earlier termination of the Letter of Credit. Seller shall cause the renewal or extension of the Letter of Credit for additional consecutive terms of three hundred sixty (360) Days or more (or, if shorter, through the end of the period required under Section 11.5 below) more than thirty (30) Days prior to each expiration date of the security. If the Letter of Credit is not renewed or extended at least thirty (30) Days prior to its expiration date or otherwise is terminated early, Company shall have the right to draw immediately upon the Letter of Credit and to place the amounts so drawn in Company's account until such time as Seller provides a substitute form of security meeting the requirements of this Section 11.3.

(B) The Security Fund may be in the form of U.S. currency deposited into an escrow account with a state- or federally chartered commercial bank with an office in the State of [Minnesota or Wisconsin], with net assets of at least \$1 billion (the "Escrow Account").

1. The Escrow Account shall be governed by an escrow and account control agreement in a form mutually satisfactory to Seller, Company and the escrow agent, provided that (a) Company shall hold a first and exclusive perfected security interest in the funds in the Escrow Account, (b) Company shall be permitted unilaterally to draw down any amount therein, regardless of any protest by Seller or any other party liable thereon (*provided* that nothing in the escrow agreement shall preclude any protest against Company by Seller, following any draw, that such draw did not comply with this PPA), and (c) Seller shall pay all fees and expenses of the escrow agent.

2. Funds held in the Escrow Account may be invested as Seller may direct in any of the following:

- a. a money-market fund sponsored by the escrow agent;
- b. U.S. treasury obligations with a maturity of ninety (90) Days or less;
- c. commercial paper rated "A" or better, with a maturity of ninety (90) Days or less; and
- d. other liquid investment-grade investments with maturities of three months or less, approved by Company in advance (such approval not to be unreasonably withheld or delayed).

3. All investment income on the Escrow Account shall be taxable to, and accrue for the benefit of, Seller. After the Commercial Operation Date, periodic sweeps by Seller for recovery of interest earned by the escrowed funds shall be allowed, and, at any time the balance in the Escrow Account exceeds the required amount of security, the escrow agent may remit any excess to Seller.

(C) Following COD, the Security Fund may consist of a guaranty

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substantially in the form of Exhibit H - Form of Guaranty, from a parent or other guarantor (“Guarantor”) acceptable to Company in its sole and absolute discretion, and up to an amount within Company's sole and absolute discretion. Subject to Company's sole and absolute discretion, to be eligible to provide a guaranty, the proposed Guarantor must have a minimum tangible net worth of at least \$250,000,000 and an Investment Grade Credit Rating (and if such Credit Rating is exactly equivalent to BBB- (S&P) / Baa3 (Moody's), the Guarantor must not be on credit watch by any rating agency). If the Credit Rating of the Guarantor is downgraded below Investment Grade, put on credit watch, or an event occurs that (in the reasonable determination of Company) portends a Material Adverse Effect in the creditworthiness of the Guarantor, then Company may require Seller to convert the guaranty to a Security Fund instrument meeting the criteria set forth in either paragraph (A) or paragraph (B) above no later than ten (10) Days after notice from Company.

(D) Upon request by Seller, Company shall negotiate in good faith any immaterial changes to Exhibit G - Form of Letter of Credit and/or Exhibit H - Form of Guaranty, provided that Seller shall pay or reimburse Company for the incremental direct expenses (including the fees and expenses of counsel) incurred by Company in connection therewith.

(E) Seller may change the form of the Security Fund at any time and from time to time upon Commercially Reasonable prior written notice to Company, *provided, however*, that the Security Fund must at all times satisfy the requirements of this Article 11 -.

11.4 Replacement. In the event that the Security Fund ever fails to comply with the requirements of this Article 11 - or Company determines in a Commercially Reasonable manner that an event has occurred or circumstances have developed that threaten to cause the Security Fund to fail to comply with the requirements of this Article 11 - (e.g. a Guarantor is placed on negative credit watch by a rating agency), Seller shall be required to replace the Security Fund with security in compliance with Section 11.3 within five (5) Days following notice thereof from Company.

11.5 Survival. The Security Fund shall survive termination of this PPA to be available to pay any amounts owed to Company arising prior to or upon termination. Promptly following (i) the end of the Term and the completion of all of Seller's obligations under this PPA, or (ii) termination of this PPA for any reason prior to the Scheduled Termination Date, Company shall determine the amount, if any, owed by Seller for any obligations or damages arising out of this PPA. Company may draw such amount and shall release the balance of the Security Fund (including any accumulated interest, if applicable) to Seller.

11.6 Expenses. Seller shall reimburse Company for its direct expenses (including the fees and expenses of counsel) incurred by Company in connection with the preparation, negotiation, execution and/or release (including making a draw of funds) of the Security Fund under this Article 11 -.

Article 12 - Default and Remedies

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12.1 Default by Seller: General.

(A) Events. Any of the following events shall constitute a default by Seller under this PPA. If no cure period is provided below, such default shall be deemed an Event of Default by Seller immediately upon its occurrence. If a cure period is provided below, such default shall mature into an Event of Default if not cured within the indicated cure period, subject to Section 13.3 below.

1. Seller's application for, or consent (by admission of material allegations of a petition or otherwise) to, the appointment of a receiver, trustee or liquidator for Seller or for all or substantially all of its assets, or its authorization of such application or consent, or the commencement of any proceedings seeking such appointment without such authorization, consent or application, which proceedings continue undismissed or unstayed for a period of sixty (60) Days from inception.

Cure Period: None.

2. Seller's authorization or filing of a voluntary petition in bankruptcy or application for or consent (by admission of material allegations of a petition or otherwise) to the application of any bankruptcy, reorganization, readjustment of debt, insolvency, dissolution, liquidation or other similar law of any jurisdiction or the institution of such proceedings against Seller without such authorization, application or consent, which proceedings remain undismissed or unstayed for sixty (60) Days from its inception or which result in adjudication of bankruptcy or insolvency within such time.

Cure Period: None.

3. Seller's assignment of this PPA, the Facility, or any Change of Control, not permitted by Section 19.1.

Cure Period: None.

4. Any representation or warranty by Seller that materially affects its ability to perform this PPA (a) is proven to have been false in any material respect when made; or (b) ceases to remain true in all material respects during the Term, *provided however*, that a representation or warranty that ceases to remain true due to a change in Applicable Law shall not be considered an Event of Default.

Cure Period: Thirty (30) Days after Company provides notice of such breach.

5. Seller's failure to establish and, once established, maintain the Security Fund as and in the amounts required under Article 11 -.

Cure Period: Five (5) Business Days after Company provides notice of Seller's failure.

6. Seller's failure to obtain and maintain insurance in scope and amounts required under Article 16 -.

Cure Period: Five (5) Business Days after Company provides notice of Seller's failure.

7. Seller's failure to make any payment to Company as and when required by this PPA, including Liquidated Delay Damages, Actual Damages, and any

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required indemnification.

Cure Period: Ten (10) Business Days after Company provides notice that the amount is overdue.

8. The breach by Seller of the Interconnection Agreement, which breach (i) materially interferes with Seller's production and/or delivery of any product or service to be produced or delivered pursuant to this PPA or Company's ability to accept or receive such product or service, (ii) Company's ability to transmit Renewable Energy beyond the Point of Delivery, and/or (iii) otherwise has a Material Adverse Effect on Company.

Cure Period: Thirty (30) Days from the breach or the cure period allowed by the Interconnection Agreement (whichever is longer).

9. Beginning with the third Commercial Operation Year, Seller's failure to deliver to Company at least eighty-five percent (85%) of the Committed Energy in either three consecutive Commercial Operation Years, or four non-consecutive out of six consecutive Commercial Operation Years. For purposes of establishing a default by Seller under this paragraph, the Committed Energy shall be adjusted as provided in Exhibit M - Methodology for Adjusting Committed Energy.

Cure Period: Seller shall be deemed to have cured this default if, in the Commercial Operation Year following such default, Seller delivers to Company at least ninety percent (90%) of the Committed Energy for such Commercial Operation Year (again as adjusted pursuant to Exhibit M - Methodology for Adjusting Committed Energy).

10. The failure by Seller to perform or observe any other material obligation to Company under this PPA, unexcused by Force Majeure (other than failure to achieve COD, which is addressed in Section 12.2 below).

Cure Period: Thirty (30) Days after Company provides notice thereof; *provided*, that if such default is not reasonably capable of cure within such thirty (30) Day period, Seller shall have such additional period of time (not to exceed ninety (90) Days in any event) as is reasonably necessary for cure, so long as Seller initiates cure within such thirty (30) Day period and diligently prosecutes the cure to conclusion thereafter.

11. [Wind] [Solar] Seller's failure to achieve an Equivalent Availability Reporting Factor of not less than ninety percent (90%) in a Commercial Operation Year, pursuant to Exhibit I - AGC Protocols; Data Collection; Availability Reporting.

Cure Period: Seller shall be deemed to have cured this default if, in the following Commercial Operation Year, Seller achieves an Equivalent Availability Reporting Factor of not less than ninety-five percent (95%), as determined pursuant to Exhibit I - AGC Protocols; Data Collection; Availability Reporting.

12. Seller makes any material misrepresentation or omission in any report (including any status report, logs, and reports required under Section 4.1, Section 10.3, or Exhibit I - AGC Protocols; Data Collection; Availability Reporting, to be made or furnished by Seller pursuant to this PPA.

Cure Period: Five (5) Days after Company provides notice.

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13. Seller removes from the Site equipment upon which the COD Conditions were satisfied, except for the purposes of replacement, refurbishment, repair or maintenance, and the equipment is not returned within five (5) Days after notice from Company.

Cure Period: Equipment returned five (5) Days after Company provides notice.

(B) *Remedies for Default.* In connection with any default by Seller under this Section 12.1 (whether or not cured by Seller), Company may:

1. Seek Actual Damages in such amounts and on such basis for the default as authorized by this PPA;
2. Offset against any payments due to Seller, any Actual Damages and other amounts due from Seller; and/or
3. Draw any Actual Damages and other amounts due from Seller, from the Security Fund.

(C) *Termination for Event of Default.* Upon and at any time following an Event of Default by Seller under this Section 12.1, in addition to its rights under Section 12.1(B) above, Company may terminate this PPA effective immediately upon notice to Seller, without penalty or further obligation to Seller. In connection with any such termination, Company may collect from Seller (subject to the Damage Cap) all Actual Damages arising from such Event of Default through the Scheduled Termination Date.

(D) *Specific Performance.* In addition to the other remedies specified herein, upon any Event of Default of Seller under this Section 12.1, Company may elect to treat this PPA as being in full force and effect and Company shall have the right to specific performance.

(E) *Option to Acquire Facility upon Termination due to Seller Default.* If Company terminates this PPA under this Section 12.1 following COD, then, at any time within ninety (90) Days following such termination, Company may give notice to Seller of Company's intent to purchase the Facility from Seller (a "Default Option Preliminary Exercise Notice").

1. As soon as practicable following delivery of a Default Option Preliminary Exercise Notice, the Parties shall appoint an independent appraiser experienced in appraising utility-scale [wind] [solar] power generation facilities to determine the fair market value ("Default FMV") of the Facility. If the Parties cannot agree on the identity of the appraiser, the appraiser shall be selected by the Arbitration Service. Seller shall provide to the appraiser full access to the Facility and the Site, to Seller's contracts, books and records, and to relevant personnel of Seller, during normal business hours. Such access shall include the right to conduct inspections and tests (including environmental testing of the Site and operating tests on the Facility) necessary or appropriate for the determination of the Default FMV of the Facility. Company shall pay all fees and costs of the appraiser. The Parties shall direct the appraiser to use his/her best efforts to complete and deliver his/her appraisal to the Parties within forty-five (45)

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Days following his/her appointment and to keep all information obtained by appraiser from any investigations as Confidential Information subject to the provisions of Section 20.18.

2. Following delivery of a Default Option Preliminary Exercise Notice, Seller shall provide to Company full access to the Facility and the Site, to Seller's contracts, books and records, and to relevant personnel of Seller, during normal business hours. Such access shall include the right to conduct lien searches, surveys, inspections and tests (including environmental testing of the Site and operating tests on the Facility) necessary or appropriate for due diligence review of the Facility. All information obtained by Company from such investigations shall be deemed Confidential Information subject to Section 20.18. All inspections, testing and access to the Facility and the Site by Company and the appraiser shall comport with all of Seller's policies governing the use, operation, and maintenance of the Facility, including health, safety and environmental requirements.

3. Within sixty (60) Days following receipt of an appraisal under this Section 12.1(E), Company may elect to purchase the Facility from Seller (a "Default Option"). If Company fails to notify Seller of Company's election within such 60-Day period, Company shall be deemed to have elected not to exercise the Default Option. If Company exercises the Default Option, the purchase price to be paid by Company for the Facility in connection with any exercise of the Default Option shall be the Default FMV of the Facility, as determined by the appraiser. Seller shall cooperate in all respects reasonably necessary for Company to exercise its Default Option rights.

4. If Company exercises the Default Option, the Parties shall negotiate and execute a PSA, subject to clause (iv) below. The PSA shall include the terms and conditions set forth in Exhibit L-2 - PSA Provisions. In the event that the Parties cannot agree on the final form of PSA, (i) the issue shall be submitted to "baseball" arbitration in [Minneapolis, MN or Eau Claire, WI] before one arbitrator appointed by the Arbitration Service, i.e. each Party shall submit to the arbitrator a form of proposed PSA, and the arbitrator shall be required to select one of the two forms to be used as the PSA in the transaction, without compromise, as the arbitral award, (ii) the period for closing of the transaction shall be extended for the period required to complete arbitration, (iii) the Party whose form PSA is rejected shall pay the fees and costs of the Arbitration Service, and (iv) if Company's form of PSA is rejected, Company shall have thirty (30) Days following such rejection to decide whether to execute and deliver Seller's form of PSA or abandon the transaction.

5. This Section 12.1(E) shall be specifically enforceable by Company, without bond and without the need to prove irreparable harm.

12.2 Default by Seller: Failure to Achieve Critical Path Development Milestone or COD.

(A) COD Delay. Seller shall be in default under this PPA if the Facility fails to achieve any Critical Path Development Milestone by the date set forth in Section 4.1(B) ("CPD Delay") or COD by the Target COD ("COD Delay").

1. Seller shall be liable to pay [insert \$[250]/MW of Facility Nameplate

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Capacity] (“CPD Liquidated Delay Damages”) to Company as a liquidated damage and not a penalty, in lieu of Actual Damages, for each Day of each CPD Delay. CPD Liquidated Delay Damages shall begin to accrue on the Day after the applicable missed Critical Path Development Milestone (in each case, as it may be extended due to Force Majeure) until the first to occur of the satisfaction of the applicable Critical Path Development Milestone or termination of this PPA pursuant to Section 12.2(C) below. CPD Liquidated Delay Damages shall apply if any Critical Path Development Milestone is missed, and the payment of CPD Liquidated Delay Damages with respect to any given Critical Path Development Milestone shall extend each subsequent Critical Path Development Milestone on a day-for-day basis. In the event Seller incurs CPD Liquidated Delay Damages but subsequently achieves COD by the Target COD, Company shall reimburse Seller all such CPD Liquidated Delay Damages.

2. Seller shall be liable to pay **[insert \$[250]/MW of Facility Nameplate Capacity]** (“COD Liquidated Delay Damages” and, together with CPD Liquidated Delay Damages, the “Liquidated Delay Damages”) to Company as a liquidated damage and not a penalty, in lieu of Actual Damages, for each Day of a COD Delay. COD Liquidated Delay Damages shall begin to accrue on the Day after the Target COD (in each case, as it may be extended due to Force Majeure), until the first to occur of the COD or termination of this PPA pursuant to Section 12.2(C) below. The payment of CPD Liquidated Delay Damages shall not cure Seller’s failure to achieve COD by the Target COD. For the avoidance of doubt, if Seller is delayed in reaching one or more Critical Path Development Milestones and the Target COD, then Seller may incur both CPD Liquidated Delay Damages and COD Liquidated Delay Damages.

3. Except as provided in Section 12.2(C) below, the payment of Liquidated Delay Damages shall be Company’s sole and exclusive remedy for a CPD Delay or a COD Delay.

(B) Cure. Subject to the obligations in this Section 12.2(B), Seller shall have a cure period of up to ninety (90) Days for its failure to achieve any Critical Path Development Milestone by the date set forth in Section 4.1(B) (subject to compliance with Seller’s obligations in Section 4.1(B) or Commercial Operation by the Target COD, as applicable so long as the following conditions are satisfied:

1. Seller’s payment of accrued Liquidated Delay Damages shall be a condition to any such cure. In order to utilize the cure period set forth in this Section 12.2(B), Seller must, at any time prior to, but no later than, 6:00 a.m. on the third Business Day immediately prior to the Critical Path Development Milestone date set forth in Section 4.1(B) or the Target COD, as applicable (as such dates may have been previously extended pursuant to this Section 12.2(B), provide Company with (a) Notice of its election to extend such Critical Path Development Milestone date or the Target COD, (b) Seller’s reasonable estimate of the required duration of the full estimated extension period, and (c) its payment of the applicable Liquidated Delay Damages for each Day of the full estimated extension period; provided, that if the actual delay is less than the full estimated extension period, then Company shall refund to Seller any unused portion of the applicable Liquidated Delay Damages. For the avoidance of doubt, (i) the Security Fund may not be utilized by Seller for the payment of Liquidated Delay Damages and (ii) the payment of

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CPD Liquidated Delay Damages shall only extend the Critical Path Development Milestones and not the Target COD, and payment of the COD Liquidated Delay Damages shall only extend the Target COD and not the Critical Path Development Milestones. To the extent Seller achieves the Commercial Operation Date prior to the Target COD as extended pursuant to this Section 12.2(B), Company shall refund Seller any estimated COD Liquidated Delay Damages corresponding to the number of Days by which the extended Target COD Date exceeded the Commercial Operation Date.

(C) In addition, for any extensions pursuant to Section 12.2(B) of more than an aggregate total of forty-five (45) Days, Seller must, at any time prior to, but no later than, 6:00 a.m. on the third Business Day immediately prior to the Critical Path Development Milestone date set forth in Section 4.1(B) or the Target COD, as applicable (as such dates may have been previously extended pursuant to this Section 12.2(B)), provide a written opinion from a mutually-agreeable Independent Engineer that such Critical Path Development Milestone or COD, as applicable, can reasonably be achieved within such additional period.

(D) Termination. Failure to cure a CPD Delay or COD Delay within the applicable cure period set forth in Section 12.2(B) shall be an Event of Default by Seller. Upon such an Event of Default, Company may (i) terminate this PPA immediately upon notice to Seller, without penalty or further obligation to Seller except as to costs and balances incurred prior to the effective date of such termination, and (ii) in connection therewith, in addition to accrued Liquidated Delay Damages but in lieu of Actual Damages for the balance of the Term, collect from Seller liquidated damages therefor in the amount of [insert \$100/kW x Facility Nameplate Capacity].

12.3 Default by Company.

(A) Events. Any of the following events shall constitute a default by Company under this PPA. If no cure period is provided below, such default shall be deemed an Event of Default by Company immediately upon its occurrence. If a cure period is provided below, such default shall mature into an Event of Default if not cured within the indicated cure period, subject to Section 13.3 below.

1. Company's application for, or consent (by admission of material allegations of a petition or otherwise) to, the appointment of a receiver, trustee or liquidator for Company or for all or substantially all of its assets, or its authorization of such application or consent, or the commencement of any proceedings seeking such appointment without such authorization, consent or application, which proceedings continue undismissed or unstayed for a period of sixty (60) Days from inception.

Cure Period: None.

2. Company's authorization or filing of a voluntary petition in bankruptcy or application for or consent (by admission of material allegations of a petition or otherwise) to the application of any bankruptcy, reorganization, readjustment of debt, insolvency, dissolution, liquidation or other similar law of any jurisdiction or the institution of such proceedings against Company without such authorization, application or consent, which proceedings remain undismissed or unstayed for sixty (60) Days from its inception

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or which result in adjudication of bankruptcy or insolvency within such time.

Cure Period: None.

3. Company's assignment of this PPA, not permitted by Section 19.2.

Cure Period: None.

4. Any representation or warranty by Company that materially affects its ability to perform this PPA (a) is proven to have been false in any material respect when made; or (b) ceases to remain true in all material respects during the Term, *provided however*, that a representation or warranty that ceases to remain true due to a change in Applicable Law shall not be considered an Event of Default.

Cure Period: Thirty (30) Days after Seller provides notice of such breach.

5. Company's failure to make any payment to Seller as and when required by this PPA, including invoiced amounts, Actual Damages and any required indemnification.

Cure Period: Ten (10) Business Days after Seller provides notice that the amount is overdue.

6. The failure by Company to perform or observe any other material obligation to Seller under this PPA, unexcused by Force Majeure.

Cure Period: Thirty (30) Days after Seller provides notice; *provided*, that if such default is not reasonably capable of cure within such thirty (30) Day period, Company shall have such additional period of time (not to exceed ninety (90) Days in any event) as is reasonably necessary for cure, so long as Company initiates cure within such thirty (30) Day period and diligently prosecutes the cure to conclusion thereafter.

(B) Remedies for Default. In connection with any default by Company (whether or not cured by Company), Seller may;

1. Seek Actual Damages in such amounts and on such basis for the default as authorized by this PPA; and/or

2. Offset against any payments due to Company, any Actual Damages and other amounts due from Company.

(C) Termination for Event of Default. Upon an Event of Default by Company, in addition to its rights under Section 12.3(B) above, Seller may terminate this PPA immediately upon notice to Company, without penalty or further obligation to Company, and in connection therewith, collect from Company all Actual Damages arising from such Event of Default through the Scheduled Termination Date.

12.4 Limitations on Damages.

(A) Except as otherwise provided in Section 12.4(B), following COD Seller's aggregate financial liability to Company for Actual Damages shall not exceed **[insert \$75/kW x Facility Nameplate Capacity]** (the "Damage Cap"). If at any time

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following COD, Company incurs damages in excess of the Damage Cap that Seller does not pay when billed by Company, Company shall have the right to terminate this PPA upon notice to Seller, without further obligation by either Party except as to costs and balances incurred prior to the effective date of such termination.

(B) Actual Damages payable by Seller arising out of any of the following events shall not be subject to the Damage Cap and shall not be credited against the Damage Cap:

1. damage to Company-owned facilities proximately caused by negligence, breach of this PPA or misconduct by Seller, its directors, officers, employees and agents;
 2. Seller's intentional misrepresentation or intentional misconduct in connection with this PPA or the operation of the Facility;
 3. the sale or diversion by Seller to a third party of any Renewable Energy or Ancillary Services from the Facility, excluding sales of Excess Energy under Section 8.2 and any sales in mitigation of damages;
 4. Seller's failure (i) to maintain insurance coverages in the types and amounts required by this PPA or (ii) to apply any insurance proceeds as required by Section 16.5;
 5. any indemnification claim under this PPA;
 6. any Environmental Contamination caused or exacerbated by Seller;
- or
7. damages incurred by Company in connection with any bankruptcy or insolvency proceeding involving Seller, including Company's loss of the benefit of its bargain due to rejection or other termination of this PPA in such proceeding.

(C) The Parties confirm that the express remedies and measures of damages provided in this PPA satisfy the essential purposes hereof. If no remedy or measure of damages is expressly herein provided, the obligor's liability shall be limited to all direct damages proximately caused by such default ("Actual Damages") incurred by the non-defaulting Party, provided that if Seller is the defaulting Party, Actual Damages recoverable by Company hereunder may include Replacement Power Costs. **Neither Party shall be liable to the other Party for consequential, incidental, punitive, exemplary, special, treble, equitable or indirect damages, lost profits or other business interruption damages regardless of whether the relevant cause of action arises from statute, in tort or contract** (except to the extent expressly provided herein); *provided, however*, that if either Party is held liable to a third party for such damages and the Party held liable for such damages is entitled to indemnification from the other Party hereto, the Indemnifying Party shall be liable for, and obligated to reimburse the Indemnified Party for all such damages.

(D) To the extent damages required to be paid hereunder are liquidated, the Parties acknowledge that Actual Damages would be substantial but difficult or impossible to determine, that otherwise obtaining an adequate remedy is inconvenient,

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and that the liquidated damages constitute a reasonable approximation of the harm or loss.

12.5 Bankruptcy. This PPA grants each Party the contractual right to “cause the liquidation, termination or acceleration” of the transactions within the meaning of Sections 556, 560 and 561 of the U.S. Bankruptcy Code, as they may be amended superseded or replaced from time to time. Upon a bankruptcy, a non-defaulting Party shall be entitled to exercise its rights and remedies under this PPA in accordance with the safe harbor provisions of the U.S. Bankruptcy Code set forth in, *inter alia*, Sections §362(b)(6), §362(b)(17), §362(b)(27), §362(o), §546(e), §548(d)(2), §556, §560 and §561, as they may be amended, superseded or replaced from time to time.

12.6 Cumulative Remedies. Except as explicitly provided to the contrary in this PPA, each right or remedy of the Parties provided for in this PPA shall be cumulative of and shall be in addition to every other right or remedy provided for in this PPA, and the exercise of one or more of the rights or remedies provided for herein shall not preclude the simultaneous or later exercise by such Party of any other rights or remedies provided for herein.

12.7 Duty to Mitigate. Each Party shall use Commercially Reasonable Efforts to mitigate any damages it may incur as a result of a default by the other Party under this PPA.

Article 13 - Dispute Resolution

13.1 Negotiation.

(A) In the event of any dispute arising under or associated with the Parties' performance of this PPA (a “Dispute”), within ten (10) Business Days following notice by either Party (a “Dispute Notice”), (i) each Party shall appoint a representative, and (ii) the representatives shall meet, negotiate and attempt in good faith to resolve the Dispute quickly, informally and inexpensively. Any Dispute that is mutually agreed by the Parties (each acting in its sole and complete discretion) to involve engineering, construction or technical matters as the sole or primary area of disagreement between the Parties shall be deemed to be a “Technical Dispute” (each, a “Technical Dispute”). The Parties agree that the technical expert for purposes of resolving any Technical Disputes shall be a mutually agreeable Independent Engineer, the costs and expenses for which will be shared equally by the Parties. The Independent Engineer may, if he or she deems it appropriate, hold a hearing on the subject of the Technical Dispute and shall, upon the request of either Party, meet with the Parties or their representatives with respect to such Technical Dispute within three (3) Business Days of the request for such meeting. The Independent Engineer shall render a decision solely resolving the Technical Dispute within five (5) Business Days of the meeting with the Parties or their representatives or hearing (if any), or such longer period as the Parties and the Independent Engineer may agree. The decision of the Independent Engineer shall be advisory rather than final and binding on the Parties.

(B) In the event the Parties' representatives cannot resolve the Dispute, or if either Party is not satisfied with the resolution of the Technical Dispute by the

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Independent Engineer, within thirty (30) Days after the first meeting, either Party may request that consideration and resolution of the Dispute be transferred to senior management. Within ten (10) Days following such a request, each Party shall submit a written summary of the Dispute describing the issues and claims to a senior officer of each Party designated to address the Dispute. Within ten (10) Business Days after receipt of each Party's Dispute summaries, the designated senior managers for both Parties shall negotiate in good faith to resolve the Dispute. If such senior managers are unable to resolve the Dispute thereafter, either Party may seek available legal remedies, subject to Sections 13.3, 19.3 and 19.5.

13.2 Time Bar. If no Dispute Notice has been issued within eighteen (18) months following the occurrence of events or circumstances giving rise to the Dispute (regardless of the actual knowledge of either Party of such events and circumstances), all claims related to such Dispute (including any allegations of billing errors) shall be deemed waived and the aggrieved Party shall thereafter be barred from proceeding thereon.

13.3 No Termination Pending Dispute Resolution. Notwithstanding Section 12.1 or Section 12.3 to the contrary:

(A) An Event of Default shall not be deemed to have occurred (and hence neither Party may terminate this PPA) for failure by the other Party to pay any amount(s) allegedly due totaling less than one hundred thousand Dollars (\$100,000), if (1) such amount(s) are disputed in good faith, (2) the Party alleged to owe such amount(s) promptly commences and diligently pursues resolution of the Dispute pursuant to Section 13.1, and (3) the owed amount (if any) is paid within ten (10) Business Days after all dispute resolution mechanisms are completed with respect thereto.

(B) An Event of Default by Seller shall not be deemed to have occurred (and hence Company may not terminate this PPA) for failure by Seller to pay any amount(s) allegedly due totaling one hundred thousand Dollars (\$100,000) or more, if:

1. such amount(s) are disputed by Seller in good faith;
2. Seller promptly commences and diligently pursues resolution of the Dispute pursuant to Section 13.1;
3. Seller either holds an Investment Grade Credit Rating, or posts cash collateral to secure its obligations (if any) with respect to the disputed amount(s), in an amount equal to the amount(s) in dispute, under a mutually agreeable third-party escrow and account control agreement, in addition to the Security Fund; and
4. the owed amount (if any) is paid by Seller within ten (10) Business Days after all dispute resolution mechanisms are completed with respect thereto.

(C) An Event of Default by Company shall not be deemed to have occurred (and hence Seller may not terminate this PPA) for failure by Company to pay any amount(s) allegedly due totaling one hundred thousand Dollars (\$100,000) or more, if

1. such amount(s) are disputed by Company in good faith;

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2. Company promptly commences and diligently pursues resolution of the Dispute pursuant to Section 13.1;

3. Company either holds an Investment Grade Credit Rating, or posts cash collateral to secure its obligations (if any) with respect to the disputed amount(s), in an amount equal to the amount(s) in dispute, under a mutually agreeable third-party escrow and account control agreement; and

4. the owed amount (if any) is paid by Company within ten (10) Business Days after all dispute resolution mechanisms are completed with respect thereto.

13.4 Governing Law. The interpretation and performance of this PPA and all actions related hereto (whether sounding in contract, tort or otherwise), shall be governed and construed in accordance with the laws of the State of [Minnesota or Wisconsin] exclusive of conflict of laws principles.

13.5 Venue. The Parties submit to the exclusive jurisdiction of the state courts of the State of [Minnesota or Wisconsin] for purposes of resolving any Dispute hereunder, except as provided in Sections 12.1(E), 19.3 and 19.5. Venue for any court proceedings shall lie exclusively in

[NSPM] the Minnesota District Court for the Fourth District or, if jurisdictionally available, the U.S. District Court for the District of Minnesota.

[NSPW] [update as applicable] [the Wisconsin District Court for the [District] or, if jurisdictionally available, the U.S. District Court for the District of Wisconsin].

13.6 Waiver of Jury Trial. **Seller and Company each hereby knowingly, voluntarily and intentionally waive any rights they may have to a trial by jury** in respect of any litigation based hereon, or arising out of, under, or in connection with, this PPA or any course of conduct, course of dealing, statements (whether oral or written) or actions of Seller and Company related hereto and expressly agree to have any Disputes be adjudicated by a judge of the court having jurisdiction, without a jury, subject only to Sections 12.1(E), 19.3 and 19.5.

Article 14 - Force Majeure

14.1 Definition. For purposes hereof, "Force Majeure" means an event or circumstance that prevents a Party from performing its obligations under this PPA, which event or circumstance (i) was not anticipated as of the Effective Date, (ii) is not within the control of or the result of the fault or negligence or failure to follow Good Utility Practices of the Party claiming excuse, and (iii) which by exercise of due diligence and foresight could not reasonably have been avoided. Force Majeure shall not include:

(A) any failure, inability, delay or excess cost, to procure any equipment or component to perform this PPA for any reason (the risk of which is assumed by Seller), including as a result of the imposition of tariffs or any other changes in Applicable Law or supply chain disruptions;

(B) acts or omissions of a third party (including vendors and contractors

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to Seller), unless such acts or omissions are themselves excused by reason of Force Majeure as defined in this Section 14.1;

(C) failure to obtain any Permits required for the Facility, including the Permits set forth on Exhibit F - Seller's Needed Permits hereto;

(D) mechanical or equipment breakdown or failure to operate under circumstances that are within the design criteria and/or normal operating tolerances of similar equipment;

(E) [Solar only] variability in solar irradiance, including periods of low solar irradiance resulting from cloud cover, pollution, dust, smoke, weather conditions, and other causes, in the area in which the Facility is located], [Wind only] variability in wind speed and direction, including changes in wind speed and direction resulting from weather conditions and other causes, in the area in which the Facility is located], except to the extent directly caused by circumstances that would constitute Force Majeure as defined in this Section 14.1;

(F) Environmental Contamination at the Site;

(G) changes in market conditions;

(H) any delay or failure by the Transmission Authority to perform its obligations under the Interconnection Agreement or any Curtailment or reduction in deliveries by the Transmission Authority;

(I) any delay or nonperformance by supplier, vendors or other third parties with whom Seller has contracted, including the failure of such third party to deliver any required components to Seller, except to the extent such delay or nonperformance is directly caused by circumstances that would themselves constitute Force Majeure as defined in this Section 14.1 as applied to such third party;

(J) the delay or effects of the COVID epidemic or pandemic (or any variant of COVID), except to the extent there occurs after the Effective Date: (A) the adoption or taking effect of any Applicable Law in respect of such COVID epidemic or pandemic (or any variant thereof), or (B) a change in any Applicable Law or any health or safety recommendation or guideline of a Governmental Authority in respect of such COVID epidemic or pandemic (or variant thereof);

(K) changes of Applicable Law, except to the extent the change (i) occurs after the Effective Date and (ii) renders performance under the Agreement by the Party claiming Force Majeure illegal or impossible; or

(L) labor strikes, slowdowns, work stoppages, or other labor disruptions.

14.2 Applicability of Force Majeure. A Party shall be relieved of its obligations to perform this PPA and shall not be considered to be in default with respect to any obligation under this PPA if and to the extent such Party is prevented from fulfilling such obligation by Force Majeure, *provided, however*, that: (i) such Party gives notice describing the circumstances and impact of the Force Majeure no later than ten (10) Business Days after the occurrence of such Force Majeure; (ii) the relief from its obligations sought by such

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Party is of no greater scope and of no longer duration than is required by the Force Majeure; (iii) such Party proceeds with due diligence to overcome the Force Majeure and resumes performance of its obligations under this PPA as soon as practicable thereafter; and (iv) such Party provides notice upon conclusion of the Force Majeure. Failure to provide such notice within the required time period shall be deemed conclusive evidence that the claimed Force Majeure event either did not occur or did not impact Seller's ability to perform its obligations under this PPA in any fashion and thus Seller shall not be entitled to relief under this Article 14 -.

14.3 Limitations on Effect of Force Majeure.

(A) Force Majeure shall only relieve a Party of such obligations as are actually precluded by the Force Majeure.

(B) In no event will the existence of Force Majeure affect the Renewable Energy Payment Rate or extend this PPA beyond its stated Term.

(C) If, (i) prior to COD, Force Majeure affecting Seller continues for a period of ninety (90) consecutive Days or any one hundred fifty (150) non-consecutive Days or (ii) after COD Force Majeure affecting Seller continues for a period of one hundred eighty (180) consecutive Days or any two hundred seventy (270) non-consecutive Days in any three consecutive Commercial Operation Years, Company may, at any time following the end of such period, terminate this PPA upon notice to Seller, without further obligation by either Party except as to costs and balances incurred prior to the effective date of such termination.

Article 15 - Representations, Warranties and Covenants

15.1 Each Party hereby represents and warrants to the other as follows, which representations and warranties shall be deemed to be repeated, if applicable, by each Party throughout the Term:

(A) Such Party is a valid separate legal entity, duly organized, validly existing and in good standing under Applicable Law. It is qualified to do business in the State in which the Facility is located and each other jurisdiction where the failure to so qualify would have a Material Adverse Effect on the business or financial condition of the other Party. It has all requisite power and authority to conduct its business, to own its properties, and to execute, deliver, and perform its obligations under this PPA.

(B) The Party's execution, delivery, and performance of all of its obligations under this PPA have been duly authorized by all necessary organizational action, and do not and will not:

1. require any consent or approval by any governing corporate or management body, other than that which has been obtained and is in full force and effect (evidence of which shall be delivered to the other Party upon its request);

2. violate any Applicable Law, the violation of which could have a Material Adverse Effect on the representing Party's ability to perform its obligations under this PPA;

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3. result in a breach or constitute a default under the representing Party's formation documents, bylaws or equivalent, or under any agreement relating to its management or affairs, any indenture or loan or credit agreement, or any other agreement, lease, or instrument to which it is a party or by which it or its properties or assets may be bound or affected, the breach or default of which could reasonably be expected to have a Material Adverse Effect on the representing Party's ability to perform its obligations under this PPA; or

4. result in, or require the creation or imposition of any mortgage, deed of trust, pledge, lien, security interest, or other charge or encumbrance of any nature (other than as may be contemplated by this PPA) upon or with respect to any of the assets or properties of the representing Party now owned or hereafter acquired, the creation or imposition of which could reasonably be expected to have a Material Adverse Effect on the representing Party's ability to perform its obligations under this PPA.

(C) This PPA is a valid and binding obligation of the representing Party.

(D) The execution and performance of this PPA will not conflict with or constitute a breach or default under any contract or agreement of any kind to which the representing Party is a party or any judgment, order, or Applicable Law, applicable to it or its business.

(E) Within the meaning of the U.S. Bankruptcy Code, (i) this PPA constitutes a "master netting agreement," (ii) all transactions pursuant to this PPA constitute "forward contracts" or a "swap agreement," (iii) the representing Party is a "forward contract merchant" and "master netting agreement participant," and (iv) all payments made or to be made pursuant to this PPA constitute "settlement payments."

(F) Such Party is (i) a producer, processor, or commercial user of, or a merchant handling, the commodity which is the subject of this PPA, or the products or by products thereof; and (ii) entering into this PPA solely for purposes related to its business as such.

15.2 Seller further hereby covenants to Company throughout the Term that, in connection with its obligations under this PPA:

(A) Seller shall deliver to Company the products and services required by this PPA free and clear of all liens, security interests, claims and encumbrances or any interest therein or thereto by any person.

(B) No portion of the Facility (including any of its components and materials) will be extracted, mined, produced, manufactured, assembled or processed using any form of convict, indentured or forced labor, including indentured or forced child labor ("Forced Labor"). Seller represents and warrants that it shall at a minimum comply with all Forced Labor Laws, including but not limited to UFLPA, Section 307 of the Tariff Act of 1930, 19 U.S.C. §1307, when performing the work under this Agreement. Without limiting any other obligation of Seller hereunder, Seller shall not, and shall ensure that its Affiliates, suppliers, subcontractors, and other business partners involved in any tier of the extraction, mining, production, processing, assembly or manufacturing of the materials and components used in the Project, within the United States or globally, do not

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(i) use any form of Forced Labor at any stage of extraction, mining, production, manufacturing, assembly or processing of any components or materials or (ii) cause or permit the Facility (including any of its components and materials) to originate from, or be extracted, mined, produced, manufactured, assembled or processed in any place or region known or suspected to use Forced Labor. Seller shall maintain adequate procedures, internal controls and audit procedures necessary to ensure compliance with this Section.

Article 16 - Insurance

16.1 Evidence of Insurance. No later than commencement of construction and thereafter no later than five (5) Business Days after each applicable expiration date, Seller shall provide to Company via email a copy of insurance certificates acceptable to Company evidencing that insurance coverages for the Facility are in force and in compliance with the specifications for insurance coverage set forth in Exhibit E - Insurance Coverage to this PPA. Such certificates shall:

(A) name Company as an additional insured (except workers' compensation);

(B) provide that Company shall receive thirty (30) Days prior written notice of non-renewal, cancellation of, or significant modification to any of the corresponding policies (except that such notice may be ten (10) Days for non-payment of premiums);

(C) provide a waiver of any rights of subrogation against Company, its Affiliates and their officers, directors, agents, subcontractors, and employees; and

(D) indicate that the Commercial General Liability policy has been endorsed as described above.

16.2 Policy Requirements. All policies shall be written with insurers with an AM Best rating of at least A-VII or a Standard & Poor's rating of at least A. All policies shall be written on an occurrence basis, except as provided in Section 16.4. All policies shall contain an endorsement that Seller's policy shall be primary in all instances regardless of like coverages, if any, carried by Company. Seller may satisfy its insurance requirements using any reasonable combination of primary and secondary coverage.

16.3 No Implied Limitation. Seller's liability under this PPA is not limited to the amount of insurance coverage required herein.

16.4 Term and Modification of Insurance.

(A) All insurance required under this PPA shall cover occurrences during the Term and for a period of two (2) years after the Term. In the event that any insurance as required herein is commercially available only on a "claims-made" basis, such insurance shall provide for a retroactive date not later than the Effective Date and such insurance shall be maintained by Seller for a minimum of six (6) years after the Term.

(B) Company shall have the right, at times deemed appropriate to Company during the Term, to request Seller to modify the insurance minimum limits

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specified in Exhibit E - Insurance Coverage in order to maintain Commercially Reasonable coverage amounts. Seller shall make Commercially Reasonable Efforts to comply with any such request.

(C) If any insurance required to be maintained by Seller hereunder ceases to be reasonably available and commercially feasible in the commercial insurance market, Seller shall provide notice to Company, accompanied by a certificate from an independent insurance advisor of recognized national standing, certifying that such insurance is not reasonably available and commercially feasible in the commercial insurance market for electric generating plants of similar type, geographic location and capacity. Upon receipt of such notice, Seller shall use Commercially Reasonable Efforts to obtain other insurance that would provide comparable protection against the risk to be insured.

16.5 Application of Proceeds. Except to the extent otherwise required by the Financing Documents, Seller shall apply any insurance proceeds first to reconstruction of the Facility following any material casualty to the Facility that occurs more than eighteen (18) months prior to the Scheduled Termination Date.

Article 17 - Indemnity

17.1 Indemnification: General. Each Party (the "Indemnifying Party") shall indemnify, defend and hold the other Party (the "Indemnified Party") harmless from and against all third-party claims, demands, lawsuits (including citizen suits), losses, liabilities, fines, penalties, and expenses (including attorneys' fees) (generally, "Losses"), to the extent proximately caused by

(A) a default under this PPA by the Indemnifying Party;

(B) a violation or alleged violation of Applicable Laws by the Indemnifying Party; and

(C) the negligence, intentional acts and other misconduct of the directors, officers, employees, or agents of the Indemnifying Party.

17.2 Indemnification: Environmental. Seller shall indemnify, defend and hold Company harmless from and against all Losses arising out of any claim by any Governmental Authority or other third party alleging Environmental Contamination at the Site and/or illegal disposal of Hazardous Materials off-site, regardless of merit and regardless of Seller's responsibility therefor.

17.3 Indemnification: House Power. If Seller obtains House Power from the Facility and/or a self-generation source other than the Facility, Seller shall: (i) at Company's discretion, provide evidence reasonably satisfactory to Company that it is permitted to do so under Applicable Law, and (ii) shall indemnify, defend and hold Company harmless from and against all Losses that may result therefrom.

17.4 Indemnification: Company Remote Start of Facility. Should Company remotely start the Facility, Seller shall indemnify, defend and hold Company harmless from and against all Losses that may result therefrom.

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17.5 Limitations.

(A) The foregoing indemnification obligations shall apply notwithstanding any contributory misconduct of the Indemnified Party, but the Indemnifying Party's liability to indemnify the Indemnified Party shall be reduced in proportion to the percentage by which the Indemnified Party's misconduct caused the damages.

(B) Neither Party shall be indemnified for Losses resulting from the sole negligence or willful misconduct of the directors, officers, employees, or agents of such Party.

(C) These indemnity provisions shall not be construed to relieve any insurer of its obligation to pay claims consistent with the provisions of a valid insurance policy. Nothing in this Article 17 - shall enlarge or relieve Seller or Company of any liability to the other for any breach of this PPA.

17.6 Procedures.

(A) Promptly after receipt by a Party of any claim or notice of the commencement of any action, administrative, or legal proceeding, or investigation as to which the indemnity provided for in this Article 17 - may apply, the Indemnified Party shall provide notice thereof to the Indemnifying Party; *provided* that a delay in providing such notice shall limit the obligations of the Indemnifying Party only to the extent that such delay actually prejudices the ability of the Indemnifying Party to contest the claim or defend the proceeding.

(B) The Indemnifying Party shall assume the defense thereof with counsel designated by such Party and satisfactory to the Indemnified Party, *provided, however,* if the defendants in any such action include both the Indemnified Party and the Indemnifying Party, and the Indemnified Party shall reasonably conclude that there may be legal defenses available to it which are different from or additional to, or inconsistent with, those available to the Indemnifying Party, the Indemnified Party shall have the right to select and be represented by separate counsel, at the Indemnifying Party's expense.

(C) If an Indemnifying Party fails to assume the defense of a claim meriting indemnification, the Indemnified Party may contest, settle, or pay such claim at the expense of the Indemnifying Party, *provided, however, that* settlement or full payment of any such claim may be made only following consent of the Indemnifying Party or, absent such consent, written opinion of the Indemnified Party's counsel that such claim is meritorious or otherwise warrants settlement.

17.7 Amounts Owed. In the event that a Party is obligated for indemnification under this Article 17 -, the amount owing to the Indemnified Party will be the amount of the Indemnified Party's actual Losses net of any insurance proceeds received by the Indemnified Party following Commercially Reasonable Efforts by the Indemnified Party to obtain such insurance proceeds.

Article 18 - Lender Provisions

18.1 Accommodation of Facility Lender.

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(A) Company shall provide such consents to collateral assignment, certifications, representations, estoppels, information or other documents, as may be reasonably requested by Seller in connection with the financing of the Facility consistent with the terms set forth in Exhibit K - Lender Consent Provisions (generally, a "Lender Consent"), *provided, however*, that in providing a Lender Consent, Company shall have no obligation to

1. modify the terms of this PPA;
2. provide any consent or enter into any agreement that has a Material Adverse Effect on any of Company's rights, benefits, risks, or obligations under this PPA;
3. transfer or release any property or property interests of Company;
4. release or subordinate (or cause the release or subordination of) any lien on any property of Company for the benefit of Seller or the Facility Lender; or
5. permit any lien to be placed on property of Company.

(B) Seller shall reimburse, or shall cause the Facility Lender to reimburse, Company for the direct expenses (including the fees and expenses of counsel) incurred by Company in the preparation, negotiation, execution and/or delivery of each Lender Consent and any documents requested by Seller or the Facility Lender pursuant to this Section 18.1.

18.2 Lender Notices.

(A) Seller shall provide Company with a notice identifying the Facility Lender ("Lender Notice") and providing appropriate contact information for the Facility Lender. Following receipt of such notice, Company shall provide to the Facility Lender a copy of each notice of alleged default delivered to Seller under Section 12.1 or Section 12.2, and Company will accept a cure thereof performed by the Facility Lender, so long as the cure is accomplished within the applicable cure period set forth in this PPA or the relevant Lender Consent.

(B) Within ten (10) Days following Seller's receipt of each notice of default or Facility Lender's intent to exercise any remedies under the Financing Documents, Seller shall deliver a copy of such notice to Company.

Article 19 - Assignment

19.1 Assignment by Seller.

(A) Seller shall not sell, exchange or otherwise transfer the Facility or any material portion thereof to any third party, nor shall Seller undergo any Change of Control (whether voluntary or by operation of law), absent the prior written consent of Company, which shall not be unreasonably withheld or delayed. Company shall have no obligation to provide any consent under this Article 19 - unless

1. Seller has complied with Sections 19.3, 19.4 and 19.5, if and as applicable;

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2. Seller has provided to Company such information concerning the transferee's direct and indirect ownership as Company reasonably requests;

3. the transferee has substantial experience in the operation of power generation facilities akin to the Facility, either directly, through its Affiliates or through a Qualified Operator;

4. the transferee (together with its parents and Affiliates) possesses an Investment Grade Credit Rating or other creditworthiness satisfactory to Company;

5. Seller has provided to Company at least thirty (30) Days' prior written notice of the transaction; and

6. Seller pays or reimburses Company for the direct expenses (including the fees and expenses of counsel) incurred by Company in connection with the transaction.

(B) Any Change of Control or sale, transfer, or assignment of any interest in the Facility completed without fulfilling the requirements of this PPA shall be null, void and a breach of this PPA.

(C) Seller shall assign this PPA to any successor owner of the Facility, and shall cause such successor to assume all obligations of Seller (accrued and prospective) hereunder via a writing reasonably satisfactory to Company. Seller also may assign this PPA for collateral purposes to any Facility Lender, and may subcontract some or all of its duties under this PPA, upon notice to but without the consent of Company.

(D) Except as permitted in this Section 19.1, Seller may not assign this PPA or any portion hereof. No assignment shall relieve Seller of its obligations under this PPA, nor impair any security posted by Seller unless such security is replaced in accordance with Article 11 -. Before this PPA is assigned by Seller, the assignee must first obtain such approvals as may be required by all applicable Governmental Authorities.

19.2 Assignment by Company.

(A) Company may assign this PPA to any Affiliate, or to any successor that provides retail electric service in all or substantially all of Company's service territory and is subject to rate and quality service regulation under the jurisdiction of the MPUC/NDPSC. Any other assignment of this PPA by Company shall require the prior written consent of Seller, not to be unreasonably withheld or delayed.

(B) If an assignee of Company possesses a Credit Rating equal to or better than Investment Grade or Company's Credit Rating as of the date of assignment (whichever is higher), Seller shall release Company from its obligations hereunder if so requested by Company. Except for the foregoing, no assignment shall relieve Company of its obligations under this PPA.

(C) Any assignee of Company shall assume all obligations of Company (accrued and prospective) hereunder via a writing reasonably satisfactory to Seller. Before this PPA is assigned by Company, the assignee must first obtain such approvals

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as may be required by all applicable Governmental Authorities.

19.3 Right of First Offer ("ROFO").

(A) At any time after the Commercial Operation Date, but before the end of the Term,

1. if Seller proposes to sell the Facility to an unaffiliated third party, Seller shall first offer to sell the Facility to Company via notice to Company,

2. if Seller's parent proposes to sell a majority of any class of voting and/or non-voting equity interests in Seller (excluding interests owned by tax equity investors) to an unaffiliated third party, Seller shall cause its parent first to offer to sell such equity interests to Company via notice to Company, and

3. if Seller's parent owns no assets other than its equity interests in Seller and the parent of Seller's parent proposes to sell a majority of any class of voting and/or non-voting equity interests in Seller's parent (excluding interests owned by tax equity investors) to an unaffiliated third party, Seller shall cause its parent's parent first to offer to sell such equity interests to Company via notice to Company

in each case (1) through (3) above, a "ROFO Notice". Any ROFO Notice shall describe the proposed transaction, including the minimum price, status of title to the Site, liabilities to be assumed and other terms which Seller or its relevant parent (as applicable) is willing to accept to proceed with the contemplated transaction. The contents of a ROFO Notice shall be deemed Confidential Information for purposes of Section 20.18 below.

(B) Following issuance of a ROFO Notice, Seller shall allow Company sixty (60) Days to investigate the proposed transaction and conduct due diligence. Due diligence shall include such physical inspections, surveys and operating tests of the Facility and the Site, such reviews of Seller's contracts, books and records, and interviews of such personnel, as Company may reasonably request. All information obtained by Company from such investigations shall be deemed Confidential Information subject to Section 20.18 below. Within such sixty (60)-Day period, Company may elect to purchase the Facility or the relevant equity interests (as applicable) on substantially the same terms as set forth in the ROFO Notice. If Company fails to notify Seller of Company's election within such sixty (60)-Day period, Company shall be deemed to have rejected the transaction.

(C) If Company elects to purchase the Facility or the specified equity interests (as applicable), the Parties shall negotiate and execute a PSA. If Company elects to purchase the Facility the PSA shall include the price and other terms set forth in the ROFO Notice and such other terms as are set forth in Exhibit L-2 - PSA Provisions. If Company elects to purchase the specified equity interests, the PSA shall include the price and other terms set forth in the ROFO Notice and such other terms as are set forth in Exhibit L-3 - MIPS Provisions.

(D) If Company rejects the transaction described in a ROFO Notice, Seller shall have the right to sell the Facility (or Seller's relevant parent shall have the right to sell the specified equity interests, as applicable) on terms that a reasonable person

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would determine are not more favorable to such buyer than the terms offered to the Company in the ROFO Notice, at any time within the twelve (12)-month period following issuance of the ROFO Notice. If Seller or its relevant parent fails to close a transaction on such terms within such twelve (12)-month period, any sale of the Facility or equity interests in Seller shall again be subject to this Section 19.3.

(E) This Section 19.3 shall be specifically enforceable by Company, without bond and without the need to prove irreparable harm.

(F) Seller shall cooperate in all respects reasonably necessary for Company to exercise its ROFO rights and shall operate the Facility in the ordinary course of business following the date of issuance of a ROFO Notice.

19.4 PFT.

(A) Seller shall give Company at least ninety (90) Days' prior written notice (a "PFT Notice") of any Pending Facility Transaction that does not otherwise trigger Company's ROFO rights under Section 19.3, in order to provide Company with an opportunity to discuss and negotiate with Seller the possible sale of the Facility to Company. Any PFT Notice shall include a fair summary of Seller's plans with respect to the Facility in connection with the proposed Pending Facility Transaction, to the extent then known by Seller. The contents of a PFT Notice shall be deemed Confidential Information for purposes of Section 20.18 below.

(B) Seller shall have no obligation to sell nor shall Company have any obligation to purchase the Facility, following any PFT Notice. Issuance of a PFT Notice shall not relieve Seller of its obligation to offer a ROFO to Company if and when applicable pursuant to Section 19.3. In the event that the transaction giving rise to the PFT Notice has not been completed within twelve (12) months following a PFT Notice, Seller shall be required to resubmit a PFT Notice for such transaction.

(C) Any breach of this Section 19.4 shall entitle Company to liquidated damages from Seller in the amount of [insert \$5 x number of kW of Nameplate Capacity].

(D) For purposes hereof, a "Pending Facility Transaction" or "PFT" means:

1. any Change of Control of Seller;
2. the issuance by Seller or any of its Affiliates of a request for proposals or the response by Seller or any of its Affiliates to a request for proposal or similar process (e.g., auction) for the purchase or sale to any unaffiliated third party of any equity interests in Seller or the Facility, or any group(s) of assets or equity interests that includes the Facility;
3. the transmission by Seller or any of its Affiliates of a draft letter of intent, memorandum of understanding, term sheet or similar document (or a revised version thereof) to an unaffiliated third party with respect to the sale of any equity interests in Seller or the Facility, or any group(s) of assets or equity interests that includes the Facility; or

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4. the execution by Seller or any of its Affiliates of any letter of intent, memorandum of understanding, term sheet or similar document, whether or not legally binding, which contemplates the sale or lease to an unaffiliated third party of any equity interests in Seller or the Facility or any group(s) of assets or equity interests that includes the Facility;

provided, however, that a PFT does not include (i) any financing or refinancing of the Facility Debt, (ii) any transaction among Affiliates of Seller, and/or (iii) any transaction for which Seller offers ROFO rights to Company under Section 19.3.

19.5 Option.

(A) At any time during each of the periods that is within one hundred eighty (180) Days following any of [Solar] (i) the sixth (6th) anniversary of COD, (ii) the tenth (10th) anniversary of COD, (iii) the fourteenth (14th) anniversary of COD and (iv) the end of the Term] [Wind] (i) the twelfth (12th) anniversary of COD and (ii) the end of the Term], Company (or an Affiliate) may give notice to Seller of Company's (or such Affiliate) intent to purchase (i) the Facility from Seller (a "Facility Acquisition") or (ii) all, but not less than all, of Ultimate Parent's direct and indirect right, title and interest in the equity interests of Seller, and including, if applicable, Ultimate Parent's direct and indirect right, title and interest in the tax equity partnership (the "TE Partnership") that owns, directly or indirectly, equity interests in Seller (together, the "Equity Interest") (an "Equity Interest Acquisition") with such notice in either case referred to as an "Option Preliminary Exercise Notice".

(B) As soon as practicable following delivery of an Option Preliminary Exercise Notice for a Facility Acquisition, the Parties shall appoint an independent appraiser experienced in appraising utility-scale [wind] [solar] power generation facilities (as may be applicable to the bid) to determine the fair market value ("FMV") of the Facility. If the Parties cannot agree on the identity of the appraiser, the appraiser shall be selected by the Arbitration Service.

1. Seller shall provide to the appraiser full access to the Facility and the Site, to Seller's contracts, books and records, and to relevant personnel of Seller, during normal business hours. Such access shall include the right to conduct inspections, surveys and tests (including environmental testing of the Site and operating tests on the Facility) necessary or appropriate for the determination of FMV of the Facility.

2. Unless otherwise agreed to by Parties, Company shall engage and pay all fees and costs of the appraiser.

3. The Parties shall direct the appraiser to use his/her/its best efforts to complete and deliver his/her/its appraisal to the Parties within two (2) months following his/her/its appointment and to keep all information obtained by appraiser from any investigations as Confidential Information subject to the provisions of Section 20.18.

(C) In the case of an Option Preliminary Exercise Notice for an Equity Interest Acquisition, Company will deliver, together with the Option Preliminary Exercise Notice, its calculation of the purchase price for the Equity Interest Acquisition utilizing the formula for such determination set forth in Exhibit L-1 - Equity Purchase Price Formula

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The Parties reasonably believe, based on all facts and circumstances at the time of executing this PPA, that the purchase price for the Equity Interest Acquisition so determined by such formula will not be less than the fair market value of the Equity Interest on the relevant date. All information obtained by Company from such investigations shall be deemed Confidential Information subject to Section 20.18.

(D) Following delivery of an Option Preliminary Exercise Notice, Seller shall provide to Company full access to the Facility and the Site, to Seller's contracts, books and records, and to relevant personnel of Seller, during normal business hours. Such access shall include the right to conduct lien searches, surveys, inspections and tests (including environmental testing of the Site and operating tests on the Facility) necessary or appropriate for due diligence review of the Facility. All information obtained by Company from such investigations shall be deemed Confidential Information subject to Section 20.18.

(E) All inspections, testing and access to the Facility and the Site by Company and the appraiser shall comport with all of Seller's policies governing the use, operation, and maintenance of the Facility, including health, safety and environmental requirements, and shall be conducted in a manner so as to minimize disruption in the operation of the Facility and to avoid any adverse economic impacts to Seller under this PPA.

(F) In the case of a Facility Acquisition, within sixty (60) Days following the determination of FMV as described above, Company may elect to purchase the Facility from Seller (an "Option"). If Company fails to notify Seller of Company's election within such sixty (60)-Day period, Company shall be deemed to have elected not to exercise the Option.

(G) In the case of a Facility Acquisition, the "Purchase Price" to be paid by Company for the Facility in connection with exercise of the First Option shall be the greater of:

1. the sum of:
 - a. (x) amount of Facility Debt (if any) as of the date of issuance of the Option Preliminary Exercise Notice, and
 - b. (y) if the relevant tax equity agreements allow the other members of the TE Partnership the option to purchase, at "fair market value" (as determined in those tax equity agreements) or a pre-determined price, the interest of the tax equity investor that has invested directly or indirectly in the Facility or Seller, then the amount of such purchase option price or, in any other case, the amount necessary to cause the after-tax internal rate of return of such tax equity investor's investment to equal the targeted rate of return under its tax equity agreements, or
2. the FMV of the Facility, as determined by the appraiser.

(H) If Company exercises the Option, the Parties shall use Commercially Reasonable Efforts to negotiate and sign either:

1. A PSA for the Facility. The PSA shall include the terms and conditions

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set forth in Exhibit L-2 - PSA Provisions.

2. A PSA for the Equity Interest. The PSA shall include the terms and conditions set forth in Exhibit L-3 - MIPS Provisions.

(I) This Section 19.5 shall be specifically enforceable by Company, without bond and without the need to prove irreparable harm.

(J) Seller shall cooperate, and cause its Affiliates to cooperate, in all respects reasonably necessary for Company to exercise its rights under this Section 19.5, and shall operate the Facility in the ordinary course of business following the date of issuance of an Option Preliminary Exercise Notice.

19.6 Memo of Option.

In connection with the Parties' execution and delivery of this PPA, the Parties are executing and Company is recording a Memorandum of Option memorializing its Default Option rights under Section 12.1(E), its ROFO rights under Section 19.3, and its Option rights under Section 19.5.

Article 20 - Miscellaneous

20.1 Notices.

(A) Notices required by this PPA shall be in writing and addressed to the other Party at the addresses noted in Exhibit D - Notices and Contact Information, as either Party updates such addresses from time to time by notice to the other Party. A notice shall be deemed to have been received as follows: (1) if it is delivered by email, when the recipient, by an email sent to the email address for the sender stated in Exhibit D - Notices and Contact Information or by a notice delivered by another method in accordance with this Section 20.1(A), acknowledges having received that email, with an automatic "read receipt" not constituting acknowledgment of an email for purposes of this Section 20.1(A); and, (2) If it is delivered in writing, when receipt is acknowledged in writing by the counterparty (or absent such acknowledgement, when delivered via third-party messenger or via FedEx or other reputable overnight courier service). Any notice shall be deemed to have been received by the close of the Business Day on which it was delivered. Real-time or routine communications concerning Facility operations shall be exempt from this Section 20.1(A).

(B) The Parties recognize the need for accurate communications between them. Each Party consents to the recording of telephone conversations between their employees and representatives, related to the performance and administration of this PPA.

20.2 Taxes.

(A) Company shall purchase all Renewable Energy on a wholesale basis, for resale to Company's wholesale and retail customers. Company shall obtain and provide Seller with any certificates required by any Governmental Authority or otherwise reasonably requested by Seller to evidence that the deliveries of Renewable Energy hereunder are sales for resale.

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(B) As between the Parties, Company shall be solely responsible for the payment of (1) any sales, use or equivalent taxes imposed by Governmental Authorities, whether now in existence or hereafter enacted, on the purchase of Renewable Energy and any other products and services purchased by Company hereunder at or beyond the Point of Delivery, and (2) any taxes imposed by Governmental Authorities, whether now in existence or hereafter enacted, on the transmission of Renewable Energy beyond the Point of Delivery.

(C) Subject to Section 20.2(B), Seller shall be solely responsible for any and all present and future taxes and other impositions of Governmental Authorities relating to the construction, ownership or leasing, operation or maintenance of the Facility and the Site (including *ad valorem* taxes on the Facility and the Site), and any taxes imposed prior to the Point of Delivery with respect to the products and services to be sold and delivered to Company hereunder, whether calculated based upon cost, value, labor, capital, production, savings, green attributes or other parameters. Seller's prices under Article 8 - are inclusive of such taxes and impositions during the Term, and Seller assumes the risk of changes in such taxes after the Effective Date.

(D) The Parties shall cooperate to minimize tax exposure, *provided, however*, that neither Party shall be obligated to incur any financial burden to reduce taxes for which the other Party is responsible hereunder.

20.3 Applicable Laws. Each Party shall comply with all Applicable Laws (including the Transmission Authority Tariff), except for any non-compliance that (individually or in the aggregate) could not reasonably be expected to have a Material Adverse Effect on the other Party or on such Party's ability to perform this PPA.

(A) As applicable, each Party shall give all required notices, shall procure and maintain all Permits necessary for performance of this PPA, and shall pay its respective charges and fees in connection therewith.

(B) Each Party shall promptly disclose to the other Party, any violation of any Applicable Laws arising out of their performance of this PPA.

(C) Upon permanent cessation of operation of the Facility, Seller shall decommission and remove the Facility and remediate the Site as, if and when required by Applicable Laws.

(D) Seller acknowledges that as a government contractor Company is subject to Applicable Laws regarding equal employment opportunity and affirmative action, including 41 C.F.R. §60-1.4(a) (1-7). Such Applicable Laws may also be applicable to Seller as a subcontractor to Company. All such Applicable Laws shall be deemed to be incorporated herein as required by Applicable Law.

(E) Except as specifically set forth in this Section 20.3 and elsewhere in this PPA, each Party assumes the risk of changes in Applicable Laws following the Effective Date, that affect such Party's costs of ownership and operation of its assets, and its performance of this PPA, except as otherwise specifically set forth herein.

20.4 Fines and Penalties. Seller shall pay when due all fees, fines, penalties and

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costs incurred by Company, Seller and/or their agents, employees or contractors arising from noncompliance by Seller, its employees, or subcontractors with any provision of this PPA, or any contractual obligation, Permit or requirements of Applicable Law, except for such fines, penalties and costs that are being actively contested in good faith and with due diligence by Seller and for which adequate financial reserves have been set aside to pay such fines, penalties or costs in the event of an adverse determination

20.5 Rate Changes.

(A) The terms and conditions and the rates for service specified in this PPA shall remain in effect for the Term hereof. Neither Party shall seek (nor support any third party seeking) any prospective or retroactive change to the rates or terms of service under this PPA pursuant to Sections §205, §206 or §306 of the Federal Power Act.

(B) The standard of review for changes to this PPA whether proposed by a Party, a non-party, or FERC acting *sua sponte* shall be the “public interest” standard of review set forth in *United Gas Pipe Line v. Mobile Gas Service Corp.*, 350 U.S. 332 (1956) and *Federal Power Commission v. Sierra Pacific Power Co.*, 350 U.S. 348 (1956) (aka the “Mobile-Sierra doctrine”), as interpreted in *Morgan Stanley Capital Group, Inc. v. Public Util. Dist. No. 1*, 128 S. Ct. 2733 (2008).

20.6 Certifications. Each Party shall deliver or cause to be delivered to the other Party certificates of its officers, accountants, engineers or agents as to matters as may be reasonably requested, and shall make available personnel and records relating to the Facility to the extent that the requesting Party requires the same in order to fulfill any regulatory reporting requirements, or to assist the requesting Party in litigation, including administrative proceedings before the MPUC/NDPSC.

20.7 Disclaimer of Third-Party Beneficiaries. In executing this PPA, Company does not and does not intend to extend its credit or financial support for the benefit of any Facility Lender or any other third party transacting with Seller. Nothing in this PPA shall be construed to create any duty to, or standard of care with reference to, or any liability to, any person not a party to this PPA.

20.8 Relationship of the Parties.

(A) This PPA shall not be interpreted to create an association, joint venture, or partnership between the Parties, nor to impose any partnership obligation or liability upon either Party. Except as specifically provided for in this PPA to the contrary, neither Party shall have any right, power, or authority to enter into any agreement or undertaking for, or act on behalf of, or to act as an agent or representative of, the other Party.

(B) Seller shall be solely liable for the payment of all wages, taxes, and other costs related to the employment of persons to perform such services, including all federal, state, and local income, social security, payroll, and employment taxes and statutorily mandated workers’ compensation coverage. None of the persons employed by Seller shall be considered employees of Company for any purpose; nor shall Seller represent to any person that he or she is or shall become a Company employee.

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20.9 Survival of Obligations. Cancellation, expiration, or earlier termination of this PPA shall not relieve the Parties of obligations, including warranties, remedies, or indemnities, that by their nature should survive such cancellation, expiration, or termination, which obligations shall survive for the period of the applicable statute(s) of limitation.

20.10 Severability. In the event any of the terms, covenants, or conditions of this PPA, its Exhibits, or the application of any such terms, covenants, or conditions, shall be held invalid, illegal, or unenforceable by any court or administrative body having jurisdiction, all other terms, covenants, and conditions of this PPA and their application not adversely affected thereby shall remain in force and effect; *provided, however, that* Company and Seller shall negotiate in good faith to attempt to implement an equitable adjustment in the provisions of this PPA with a view toward effecting the purposes of this PPA by replacing the provision that is held invalid, illegal, or unenforceable with a valid provision the economic effect of which comes as close as possible to that of the provision that has been found to be invalid, illegal or unenforceable.

20.11 Complete Agreement; Amendments. The terms and provisions contained in this PPA constitute the entire agreement between Company and Seller with respect to the Facility and shall supersede all previous communications, representations, or agreements, either verbal or written, between Company and Seller with respect to the sale and delivery of the products and services required by this PPA. Any amendment of this PPA, or any waiver of any provision hereof, shall be evidenced by a writing signed by the Parties to be bound thereby.

20.12 Waiver. The failure of either Party to enforce or insist upon compliance with or strict performance of any of the terms or conditions of this PPA, or to take advantage of any of its rights hereunder, shall not constitute a waiver or relinquishment of any such terms, conditions, or rights, but the same shall be and remain at all times in full force and effect.

20.13 Binding Effect. This PPA is binding upon and shall inure to the benefit of the Parties hereto and their respective successors, legal representatives, and assigns.

20.14 Headings. Captions and headings used in this PPA are for ease of reference only and do not constitute a part of this PPA.

20.15 Counterparts and Electronic Signatures. This PPA may be executed in counterparts, and each executed counterpart shall have the same force and effect as an original instrument. A manually signed copy of this PPA, or a copy of this PPA signed with an electronic or digital signature, delivered by e-mail shall be deemed to have the same legal effect as delivery of an original signed copy of this PPA. No legally binding obligation shall be created with respect to a Party until such Party has delivered or caused to be delivered a signed copy of this PPA.

20.16 Press Release. Upon the request of either Party, the Parties shall develop a mutually agreed joint press release to be issued describing the location, size and nature of the Facility, the Term, and other relevant factual information about the relationship.

20.17 Exhibits. Either Party may change the information in Exhibit D – Notices

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and Contact Information at any time by notice without the approval of the other Party. All other Exhibits may be changed to the extent allowed by specific provisions of this PPA or with the mutual consent of both Parties.

20.18 Confidentiality.

(A) For purposes hereof, "Confidential Information" means:

1. information specifically designated as Confidential Information in this PPA; and
2. written information delivered by one Party to the other from time to time during the Term, which information is labeled prominently as "Confidential," "Proprietary" or the like and specifically references this PPA.

provided, however, that "Confidential Information" shall not include information that:

- (a) is publicly available as of the Effective Date, or becomes publicly available during the Term through no fault of the recipient Party;
- (b) can be documented was independently developed by the recipient Party; and/or
- (c) is disclosed to the recipient Party from an ultimate source other than the protected Party, without breach of this PPA by the recipient Party.

(B) The recipient Party shall (i) maintain the confidentiality of all Confidential Information of the protected Party, using the same degree of care used by the recipient Party to protect its own Confidential Information (and in any event not less than a reasonable degree of care), and (ii) shall use Confidential Information only in connection with its performance of this PPA. Confidential Information may be disclosed by the recipient Party to its agents, employees, directors, officers, consultants, auditors, lenders and equity investors, subject to their acceptance of the obligations of confidentiality imposed hereby and for whose violations of this Section 20.18 the recipient Party shall be responsible.

(C) In the event that Confidential Information is disclosed to the MPUC/NDPSC, their staff, parties, intervenors, participants or consumer counsel in any regulatory or administrative proceedings before the MPUC/NDPSC, or Confidential Information is disclosed to the MPUC/NDPSC, their staff, or consumer counsel outside of any regulatory or administrative proceedings before the MPUC/NDPSC, the disclosing Party shall submit such Confidential Information in accordance with applicable MPUC/NDPSC confidentiality rules and procedures, the MPUC/NDPSC protective order or signed non-disclosure agreement.

(D) In the event that Confidential Information must otherwise be disclosed by Applicable Law (e.g., pursuant to subpoena or civil discovery), the Party required to make disclosure shall notify the protected Party sufficiently in advance to allow the protected Party a reasonable opportunity to obtain a protective order or seek other remedies, prior to disclosure by the recipient Party.

20.19 Accounting Treatment.

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(A) If and when Company reasonably determines that Company must consolidate financial information of Seller into Company's financial statements under FASB ASC 810 or other accounting standard applicable to Company:

1. the Parties shall use Commercially Reasonable Efforts to amend this PPA and/or the Parties' protocols for operation of the Facility to avoid such treatment, at the least possible cost to the Parties, consistent with the intent of this PPA to the extent possible; or

2. if such avoidance is not reasonably feasible, Seller shall provide to Company from time to time upon request such quarterly and annual financial information as may be needed for Company to comply with such standard, in such format and within such time frames as Company may reasonably request.

(B) If and when Company reasonably determines that Company must treat this PPA as a "finance lease" under FASB ASC 842 or other accounting standard applicable to Company, the Parties shall use Commercially Reasonable Efforts to amend this PPA and/or the Parties' protocols for operation of the Facility to avoid such treatment, at the least possible cost to the Parties, consistent with the intent of this PPA to the extent possible, if so requested by Company.

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IN WITNESS WHEREOF, the Parties have executed this PPA as of the date first set forth above.

Seller:

[LLC]

By: _____
[name and title]

Company:

**Xcel Energy Services, Inc., authorized signatory
for Northern States Power Company, a [Minnesota
or Wisconsin] corporation**

By: _____
[name and title]

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EXHIBIT A - DEFINITIONS

The following terms shall have the meanings set forth herein:

“AC” shall have the meaning set forth in Section 1.1(D).

“Actual Damages” shall have the meaning set forth in Section 12.4(C).

“Affiliate” of any designated person or entity means any person or entity that directly or indirectly controls, is under the control of, or is under common control with, the designated person or entity by the power to direct or cause the direction of the management of the policies of designated person or entity, whether through ownership interest, by contract or otherwise.

“AGC” or “Automatic Generation Control” means the equipment and capability of an electric generation facility automatically to adjust the generation quantity within the applicable Balancing Authority with the purpose of interchange balancing and specifically, the Facility’s capability of accepting an AGC Set-Point electronically, and the automatic adjustment and regulation of the Facility’s Renewable Energy production via the SCADA System.

“AGC Protocols” means the protocols for AGC included in Exhibit I - AGC Protocols; Data Collection; Availability Reporting, as such protocols may be modified from time to time in accordance with Section 10.7.

“AGC Remote/Local” means a handshake electronic signal sent from the Facility to the EMCC AGC system, and from the EMCC AGC system to the Facility, indicating the Facility is receiving AGC Set-Point locally (from the Facility) or remotely (EMCC AGC system) and is following that AGC Set-Point.

“AGC Set-Point” means the Company-generated analog or digital signal sent by the SCADA System to the Facility, representing the quantity of Renewable Energy to be generated by the Facility. The AGC Set-Point is calculated by the EMCC AGC system and communicated electronically to the Facility via the SCADA System.

“Ancillary Services” shall have the meaning set forth in Section 7.4(C).

“Applicable Law(s)” means all laws, statutes, treaties, codes, ordinances, regulations, standards, certificates, orders, licenses and permits of any Governmental Authority that are applicable to a Party, the business of a Party or the Facility, now in effect or hereafter enacted, including amendments to or interpretations of any of the foregoing by a Governmental Authority having jurisdiction, and all applicable judicial, administrative, arbitration and regulatory decrees, judgments, injunctions, writs, orders, awards and/or like actions, including, for the avoidance of doubt, electrical, building, fire, zoning, environmental, and occupational health and safety requirements.

“Arbitration Service” means Judicial Arbitration and Mediation Services, Inc. (aka JAMS).

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“Back-Up Metering” shall have the meaning set forth in Section 5.3(C).

“Balancing Authority” means the system of electrical generation, distribution and transmission facilities within which generation is regulated in order to maintain interchange schedules with other such systems.

“Building Trades CBA” shall have the meaning set forth in Section 4.5(C)2.I.

“Business Day” means any Day that is not a Saturday, a Sunday, or a NERC recognized holiday.

“Change of Control” means the occurrence of any one of the following events with respect to Seller or any direct or indirect owner of a majority of the ownership interests in Seller: (a) a transfer of a majority of the ownership interests in Seller or such owner; (b) any consolidation or merger of Seller or such owner in which Seller or such owner, as the case may be, is not the continuing or surviving entity; or (c) a sale or conveyance of any direct or indirect ownership interest in Seller following which [] (“Ultimate Parent”) is no longer the direct or indirect owner of at least fifty percent (50%) of the ownership interests of Seller, *provided, however*, that a Change of Control shall not be deemed to have occurred solely as a result of

- (i) transactions exclusively among Affiliates of Seller,
- (ii) any exercise by the Facility Lender of its rights and remedies under the Financing Documents, with respect to any Facility Debt secured only by the Facility,
- (iii) a change of control of Ultimate Parent, or
- (iv) any change of economic and/or voting rights triggered in Seller’s organizational documents arising from (a) a tax-equity financing of the Facility, or (b) a transaction in which interests in Seller or any direct or indirect owner are sold to or by a tax equity investor.

“COD Conditions” means all of the requirements that must be satisfied by Seller as a prerequisite to achieving Commercial Operation. The COD Conditions are set forth in Section 4.5(C)2.

“COD Delay” shall have the meaning set forth in Section 12.2(A).

“COD Liquidated Delay Damages” shall have the meaning set forth in Section 12.2(A).

“COD Notice” shall have the meaning set forth in Section 4.5(B).

“Commercial Operation” means the period beginning on the Commercial Operation Date and continuing through the balance of the Term of this PPA.

“Commercial Operation Date” or “COD” shall have the meaning set forth in Section 4.5(C)1.

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“Commercial Operation Year” shall have the meaning set forth in Section 4.5(D).

“Commercially Reasonable” or “Commercially Reasonable Efforts” means, with respect to any action to be taken or attempted by a Party under this PPA, the level of effort in light of the facts known to such Party at the time a decision is made that: (a) can reasonably be expected to accomplish the desired action at a reasonable cost; (b) is consistent with Good Utility Practices; and (c) is consistent with the terms in this PPA; and (d) takes into consideration the amount of advance notice required to take such action, the duration and type of action, and the competitive environment in which such action occurs.

“Committed Energy” from the Facility for each Commercial Operation Year is set forth on Exhibit J – Renewable Energy Payment Rate; Committed Energy hereto. The amount of Committed Energy shall be deemed Confidential Information for purposes of Section 20.18.

“Company” shall have the meaning set forth in the introductory paragraph.

“Confidential Information” shall have the meaning set forth in Section 20.1(A).

“Construction Contracts” shall have the meaning set forth in Section 4.1(A).

“Construction Craft Employees” means employees engaged in on-Site construction and commencement of operations of the Facility, excluding (i) Specialty Vendors, (ii) management and supervisory employees, (iii) employees engaged in non-construction support services (including messengers, guards, safety personnel, medical and first-aid technicians, community relations or public affairs, etc.), and (iv) employees engaged in on-Site maintenance of installed equipment or systems but which maintenance occurs after installation of such equipment or system and is not directly related to construction services.

“Construction Milestones” means the dates set forth in Exhibit B - Construction Milestones.

“COVID” means SARS-CoV-2 or COVID-19, and any evolutions or mutations thereof or related or associated epidemics, pandemic, or disease outbreaks.

“CPD Delay” shall have the meaning set forth in Section 12.2(A).

“CPD Liquidated Delay Damages” shall have the meaning set forth in Section 12.2(A).

“Credit Rating” of any person or entity means the lowest rating assigned to such person or entity's long-term debt or deposit obligations (unenhanced by third-party support) by Standard & Poor's and Moody's. If such person or entity has no outstanding long-term debt or deposit obligations, or if no rating is assigned to such obligations, “Credit Rating” shall mean the lowest general corporate credit rating or long-term issuer rating assigned to such person or entity by Standard & Poor's or Moody's.

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“Critical Path Development Milestone” or “CPD” shall have the meaning set forth in Section 4.1(B).

“Curtailment” shall have the meaning set forth in Section 8.3(A).

“Damage Cap” shall have the meaning set forth in Section 12.4(A).

“Day” means a calendar day.

“DC” shall have the meaning set forth in Section 1.1(D).

“Default FMV” shall have the meaning set forth in Section 12.1(E)1.

“Default Option” shall have the meaning set forth in Section 12.1(E)3.

“Default Option Preliminary Exercise Notice” shall have the meaning set forth in Section 12.1(E).

“Dispute” shall have the meaning set forth in Section 13.1(A).

“Dispute Notice” shall have the meaning set forth in Section 13.1(A).

“Distributed Network Protocol (DNP)” means a set of communications protocols used between components in process automation systems.

“Dollar”, “\$”, or “US\$” means the lawful currency of the United States of America.

“Effective Date” shall have the meaning set forth in the introductory paragraph.

“Electric Metering Devices” means revenue quality meters, metering equipment and/or data processing equipment used to measure, record and transmit data with respect to the output of Renewable Energy from the Facility, including metering current transformers and metering voltage transformers. The Electric Metering Devices must be capable of storing five-minute revenue quality meter data for transmission to, and retrieval by, Company.

“Eligible Energy Resource” means any generation resource eligible to be certified to generate, claim, own or use Renewable Energy Credits and green tags pursuant to the protocols and procedures developed and approved by applicable Government Authorities for the REC Registration Program.

“Energy Markets Control Center” or “EMCC” means Company's merchant representatives responsible for dispatch of generating units, including the Facility.

“Energy Payment Reduction” shall be as defined in Section 8.4.

“Environmental Attributes” shall have the meaning set forth in Section 7.3(C).

“Environmental Contamination” shall have the meaning set forth in Section

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4.2(C).

“Equity Interest” shall have the meaning set forth in Section 19.5(A).

“Equity Interest Acquisition” shall have the meaning set forth in Section 19.5(A).

“Equity Purchase Price” shall have the meaning set forth in Exhibit L-1 – Equity Purchase Price Formula.

“Equivalent Availability Reporting Factor” shall have the meaning set forth in Exhibit I - AGC Protocols; Data Collection; Availability Reporting.

“ERO” means the Electric Reliability Organization certified by FERC pursuant to Section 215 of the Federal Power Act, which as of the Effective Date is NERC, or any successor organization. For purposes of this PPA, ERO also includes the Midwest Reliability Organization (MRO).

“Escrow Account” shall have the meaning set forth in Section 11.3(B).

“Event of Default” shall have the meaning set forth in Article 12 -.

“Equity Purchase Price” shall have the meaning set forth in Exhibit L-1

“Excess Energy” shall have the meaning set forth in Section 8.2(D).

“Facility” means Seller’s electric generating facilities, associated balance of plant, parts, fixtures and equipment, and all equipment necessary to interconnect to the Transmission Authority’s System, all as further described in Exhibit C - Facility Description and Site Maps, including Seller’s rights to the Site and all of the following: buildings, [turbines] [panels], generators, step-up transformers, output breakers, facilities necessary to connect to the Interconnection Point, protective and associated equipment, improvements, and other tangible and intangible assets, contract rights, Permits, easements, rights of way, surface use agreements and other interests or rights in real estate, owned or used for construction, operation, maintenance, generation and delivery of the capacity and Renewable Energy subject to this PPA.

“Facility Acquisition” shall have the meaning set forth in Section 19.5(A).

“Facility Debt” means the obligations of Seller or its Affiliates to any lender or tax equity or other investor pursuant to the Financing Documents, including principal of, premium and interest on indebtedness, fees, expenses or penalties, amounts due upon acceleration, prepayment or restructuring, swap or interest rate hedging breakage costs and any fees or interest due with respect to any of the foregoing.

“Facility Lender” means, collectively, any lenders or tax equity investors or other investors providing Facility Debt, including any successors or assigns thereof.

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"Federal Power Act" means the provisions of 16 U.S.C. §791(A) *et seq.* and amendments or supplements thereto.

"FERC" means the Federal Energy Regulatory Commission or any successor agency.

"Financing Documents" means the loan and credit agreements, notes, bonds, indentures, security agreements, lease financing agreements, equity contribution agreements, mortgages, deeds of trust, interest rate exchanges, swap agreements and other documents relating to the development, bridge, construction, back-leverage or permanent debt financing and/or tax equity financing for the Facility, including any credit enhancement, credit support, working capital financing, or refinancing documents, and any and all amendments, modifications, or supplements to the foregoing that may be entered into from time to time at the discretion of Seller in connection with development, construction, ownership, leasing, operation or maintenance of the Facility.

"FMV" means the "fair market value."

"Forced Labor Laws" shall have the meaning set forth in Section 15.2(B).

"Force Majeure" shall have the meaning set forth in Section 14.1.

"Forced Outage" means any condition at the Facility that requires the immediate and unplanned removal of the Facility, or at least ten percent (10%) or five (5) MW, whichever is less thereof, from service, another outage state, or a reserve shutdown state, resulting from immediate mechanical/electrical/hydraulic control system trips and operator-initiated trips in response to abnormal Facility conditions or alarms.

"Generation Limit" shall have the meaning set forth in Section 8.1(B).

"Good Utility Practices" means the practices, methods, standards and acts engaged in or approved by a significant portion of the applicable segment of the electric power generation industry pertaining to facilities of the type, similar size and location to the Facility that, at a particular time, in the exercise of Commercially Reasonable judgment, in light of the facts that are known (or reasonably should have been known) at the time a decision was made, would have been expected to accomplish the desired result in a manner consistent with Applicable Law, Permits, codes, standards, equipment manufacturer's recommendations, reliability, safety, environmental protection, economy, and expedition. Good Utility Practices is not limited to the optimum practice, method, standard or act to the exclusion of all others, but rather to those practices, methods, standards and acts generally acceptable or approved by a significant portion of the applicable segment of the electric power generation industry in the relevant region, during the relevant period. [Wind Only: *"Good Utility Practices include adherence to the United States Fish and Wildlife Services' Land Based Wind Energy Guidelines"*] [Solar Only: *Good Utility Practices include adherence to any applicable current or future federal or state best management practices or guidelines for solar energy development.*]

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“Governmental Authority” means any federal, state, local or municipal governmental body; any governmental, quasi-governmental, regulatory or administrative agency, commission, body or other authority exercising or entitled to exercise any administrative, executive, judicial, legislative, policy, regulatory or taxing authority or power; and/or any court or governmental tribunal. By way of example only, “Governmental Authorities” include, but are not limited to NERC, the ERO, the Market Operator (if any), an applicable PUC, the Transmission Authority, FERC, and successor organizations. For the avoidance of doubt, Company is not a Governmental Authority for purposes of this PPA.

“GSU Transformer” means a power transformer that is contained within the Facility and that increases the AC voltage of the electrical energy produced by the Facility to the AC voltage at which such electrical energy is delivered to Company at the Interconnection Point.

“GSU Transformer Failure” means the failure of a GSU Transformer; *provided, however*, that such failure requires the replacement or substantial remanufacturing of such GSU Transformer to return to service (i) the Facility in the event the Facility contains one GSU Transformer or (ii) the portion of the Facility served by such failed GSU Transformer in the event the Facility contains more than one GSU Transformer, *provided further, however*, that such GSU Transformer Failure shall not exceed in the aggregate more than eighteen (18) months in duration during the Term. Seller may only claim one (1) GSU Transformer Failure during the Term.

“Guarantor” shall have the meaning set forth in Section 11.3(C).

“Hazardous Materials” shall have the meaning set forth in Section 4.2(C).

“House Power” shall have the meaning set forth in Section 1.2(B).

“Indemnified Party” shall have the meaning set forth in Section 17.1.

“Indemnifying Party” shall have the meaning set forth in Section 17.1.

“Independent Engineer” means a qualified and independent third party engineering firm.

“Interconnection Agreement” means the separate contract for interconnection of the Facility to the Transmission Authority’s System, as such agreement may be amended from time to time. For purposes of this PPA, the Interconnection Agreement shall be interpreted to include any third party facility construction agreement or other agreement required by the Transmission Authority to interconnect the Facility in accordance with the Transmission Tariff. For the avoidance of doubt, “Interconnection Agreement” excludes any temporary or provisional interconnection agreement or any agreement where the Transmission Provider may limit the operational output of the Facility.

“Interconnection Facilities” means those facilities designated in the

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Interconnection Agreement for the direct purpose of interconnecting the Facility at the Interconnection Point, along with any easements, rights of way, surface use agreements and other interests or rights in real estate reasonably necessary for the construction, operation and maintenance of such facilities, whether owned by Seller, the Transmission Authority or another entity. This equipment is conceptually depicted in Exhibit C - Facility Description and Site Maps to this PPA.

“Interconnection Point” means the physical point within the operational authority of the Transmission Authority as specified in the Interconnection Agreement as project [REDACTED], at which electrical interconnection is made between the Facility and the Transmission Authority’s System in accordance with the Transmission Tariff and the Interconnection Agreement.

“Investment Grade” means a Credit Rating of both (a) Baa3 or higher by Moody’s, and (b) BBB- or higher by Standard & Poor’s.

“Issuer” shall have the meaning set forth in Section 11.3(A).

[if applicable] “ITCs” means Investment Tax Credits applicable to electricity produced from solar energy resources pursuant to 26 U.S.C. §48 as in effect as of the Effective Date and as administered and interpreted under Applicable Law as of the Effective Date.

[if applicable] “ITC Period” means the period starting on the Commercial Operation Date and ending on the ____ (____th) anniversary of the Commercial Operation Date.

“kW” means kilowatt.

“kWh” means kilowatt hour.

“Lender Consent” shall have the meaning set forth in Section 18.1.

“Lender Notice” shall have the meaning set forth in Section 18.2(A).

“Letter of Credit” shall have the meaning set forth in Section 11.3(A).

“Liquidated Delay Damages” shall have the meaning set forth in Section 12.2.

“Local Provider” shall have the meaning set forth in Section 1.2(B).

“Losses” shall have the meaning set forth in Section 17.1.

“Maintenance Schedules” shall have the meaning set forth in Section 10.2(A).

“Market Operator” means the entity that instructs market participants and/or generators to regulate generation assets (including the Facility) within any energy

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market in which Company participates, based on price-based offer curves for the purpose of matching generation output to system load demand while maintaining bulk electric system reliability. If such entity is the Transmission Authority, then “Market Operator” shall mean such entity acting in its capacity as such.

“Material Adverse Effect” means any effect (or effects taken together) that is materially adverse to the present or future business, operations, assets, liabilities, properties, results in operations or condition (financial or otherwise), prospects, or property of a Party, its business, or this PPA.

“MIPSA” means member interest purchase and sale agreement.

“Monthly Energy Payment” shall have the meaning set forth in Section 8.1(B).

“MPUC” means the Minnesota Public Utilities Commission or any successor agency.

“MW” means megawatt or one thousand kW, and “MWh” means megawatt hours or one thousand kWh..

“Nameplate Capacity” of the Facility means the sum of the designed maximum outputs of each [Wind Turbine] [Solar Unit] comprising the Facility expressed in MWs, as designated by the manufacturer, as measured at the Interconnection Point, and as set forth in Section 3.2(C). For the avoidance of doubt, the Nameplate Capacity may not be greater than the interconnection capacity specified in the Interconnection Agreement.

“NDPSC” means the North Dakota Public Service Commission or any successor agency.

“NERC” means the North American Electric Reliability Council or any successor organization.

[if applicable] “Network Resource Interconnection Service” means the type of interconnection service which allows Seller to connect the Facility to the transmission or distribution system, as applicable, as a “Network Resource” as defined by the Transmission Tariff and be eligible to deliver the Facility’s output in a manner comparable to that in which the Transmission Authority integrates its generating facilities to serve native load customers.

“Operating Committee” means one representative(s) each from Company and Seller, pursuant to Section 10.7.

“Operating Procedures” means those procedures developed by the Operating Committee pursuant to Section 10.7, if any.

“Operating Records” means all agreements associated with the Facility, operating logs, blueprints for construction, operating manuals, all warranties on

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equipment, and all documents, whether in printed or electronic format, that Seller uses or maintains for the operation of the Facility.

“Option” means Company’s rights to purchase the Facility on the terms and conditions set forth in Section 19.5.

“Option Preliminary Exercise Notice” shall have the meaning set forth in Section 19.5(A).

“Park Potential” means the number of MW that depicts Seller’s real time calculation of the Potential Energy capable of being provided by the Facility to Company at the Point of Delivery. Park Potential shall be calculated using the best-available data obtained through Commercially Reasonable methods; and shall be dependent upon [measured wind speeds] [measured solar irradiance], power curves, [Wind Turbine] [Solar Unit] availability, and derate(s) and transmission line losses, and any other adjustment necessary to accurately reflect the Potential Energy at the Point of Delivery; and, at any given moment in time, may not exceed the Nameplate Capacity. Park Potential should be provided to Company in real time through Company’s SCADA System in accordance with the AGC Protocols. Park Potential shall remain within a measured difference of plus or minus two percent (2%) between the metered Renewable Energy and Park Potential, during periods when generation is not curtailed.

“Party” and “Parties” shall have the meanings set forth in the introductory paragraph.

“Pending Facility Transaction” or “PFT” shall have the meaning set forth in Section 19.4(D).

“Permits” shall have the meaning set forth in Section 4.3.

“PFT Notice” shall have the meaning set forth in Section 19.4(A).

“PI System” means the “plant information” system for the Facility or other data collection systems, as described and implemented in Exhibit I - AGC Protocols; Data Collection; Availability Reporting.

“Point of Delivery” means the physical point within the operational authority of Transmission Authority at which Seller makes available and delivers to Company the Renewable Energy. The Point of Delivery is specified in Exhibit C - Facility Description and Site Maps.

“Potential Energy” for any period of time means the MWh of energy that the Facility is actually capable of delivering to the Point of Delivery by virtue of the Park Potential during such period; provided that, for the avoidance of doubt, the maximum net instantaneous output that the Facility shall be deemed to be able to deliver to the Point of Delivery for purposes of determining the Potential Energy shall not exceed the Nameplate Capacity.

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“PPA” shall have the meaning set forth in the introductory paragraph.

“PSA” means purchase and sale agreement.

[if applicable] “PTCs” means Production Tax Credits applicable to electricity produced from certain wind energy resources pursuant to 26 U.S.C. §45, as in effect as of the Effective Date and as administered and interpreted under Applicable Law as of the Effective Date.

[if applicable] “PTC Period” means the period starting on the Commercial Operation Date and ending on the tenth (10th) anniversary of the Commercial Operation Date.

“PUC Approval” shall have the meaning set forth in Section 6.1(D).

“Purchase Price” shall have the meaning set forth in Section 19.5(G)

“Qualified Operator” means an operator of [wind] [solar] generation facilities that has sufficient experience to successfully operate the Facility, including a minimum of three (3) years’ experience in the [wind] [solar] energy generation and operation business, and owns, controls or operates (or has owned, controlled or operated) a minimum of 300 MW of [wind] [solar] energy generation capacity in aggregate.

“REC Registration Program” means the current or successor State, regional, or federal program established to register Eligible Energy Resources, and create and certify RECs arising from such Resources, including any rights associated with any renewable energy information or tracking system that exists or may be established by Applicable Law with regard to monitoring, registering, tracking, certifying, or trading such credits. For purposes of this PPA, the REC Registration program shall mean the Midwest Renewable Energy Tracking System (M-RETS).

“Real Time Data” shall have the meaning set forth in Section 10.5.

“Recovery Plan” means, with respect to Seller’s failure to achieve a Critical Path Development Milestone under Section 4.1(B), a plan (confirmed by a qualified consultant, vendor or expert reasonably acceptable to Company) indicating in sufficient detail, and to Company’s reasonable satisfaction, the steps to be taken by Seller to achieve the missed Critical Path Development Milestone by a date certain, which date shall be the earliest reasonable date for achievement of the Critical Path Development Milestone, but shall not exceed ninety (90) days following the completion deadline set forth in Section 4.1(B) for such Critical Path Development Milestone. If the date certain identified in a Recovery Plan is later than the completion deadline(s) for any other Critical Path Development Milestone(s) (as those deadlines are set forth in Section 4.1(B)), then such Recovery Plan shall also describe the impacts, if any, to such other Critical Path Development Milestone(s); *provided, however*, that Seller shall remain responsible for achieving such other Critical Path Development Milestone(s), as set forth in Section 4.1(B), Section 12.2(A), and Section 12.2(B).

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“Renewable Energy” means all electric energy generated by the Facility and delivered to Company at the Point of Delivery during the Term, including all Test Energy and any Excess Energy purchased by Company. “Renewable Energy” shall be deemed to include all Environmental Attributes associated with such electric energy.

“Renewable Energy Credits” or “RECs” means the right to all non-energy attributes (including economic, carbon and pollutant-related tags and credits, benefits, avoided or reduced emissions reductions, offsets, emission rate reductions, tags and allowances, howsoever titled) attributable to the capacity available and/or energy generated by the Facility, including environmental air quality credits, tags and allowances created by Applicable Law by virtue of the Facility’s environmentally favorable or renewable characteristics or attributes. “RECs” includes but is not necessarily limited to rights eligible for registration, trading and/or use under the REC Registration Program. In Minnesota and Wisconsin, “REC” shall include renewable energy credits (as used in §7835-5950 of the Minnesota Administrative Rules), and renewable energy certificates (as defined in PSC 118.02 of the Wisconsin Administrative Code) with respect to one MWh of Renewable Energy, as applicable.

“Renewable Energy Payment Rate” shall have the meaning set forth in Exhibit J – Renewable Energy Payment Rate; Committed Energy.

“Replacement Power Costs” for any period mean the costs incurred by Company to replace the products and services which Seller was required to provide under this PPA (but failed to so provide) during such period, less the sum of any payments from Company to Seller under this PPA that were eliminated with respect to such period as a result of such failure. Replacement Power Costs shall be determined on an hourly basis and shall equal the sum of the following for each hour where the following calculation achieves a positive number:

Hourly Replacement Power Costs = (A + B + C + D) – E, where

- “A” = the product of (x) the number of MW of lost capacity, derived by subtracting the number of MW of capacity of the Facility that qualifies for capacity credit actually made available to Company from the amount of qualifying capacity associated with the entire Facility, and (y) the applicable market price for capacity made available to Company’s system, for such hour;
- “B” = the price paid by Company for the MWh of energy purchased by Company to replace the Renewable Energy that was not delivered under this PPA during such hour;
- “C” = the product of (x) the number of MWh of energy purchased by Company with respect to such hour, to replace the Committed Energy that was not delivered under this PPA, and (y) the actual cost of registered RECs for that number of MWh, for such hour;
- “D” = the actual cost of transmission, Ancillary Services, fuel and fuel transportation, other incremental costs, and any related penalties that

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could not be avoided or mitigated, and transaction charges to deliver reasonably available energy to Company in amounts equal to the number of MWh for which Replacement Power Costs are owed; and

“E” = the sum of all payments avoided by Company as a result of Seller’s breach, for such hour, including avoided payments under Article 8 -.

“ROFO” means “Right of First Offer.”

“ROFO Notice” shall have the meanings set forth in Section 19.3(A).

“Safety Requirements” means those requirements set forth in Exhibit N – Safety Requirements, in addition to any other safety-related practices required by Applicable Law and Good Utility Practices.

“SCADA” or “SCADA System” means supervisory control and data acquisition.

“Scheduled Termination Date” shall have the meaning set forth in Article 2 -.

“Security Fund” shall have the meaning set forth in Section 11.1(A).

“Seller” shall have the meaning set forth in the introductory paragraph.

“Seller Excuse Hours” means those hours during which Seller is unable to schedule or deliver Energy to Company as a result of (A) a Curtailment (but only to the extent such Curtailment does not result from Seller’s failure to perform under this PPA or the Interconnection Agreement, or Seller’s failure to observe Good Utility Practices), (B) Force Majeure; (C) a GSU Transformer Failure, or (D) Company’s failure to perform.

“Site” means the parcel or parcels of real property on which the Facility will be located, including any easements, rights of way, surface use agreements and other interests or rights in real estate necessary for the construction, operation and maintenance of the Facility. The Site is more specifically described in Exhibit C - Facility Description and Site Maps to this PPA.

[solar only] “Solar Units” means the photovoltaic arrays, mirrors, lenses, tracking devices and other equipment necessary for the Facility to collect sunlight at the Site and convert it into electricity or thermal energy. The manufacturer and model number of the Solar Units will be identified on Exhibit C - Facility Description and Site Maps.

“Specialty Vendors” means one or more employers or service providers (collectively with their respective employees, contractors and service providers) that uses or relies upon proprietary or specialized procedures, processes, equipment, or requires workers with specialized training or certification to investigate, inspect, or provide other services that do not constitute construction labor. Examples of Specialty Vendors include but are not limited to engineers, professional engineers, architects, quality control/assurance personnel and/or environmental compliance personnel. Work provided by Specialty Vendors is excluded from the requirement to be certified as set

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forth in Section 4.5(C)2.k.

“Target COD” shall have the meaning set forth in Section 4.5(A).

“TE Partnership” shall have the meaning set forth in Section 19.5(A).

“Term” means the period of time during which this PPA remains in full force and effect, as further defined in Article 2 -.

“Test Energy” shall have the meaning set forth in Section 4.6.

“Transmission Authority” means collectively those entities owning and/or operating the interconnected transmission system applicable to Seller and the Facility pursuant to a Transmission Tariff, including (i) Company operating under and in accordance with its Transmission Tariff, and (ii) all entity(ies) responsible under the Interconnection Agreement for providing the transmission lines, any Interconnection Facilities and other equipment and facilities with which the Facility interconnects at the Interconnection Point and transmission system.

“Transmission Authority’s System” means the contiguously interconnected electric transmission and sub-transmission facilities, over which the Transmission Authority has rights (by ownership or contract) to provide bulk transmission of capacity and energy from the Interconnection Point.

“Transmission Tariff” means the applicable Open Access Transmission Tariff of the Transmission Authority, as amended from time to time.

“UFLPA” means the Uyghur Forced Labor Prevention Act, Pub. L. 117-78 (2021).

“Ultimate Parent” shall have the meaning set forth in the definition of Change of Control.

[wind only] “Wind Turbine(s)” means the wind-energy generating devices that are included in the Facility. The manufacturer and model number of the Wind Turbines is identified on Exhibit C - Facility Description and Site Maps.

* * * * *

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EXHIBIT B - CONSTRUCTION MILESTONES

Construction

<u>Milestone</u>	<u>Outcome</u>
[Date]	Seller and all required counterparties shall have executed such Construction Contracts as are needed to construct the Facility.
[Date]	Seller and the Transmission Authority shall have executed the Interconnection Agreement.
[Date]	Seller shall have achieved closing on financing for the Facility or provided Company with proof of financial capability to construct the Facility.
[Date]	Commencement of construction of the Facility.
[Date]	Seller shall have laid the foundation for all Facility buildings, generating facilities and step-up transformation facilities.
[Date]	The [Wind Turbines] [Solar Units] and step-up transformer shall have been delivered and installed at the Site.
[Date]	Seller has submitted to Company and obtained Company approval of serialized information for all Electric Metering Devices and Back-Up Metering.
[Date]	Seller's Interconnection Facilities shall have been constructed, and such facilities are capable of being energized.
[Date]	Seller has demonstrated to Company's reasonable satisfaction that all Electric Metering Devices and Back-Up Metering and communications equipment are functional and provide data integrity.
[Date]	Start-up testing of the Facility commences.
[Date]	Seller shall make all applications and/or filings required by Applicable Law for REC accreditation and for the assignment of such RECs to Company.

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EXHIBIT C - FACILITY DESCRIPTION AND SITE MAPS

[This Exhibit shall include a description of the Facility and all material components thereof, including map, aerial pictures, AC one-line diagram, showing metering point(s), Point of Delivery, and (if different), the Interconnection Point.]

The Facility shall be located on the Site and shall be identified as Seller's [REDACTED] Generation Facility. Maps and one-line diagrams of the Facility and associated equipment are included as part of this Exhibit, as may be updated from time to time.

The address of the Facility is [REDACTED], Latitude: [REDACTED], Longitude: [REDACTED].

Point of Delivery located at [REDACTED].

The Facility must include the following specific components and capabilities:

- *Major equipment including PV modules and inverters without any inherent limitations for alignment and conformance with IEEE Std. 2800-2022.
- *Available panel space and 125VDC battery supplied voltage necessary to accommodate the metering, telemetering and communications equipment required by this PPA.
- * Communication circuits from the Facility to the EMCC for the purpose of telemetering, supervisory control/data acquisition, and voice communications as required by Company.
- * Capability of sending real time data and OPC interface to Company's PI System.
- * Equipment and software necessary to receive, accept and react to an AGC signal from the Company's SCADA System and to comply with the AGC Protocols as further specified on Exhibit I - AGC Protocols; Data Collection; Availability Reporting.
- * Ramping capability, reactive power - voltage control capability and active power - frequency response capability pursuant to NERC guidelines/requirements and applicable sections of IEEE Std. 2800-2022, including but not limited to Section 5 "Reactive power-voltage control requirements within the continuous operation region", and Section 6 "Active-power – frequency response requirements".
- * Facility has Low Voltage Ride-Through (LVRT) Capability described under FERC Order No. 661 and meets the requirements for Reactive Power Design Criteria under FERC Order No. 827.

Northern States Power Company **[Wind]** **[Solar]** Energy Purchase Agreement

[wind - insert make, model and number of turbines.]

*Major equipment including inverters and/or wind-turbine generators without any inherent limitations for alignment and conformance with IEEE Std. 2800-2022.

* **[wind]** Each Wind Turbine equipped with meteorological measurement equipment (e.g., anemometers), individually linked to Seller's information system.

* **[wind]** Facility is capable of operating at an ambient temperature down to -30° Celsius (-22° Fahrenheit).

* **[solar]** DC and AC capacity of Facility (from Seller's bid) [DC][AC].

The proposed Facility includes the components that are equivalent to, or better than, the following:

[Additional Bid Specific requirements to be added]

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EXHIBIT D - NOTICES AND CONTACT INFORMATION

Company	Seller
Notices: Director, Purchased Power Xcel Energy Services Inc. 1800 Larimer Street, Suite 1000 Denver, CO 80202 Email: purchasedpowernotices@xcelenergy.com <i>with a cc to:</i> Purchased Power Consultant Xcel Energy Services Inc. 1800 Larimer Street, Suite 1000 Denver, CO 80202 Email: purchasedpowernotices@xcelenergy.com	Notices: [REDACTED] [REDACTED] [REDACTED] Phone: [REDACTED] E-mail: [REDACTED]@[REDACTED].com <i>with a cc to:</i> [REDACTED] [REDACTED] [REDACTED] Phone: [REDACTED] E-mail: [REDACTED]@[REDACTED].com
Operating Committee Representative: Director, Purchased Power Xcel Energy Services Inc. 1800 Larimer Street, Suite 1000 Denver, CO 80202 Email: purchasedpowernotices@xcelenergy.com Alternate: Purchased Power Consultant Xcel Energy Services Inc. 1800 Larimer Street, Suite 1000 Denver, CO 80202 Email: purchasedpowernotices@xcelenergy.com	Operating Committee Representative: [REDACTED] [REDACTED] [REDACTED] Phone: [REDACTED] E-mail: [REDACTED]@[REDACTED].com Alternate: [REDACTED] [REDACTED] [REDACTED] Phone: [REDACTED] E-mail: [REDACTED]@[REDACTED].com
Real-Time Contact Information <u>EMCC</u> (24-hour coverage): Phone: 303-571-7426 E-mail: dlrtelectricmarketersnsp@xcelenergy.com <u>Transmission Ops:</u> Phone: 303-273-4811	Real-Time Contact Information <u>[Operations Command Center]</u> (24-hour coverage): Phone: [REDACTED] E-mail: [REDACTED]

Northern States Power Company [Wind] [Solar] Energy Purchase Agreement

E-mail: AGCOpr@xcelenergy.com	

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EXHIBIT E - INSURANCE COVERAGE

Type of Insurance	Minimum Limits of Coverage

Commercial General Liability (CGL) and commercial umbrella	\$11,000,000 combined single limit each occurrence and the aggregate, where applicable. If CGL insurance contains a general aggregate limit, it shall apply separately to the Facility.

CGL insurance shall be written on ISO occurrence form CG 00 01 01 96 (or a substitute form providing equivalent coverage) and shall cover liability arising from premises, operations, independent contractors, products/completed operations, contracts, property damage, personal injury and advertising injury, and liability assumed under an insured contract (including the tort liability of another assumed in a business contract), all with limits as specified above. CGL insurance shall include ISO endorsement CG 24 17 (or an equivalent endorsement) which modifies the definition of "Insured contract" to eliminate the exclusion of easement or license agreements in connection with construction or demolition operations on or within 50 feet of a railroad. There shall be no endorsement or modification of the CGL insurance limiting the scope of coverage for liability arising from explosion, collapse, or underground property damage.

Company shall be included as an insured under the CGL policy, using ISO additional insured endorsement CG 20 10 (or a substitute providing equivalent coverage), and under the commercial umbrella insurance. The commercial umbrella insurance shall provide coverage over the top of the CGL insurance, the Business Automobile Liability insurance, and the Employers Liability insurance. The CGL and commercial umbrella insurance to be obtained by or on behalf of Seller shall be endorsed as follows:

Such insurance as afforded by this policy for the benefit of Company shall be primary as respects any claims, losses, damages, expenses, or liabilities arising out of this PPA, and insured hereunder, and any insurance carried by Company shall be excess of and noncontributing with insurance afforded by this policy.

Business Automobile Liability	\$2,000,000 combined single limit (each accident), including all Owned, Non-Owned, Hired and Leased Autos.

Business Automobile Liability insurance shall be written on ISO form CA 00 01, CA 00 05, CA 00 12, CA 00 20, or a substitute form providing equivalent liability coverage. If necessary, the policy shall be endorsed to provide contractual liability coverage equivalent to that provided in the 1990 and later editions of CA 00 01.

Workers Compensation	Statutory Requirements. Seller may comply with these requirements through the use of a qualified self-insurance plan.

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[Exhibit E - continued]

Type of Insurance	Minimum Limits of Coverage

Employers Liability	\$2,000,000 each accident for bodily injury by accident, or \$2,000,000 each employee for bodily injury by disease.

Builder's Risk	Replacement value of the Facility.

Builder's Risk insurance, or an installation floater, shall include coverage for earthquake and flood, collapse, faulty workmanship, materials and design, testing of machinery or equipment, freezing or changes in temperature, debris removal, and partial occupancy.

Environmental Impairment Liability	\$5,000,000 each occurrence.

All-Risk Property insurance covering physical loss or damage to the Facility	Full replacement value of the Facility. A deductible may be carried which deductible shall be the absolute responsibility of Seller.

All-Risk Property insurance shall include: (i) coverage for fire, flood, wind and storm, tornado and earthquake with respect to facilities similar in construction, location and occupancy to the Facility, with sublimits of no less than \$10,000,000 each for flood and earthquake; and (ii) Boiler and Machinery insurance covering all objects customarily subject to such insurance, including boilers and turbines, in an amount equal to their full replacement value.

Business Interruption insurance	Amount required to cover Seller's continuing or increased expenses, resulting from full interruption, for a period of 12 calendar months.

Business Interruption insurance shall cover loss of revenues or the increased expense to resume operations attributable to the Facility by reason of total or partial suspension or delay of, or interruption in, the operation of the Facility as a result of an insured peril covered under Property insurance as set forth above, to the extent available on Commercially Reasonable terms as determined by Company, subject to a Commercially Reasonable deductible that shall be the responsibility of Seller. Notwithstanding any other provision of this PPA, Seller shall not be required to have Business Interruption insurance until the Commercial Operation Date.

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EXHIBIT F - SELLER'S NEEDED PERMITS

[Bid Specific]

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EXHIBIT G - FORM OF LETTER OF CREDIT

[LETTERHEAD OF ISSUING BANK]

Irrevocable Standby Letter of Credit Date of Issuance: _____
No: _____
Beneficiary: Northern States Power Initial Expiration Date: [Must be at least
Company, a [Minnesota or Wisconsin] one year after date of issuance]
corporation Applicant:

As the Issuing Bank ("Issuer"), we, [Name of Issuing Bank], hereby establish this irrevocable Standby Letter of Credit No. _____ (this "Letter of Credit") in favor of the above-named beneficiary ("Beneficiary") for the account of the above-named applicant ("Applicant") in the amount of US\$_____ (_____ Million U.S. Dollars).

Beneficiary may draw all or any portion of this Letter of Credit at any time and from time to time, and Issuer will make funds immediately available to Beneficiary upon presentation of Beneficiary's draft(s) at sight in substantially the form attached hereto as Exhibit "A" ("Sight Draft"), drawn on Issuer and accompanied by this Letter of Credit. All Sight Drafts must be signed on behalf of Beneficiary, and the signator must indicate his or her title or other official capacity. No other documents will be required to be presented. Issuer will effect payment under this Letter of Credit within twenty-four (24) hours after presentment of any Sight Draft. Payment shall be made in U.S. Dollars with Issuer's own funds in immediately available funds.

Issuer will honor any Sight Draft presented in substantial compliance with the terms of this Letter of Credit at the Issuer's letterhead office, the office located at _____ or any other full service office of the Issuer on or before the above-stated expiration date, as such expiration date may be extended hereunder. Partial and multiple draws and presentations are permitted on any number of occasions. Following any partial draw, Issuer will endorse this Letter of Credit and return the original to Beneficiary.

This Letter of Credit is issued pursuant to the provisions of that certain [Wind] [Solar] Energy Purchase Agreement between Beneficiary and Applicant dated as of _____, 20__ (as the same may have been or may be amended from time to time, the "PPA"). Notwithstanding any reference in this Letter of Credit to this PPA or any other documents, instruments or agreements, or references in this PPA or any other documents, instruments or agreements to this Letter of Credit, this Letter of Credit contains the entire agreement between Beneficiary and Issuer relating to the obligations of Issuer hereunder.

This Letter of Credit will be automatically extended each year without amendment for a period of one (1) year from the expiration date hereof, as extended, unless at least thirty (30) days prior to the expiration date, Issuer notifies Beneficiary by registered or certified mail that it elects not to extend this Letter of Credit for such additional period. Notice of

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non-extension will be given by Issuer to Beneficiary at Beneficiary's address set forth herein or at such other address as Beneficiary may designate to Issuer in writing at Issuer's letterhead address.

This Letter of Credit is freely transferable by Beneficiary in whole or in part, and the number of transfers is unlimited. Issuer shall effect any transfers immediately upon presentation to Issuer of this Letter of Credit and a completed written transfer request substantially in the form attached hereto as Exhibit "B." Such transfer will be effected at no cost to Beneficiary. Any transfer fees assessed by Issuer will be payable solely by Applicant, and the payment of any transfer fees will not be a condition to the validity or effectiveness of the transfer of this Letter of Credit.

Issuer waives any rights it may have, at law or otherwise, to subrogate to any claims which Beneficiary may have against Applicant or Applicant may have against Beneficiary.

This Letter of Credit is subject to the uniform customs and practice for documentary credits (2007 Revision), International Chamber of Commerce publication No. 600 (the "UCP"), except to the extent that the terms hereof are inconsistent with the provisions of the UCP, including but not limited to Articles 14(b) and 36 of the UCP, in which case the terms of this Letter of Credit shall govern. With respect to Article 14(b) of the UCP, Issuer shall have a reasonable amount of time, not to exceed three (3) banking days following the date of Issuer's receipt of documents from Beneficiary (to the extent required herein), to examine the documents and determine whether to take up or refuse the documents and to inform Beneficiary accordingly.

In the event of an act of God, riot, civil commotion, insurrection, war or any other cause beyond Issuer's control that interrupts Issuer's business and causes the place for presentation of this Letter of Credit to be closed for business on the last day for presentation, the expiry date of this Letter of Credit will be automatically extended without amendment to a date thirty (30) calendar days after the place for presentation reopens for business.

ISSUER:

By: _____
Authorized Signature

EXHIBIT "A"
TO LETTER OF CREDIT

SIGHT DRAFT

Draft Number _____
\$ _____

At sight, pay to the order of [Name of Beneficiary to be inserted], the amount of
USD \$ _____ (_____ and 00/100ths U.S. Dollars).

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Value received and charged to the account of: [Name of Issuer and address].
Drawn under [Name of Issuer to be inserted] Standby Letter of Credit No.

_____.

Dated: _____

Northern States Power Company,
a [Minnesota or Wisconsin] corporation

By: _____
[name and title]

Account: [Applicant to be inserted]

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EXHIBIT "B"
TO LETTER OF CREDIT

FORM OF TRANSFER REQUEST

Irrevocable Standby Letter of Credit No. _____

Current Beneficiary:

Applicant:

To: [Name of Issuer] ("Issuer")

The undersigned, as the current "Beneficiary" of the above-referenced Letter of Credit, hereby requests that you reissue the Letter of Credit in favor of the transferee named below [insert transferee name and address below]:

From and after the date this transfer request is delivered to Issuer, the transferee shall be the "Beneficiary" under the Letter of Credit for all purposes and shall be entitled to exercise and enjoy all of the rights, privileges and benefits thereof.

Dated: _____

Northern States Power Company,
a [Minnesota or Wisconsin] corporation

By: _____

Name: _____

Title: _____

[Notary Acknowledgement]

To be signed by a person purporting to be an authorized representative of Beneficiary and indicating his or her title or other official capacity and acknowledged by a notary public.

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EXHIBIT H - FORM OF GUARANTY

GUARANTY

This Guaranty is executed and delivered as of this ____ day of _____, 20__ by _____, a _____ [corporation] ("Guarantor"), in favor of Northern States Power Company, a [Minnesota or Wisconsin] corporation ("Company"), in connection with the performance by _____, a _____ [limited liability company] ("Seller") of a [Wind] [Solar] Energy Purchase Agreement dated _____, 20__ between Seller and Company (the "PPA").

- RECITALS -

A. Seller owns and operates a [wind] [solar] power electric generation facility having total Nameplate Capacity of approximately ____ MW located in _____ County, _____ (the "Facility").

B. Seller and Company have entered into this PPA for the purchase and sale of capacity and electrical energy from the Facility on the terms and conditions set forth therein.

C. Seller is controlled by Guarantor. Guarantor expects to derive substantial benefits from the performance of this PPA by Seller and Company. To induce Company to enter into and continue this PPA and to consummate the purchase and sale of electrical energy contemplated by this PPA, Guarantor has agreed to guarantee the obligations of Seller as provided in this Guaranty.

NOW, THEREFORE, in consideration of the foregoing, Guarantor agrees as follows:

- AGREEMENT -

1. Guaranty. Subject to the provisions of this Guaranty, Guarantor hereby absolutely, irrevocably, unconditionally, and fully guarantees to Company the due, prompt, and complete observance, performance, and discharge of each and every payment obligation of Seller under this PPA, whether incurred before or after the date of delivery of this Guaranty (the "Obligations"). This is a guaranty of payment, not of collection, and as such, Company shall not be required to institute, pursue, or exhaust any remedies against Seller before instituting suit, obtaining judgment, and executing thereon against Guarantor under this Guaranty. This Guaranty shall survive termination of this PPA to the extent necessary to enforce and complete the rights, duties and obligations of Company and Seller thereunder.

2. Maximum Liability. Notwithstanding anything herein to the contrary, Guarantor's maximum liability under this Guaranty shall be limited to _____ Dollars (US\$_____) plus costs of collection under Section 10 below.

Northern States Power Company [Wind] [Solar] Energy Purchase Agreement

3. Rights of Company. Guarantor hereby grants to Company, in Company's discretion and without the need to notify or obtain any consent from Guarantor, and without termination, impairment, or any other effect upon Guarantor's duties hereunder, the power and authority from time to time:

(a) to renew, compromise, extend, accelerate, or otherwise change, substitute, supersede, or terminate the terms of performance of any of the Obligations, in each case in accordance with this PPA;

(b) to grant any indulgences, forbearances, and waivers, on one or more occasions, for any length of time, with respect to Seller's performance of any of the Obligations; and

(c) to accept collateral, further guaranties, and/or other security for the Obligations, and, if so accepted, then to impair, exhaust, exchange, enforce, waive, or release any such security.

4. Performance. If any of the Obligations are not performed according to the tenor thereof, and any applicable notice and cure period provided by this PPA has expired ("Default"), Guarantor shall immediately upon receipt of written demand by Company (a) perform or cause Seller to perform the Obligation in Default, and (b) pay, reimburse, and indemnify Company against any liabilities, damages, and related costs (including attorneys' fees) incurred by Company as a result thereof, all in such manner and at such times as Company may reasonably direct.

5. Satisfaction. Satisfaction by Guarantor of any duty hereunder incident to a particular Default or the occurrence of any other Default shall not discharge Guarantor except with respect to the Default satisfied, it being the intent of Guarantor that this Guaranty be continuing until such time as all of the Obligations have irrevocably been discharged in full, at which time this Guaranty shall automatically terminate. If at any time the performance of any Obligation by Seller or Guarantor is rescinded or voided under the U.S. Bankruptcy Code or otherwise, then Guarantor's duties hereunder shall continue and be deemed to have been automatically reinstated, restored, and continued with respect to that Obligation, as though the performance of that Obligation had never occurred, regardless of whether this Guaranty otherwise had terminated or would have been terminated following or as a result of that performance.

6. Notice of Acceptance. Guarantor waives and acknowledges notice of acceptance of this Guaranty by Company.

7. Waivers by Guarantor. Guarantor hereby waives and agrees not to assert or take advantage of:

(a) all set-offs, counterclaims, and, subject to Section 4 above, all presentments, demands for performance, notices of non-performance, protests, and notices of every kind that may be required by Applicable Laws;

(b) any right to require Company to proceed against Seller or any other

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person, or to require Company first to exhaust any remedies against Seller or any other person, before proceeding against Guarantor hereunder;

- (c) any defense based upon an election of remedies by Company;
- (d) any duty of Company to protect or not impair any security for the Obligations;
- (e) the benefit of any laws limiting the liability of a surety;
- (f) any duty of Company to disclose to Guarantor any facts concerning Seller, this PPA or the Facility, or any other circumstances, that would or allegedly would increase the risk to Guarantor under this Guaranty, whether now known or hereafter learned by Company, it being understood that Guarantor is capable of and assumes the responsibility for being and remaining informed as to all such facts and circumstances; and
- (g) until all Obligations in Default have been fully paid and/or performed, any rights of subrogation, contribution, reimbursement, indemnification, or other rights of payment or recovery for any payment or performance by it hereunder. For the avoidance of doubt, if any amount is paid to Guarantor in violation of this provision, such amount shall be held by Guarantor for the benefit of, and promptly paid to, Company.

8. Cumulative Remedies. The rights and remedies of Company hereunder shall be cumulative and not alternative to any other rights, powers, and remedies that Company may have at law, in equity, or under this PPA. The obligations of Guarantor hereunder are independent of those of Seller and shall survive unaffected by the bankruptcy of Seller. Company need not join Seller in any action against Guarantor to preserve its rights set forth herein.

9. Representations and Warranties. Guarantor represents and warrants to Company as follows:

- (a) Guarantor is a corporation, duly organized, validly existing, and in good standing under the laws of the state of its incorporation. Seller is a direct or indirect wholly-owned subsidiary of Guarantor. Guarantor has all necessary corporate power and authority to execute and deliver this Guaranty and to perform its obligations hereunder.
- (b) The execution, delivery and performance of this Guaranty has been duly and validly authorized by all corporate proceedings of Guarantor and is not in violation of any law, judgment of court or government agency. This Guaranty has been duly and validly executed and delivered by Guarantor and constitutes a legal, valid and binding obligation of Guarantor, enforceable against Guarantor in accordance with its terms.

10. Collection Costs. Guarantor shall pay to Company, upon demand, and in addition to the maximum liability set forth in Section 2 hereof, all reasonable attorneys' fees and other expenses which Company may expend or incur in enforcing the

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Obligations against Seller and/or enforcing this Guaranty against Guarantor, whether or not suit is filed, including, without limitation, all attorneys' fees, and other expenses incurred by Company in connection with any insolvency, bankruptcy, reorganization, arrangement, or other similar proceedings involving Seller that in any way affect the exercise by Company of its rights and remedies hereunder.

11. Severability. Should any one or more provisions of this Guaranty be determined to be illegal or unenforceable, all other provisions nevertheless shall be effective.

12. Waiver or Amendment. No provision of this Guaranty or right of Company hereunder can be waived, nor can Guarantor be released from Guarantor's duties hereunder, except by a writing duly executed by Company. This Guaranty may not be modified, amended, revised, revoked, terminated, changed, or varied in any way whatsoever except by the express terms of a writing duly executed by Company.

13. Successors and Assigns. This Guaranty shall inure to the benefit of and bind the successors and assigns of Company and Guarantor.

14. Governing Law. This Guaranty shall be governed by and construed in accordance with the law of the State of [Minnesota or Wisconsin] without regard to the principles of conflicts of law thereof. Venue for any dispute hereunder shall be as set forth in Section 13.5 of this PPA.

15. Notices. All notices, requests, claims, demands, and other communications hereunder shall be in writing and shall be given (and shall be deemed to have been duly given upon receipt) by delivery in the manner contemplated by this PPA, addressed as follows:

(a) if to Company: as provided in this PPA

(b) if to Guarantor: _____

Attn:

with a copy to: _____

Attn:

or to such other address (es) as the person to whom notice is given may have previously furnished to the others in writing in the manner set forth above.

IN WITNESS WHEREOF, Guarantor has caused this Guaranty to be duly executed and delivered to Company as of the day and year first above written.

[Name of Guarantor]

Title:

The foregoing instrument was acknowledged before me this _____ day of _____, 20____, by _____, as _____ of _____.

My commission expires:_____.

Notary Public

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EXHIBIT I - AGC PROTOCOLS; DATA COLLECTION; AVAILABILITY REPORTING

AGC Protocols

1. AGC communications between Company and Seller

Company will receive and send AGC Set-Point and related data over a secure analog or digital line. The data points covered under this PPA, as described below, may overlap data requirements for the Transmission Authority or Company's applicable forecasting group. Latitude and longitude coordinates for the location of the AGC communications at the facility are: [REDACTED].

2. AGC data points to be sent from Seller to Company via SCADA

The following data points will be transmitted via SCADA from Seller to Company and represent Facility level data:

<u>Description</u>	<u>Units</u>
AGC Set-Point (echo)	MW
Actual power	MW
Park Potential	MW
[wind only] Number of turbines online and running	Integer
[solar only] Number of inverters online	Integer
AGC Status	Remote/Local

3. Response times and limitations of Facility in regard to AGC

The following protocols outline the expectations for responding to the AGC Set-Point. Except in the case of the Frequency of Changes, these protocols will be generally bound by the manufacturers' specifications for the equipment that Seller has chosen for the Facility.

- a. Allowable Variances in Excess of AGC Set-Point. Once the Facility has reached the AGC Set-Point, there may be variances in excess of such set-point up to 2% on average as measured during a 10-minute period. This is due to changing [wind] [solar] conditions vs. the manufacturer's specifications for responding to those new conditions.
- b. Allowable Variances in Park Potential. Park Potential must remain within a measured difference of plus or minus 2%, during periods when generation is not curtailed.
- c. Allowable Variances in Other Data Points. All data points transmitted via SCADA from Seller to Company and that represent Facility level data must remain within a measured difference of plus or minus 2%.

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d. Frequency of Changes. Company may send a new AGC Set-Point to the Facility as frequently as the [Wind Turbine] [Solar Inverters] manufacturer specifications allow.

e. Range of AGC Set-Point. The range of set point values can be between 0% and 100% of Park Potential.

4. Backup Communications

In the event of an AGC failure, Company and Seller shall communicate via telephone in order to correct the failure.

[solar]

DATA COLLECTION

Seller shall install at least two (2) meteorological stations, spaced such that all panels of the facility are located within a 5km maximum radius from a station. Each station shall provide the data points set forth below.

One meteorological station must be 10 meters in height and must be located as close to the geographic center of the Facility as possible, unshaded and unblocked by any Solar Panels. This meteorological station must measure wind speed, wind direction, ambient air temperature, back of panel temperature, barometric pressure, direct irradiance and plane of array irradiance.

All other meteorological stations must measure direct irradiance, plane of array irradiance and back panel temperature.

Each inverter shall be capable of transmitting the following data to Company: Inverter generation (kW); and Inverter availability.

At least two months prior to the Commercial Operation Date, Seller shall deliver to Company a report showing (i) manufacturer, model and year of all panels, inverters and meteorological instrumentation, (ii) the latitude and longitude of the center of the solar panels for every inverter and every meteorological station, (iii) the locations, latitude and longitude of each pedestal, so as to allow Company to correlate the data Company receives to each individual station and inverter.

Beginning upon COD, Seller shall transmit and provide to Company from each meteorological station the real-time data set forth above, refreshed as frequently as allowed by the SCADA System, not to exceed sixty (60) second intervals.

Beginning upon COD, Seller shall transmit and provide to Company the following data from each inverter:

Six data points from each Inverter:

1. Inverter generation (kW)
2. Inverter Availability
3. Temperature – Back panel.

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4. Temperature – Inverter (Celsius)
5. Potential Power
6. Power by Pedestal or logical location

The data stream from the meteorological stations to the Company must be transmitted to Company via a dedicated communications link that is separate from the communications link used to transmit the data from the inverters. The data stream must be capable of being transmitted during an outage or any Curtailment and must include battery back-up at the meteorological station and a local source of electricity to power the interconnectivity between the Facility and Company during such outages and Curtailments.

Seller's system used to communicate the Facility's real time panels, inverters, or meteorological data shall be a dedicated communication interface installed on a dedicated Windows-based server, that is separate of the real time AGC data. Such interface shall be either (a) PI-to-PI, (b) OPC, (c) DNP3, (d) Modbus, or (e) such other interface approved by Company.

AVAILABILITY REPORTING REQUIREMENTS

Two (2) Days prior to COD, the availability reporting requirements shall go into effect.

The schedule of available generating capacity at the Facility shall be posted by 4:00 AM Mountain Prevailing Time ("MPT") the Day prior to each Day and shall be applicable thorough the end of such Day. For example, at 4 AM MPT on Monday, an availability schedule is required for Wednesday (midnight to midnight). On Tuesday, the schedule for Thursday, Wednesday the schedule for Friday, and so on. The availability schedule shall be submitted through an availability forecast system as specified by Company to Seller. Prior to the Commercial Operation Date, Company shall provide Seller with the information necessary for Seller to access the chosen availability forecast system.

If any events or circumstances reduce the forecasted availability of the Facility by 10% of Nameplate Capacity or 5 MW, whichever is lesser, such reduction shall be (1) communicated to the real-time operator via telephone with (2) immediate update to the availability schedule in the availability forecast system.

Seller shall pay to Company any charges imposed on the Company by the Market Operator to the extent such charges result from Seller's failure to submit an accurate and/or timely forecast of available generating capacity for the Facility.

EQUIVALENT AVAILABILITY REPORTING FACTOR

During each Commercial Operation Year, Seller shall achieve an Equivalent Availability Reporting Factor of not less than ninety percent (90%).

"Availability Reporting Percentage" means, during any given Outage, the percentage obtained by dividing the available capacity by the Nameplate Capacity of the Facility.

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“Equivalent Availability Reporting Factor” shall be calculated as follows: $(\text{Hours} - \text{Total Equivalent Unreported Unavailable Hours} - \text{Total Equivalent Reported Unavailable Hours}) / (\text{Hours} - \text{Total Equivalent Reported Unavailable Hours})$.

“Equivalent Unavailable Hours” (Reported or Unreported) means, for any Outage, the product of (x) the number of hours during such Outage multiplied by (y) one minus the Availability Reporting Percentage during such Outage.

“Total Equivalent Unreported Unavailable Hours” means the sum of the number of Equivalent Unavailable Hours which are not reported by Seller to Company via the Company’s availability forecast system and by telephone, if applicable, during the applicable month.

“Total Equivalent Reported Unavailable Hours” means the sum of the number of Equivalent Unavailable Hours which are reported by Seller to Company via the Company’s availability forecast system and by telephone, if applicable, during the applicable month.

* * * * *

[wind]

DATA COLLECTION

At least two months prior to the Commercial Operation Date, Seller will deliver to Company a report showing (i) manufacturer, model, and year of all Wind Turbines and meteorological instrumentation and (ii) the latitude, longitude and hub height at every Wind Turbine and meteorological station.

Beginning upon COD, Seller shall transmit and provide to Company the real-time data set forth below, refreshed in approximately four-ten (4-10) second intervals with regard to its generation of Renewable Energy at the Facility:

Six data points from each Wind Turbine:

1. Turbine generation (kW)
2. Wind Speed (meters per second - mps)
3. Turbine Availability (Status)
4. Wind Direction (in degrees relative to true north)
5. Ambient Temperature (Celsius)
6. Park Potential per turbine

In addition to the turbine data points listed above, Seller shall provide the Park Potential for the entire Facility.

Seller shall provide a map and key for each Wind Turbine sufficient to allow Company to correlate the data received through the PI System to each individual Wind Turbine.

In addition to any other requirements for data collection, Seller shall install, maintain

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and operate at least one meteorological station that is installed at hub height and is placed upstream of the prevailing wind path.

Beginning upon COD, Seller shall transmit and provide to Company the real-time data set forth below, refreshed in approximately four-ten (4-10) second intervals with regard to its generation of Renewable Energy at the Facility:

Seven data points from each Meteorological Station:

1. Wind Speed** (mps)
2. Wind Direction** (degrees relative to true north)
3. Temperature (Celsius)
4. Pressure (mb)
5. Air Density (kg/m³)
6. Relative Humidity
7. Present Weather Status/Ice Condition Metering

** = at all metered heights.

A second meteorological station is required to measure barometric pressure, temperature, wind speed and direction. The second meteorological station may be co-located on the primary meteorological station. The height of the second station should be approximately 30 meters below the average hub height.

The data stream from the meteorological stations to the Company's PI System must be transmitted to Company via a dedicated communications link that is separate from the communications link used to transmit the data from the wind turbines. The data stream must be capable of being transmitted during an outage or any Curtailment and must include battery back-up at the meteorological station and a local source of electricity to power the PI System and interconnectivity between the Facility and Company during such outages and Curtailments.

Seller's system used to communicate the Facility's real time panels, inverters, or meteorological data shall be a dedicated communication interface installed on a dedicated Windows-based server, that is separate of the real time AGC data. Such interface shall be either (a) PI to PI, (b) OPC, (c) DNP3, (d) Modbus, or (e) such other interface approved by Company.

AVAILABILITY REPORTING REQUIREMENTS

Two (2) Days prior to COD, the availability reporting requirements shall go into effect.

The schedule of available generating capacity at the Facility shall be posted by 4:00 AM Mountain Prevailing Time ("MPT") the Day prior to each Day, and shall be applicable thorough the end of such Day. For example, at 4 AM MPT on Monday, an availability schedule is required for Wednesday (midnight to midnight). On Tuesday, the schedule for Thursday, Wednesday the schedule for Friday, and so on. The availability schedule shall be submitted through an availability forecast system as specified by Company to Seller. Prior to the Commercial Operation Date, Company shall provide Seller with the

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information necessary for Seller to access the chosen availability forecast system.

If any events or circumstances reduce the forecasted availability of the Facility by ten percent (10%) of Nameplate Capacity or five (5) MW, whichever is lesser, such reduction shall be (1) communicated to the real-time operator via telephone with (2) immediate update to the availability schedule in the availability forecast system coming on-line.

Seller shall pay to Company any charges imposed on Company by the Market Operator to the extent such charges result from Seller's failure submit an accurate and/or timely forecast of available generating capacity for the Facility.

EQUIVALENT AVAILABILITY REPORTING FACTOR

During each Commercial Operation Year, Seller shall achieve an Equivalent Availability Reporting Factor of not less than ninety percent (90%).

"Availability Reporting Percentage" means, during any given Outage, the percentage obtained by dividing the available capacity by the Nameplate Capacity of the Facility.

"Equivalent Availability Reporting Factor" shall be calculated as follows: $(\text{Hours} - \text{Total Equivalent Unreported Unavailable Hours} - \text{Total Equivalent Reported Unavailable Hours}) / (\text{Hours} - \text{Total Equivalent Reported Unavailable Hours})$.

"Equivalent Unavailable Hours" (Reported or Unreported) means, for any Outage, the product of (x) the number of hours during such Outage multiplied by (y) one minus the Availability Reporting Percentage during such Outage.

"Total Equivalent Unreported Unavailable Hours" means the sum of the number of Equivalent Unavailable Hours which are not reported by Seller to Company via the Company's availability forecast system and by telephone, if applicable, during the applicable month.

"Total Equivalent Reported Unavailable Hours" means the sum of the number of Equivalent Unavailable Hours which are reported by Seller to Company via the Company's availability forecast system and by telephone, if applicable, during the applicable month.

* * * * *

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EXHIBIT J - RENEWABLE ENERGY PAYMENT RATE; COMMITTED ENERGY

[The “Committed Energy” values in Exhibit J shall be the P50 value as set forth in Seller’s bid.]

This entire Exhibit shall be deemed Confidential Information subject to Section 20.18.

Commercial Operation Year	Renewable Energy Payment Rate (\$/MWh)	Committed Energy (MWh)	Commercial Operation Year	Renewable Energy Payment Rate (\$/MWh)	Committed Energy (MWh)
1	\$ _____	_____	14	\$ _____	_____
2	\$ _____	_____	15	\$ _____	_____
3	\$ _____	_____	16	\$ _____	_____
4	\$ _____	_____	17	\$ _____	_____
5	\$ _____	_____	18	\$ _____	_____
6	\$ _____	_____	19	\$ _____	_____
7	\$ _____	_____	20	\$ _____	_____
8	\$ _____	_____	21	\$ _____	_____
9	\$ _____	_____	22	\$ _____	_____
10	\$ _____	_____	23	\$ _____	_____
11	\$ _____	_____	24	\$ _____	_____
12	\$ _____	_____	25	\$ _____	_____
13	\$ _____	_____			

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EXHIBIT K - LENDER CONSENT PROVISIONS

In the event Seller collaterally assigns its rights hereunder to a Facility Lender as security, any related Lender Consent will contain provisions substantially as follows:

1. Seller and Company will neither modify nor terminate this PPA in any material respect, without the prior written consent of the Facility Lender.
2. The Facility Lender shall have the right, but no obligation, to do any act required to be performed by Seller under this PPA, and any such act performed by the Facility Lender shall be as effective to prevent or cure a default as if done by Seller itself.
3. If Company becomes entitled to terminate this PPA due to an Event of Default by Seller, Company shall not terminate this PPA unless it has first given notice of such Event of Default to the Facility Lender and has given the Facility Lender the same cure period afforded to Seller under Article 12 - of this PPA, plus an additional thirty (30) Days beyond Seller's cure period to cure such Event of Default; *provided*, that the total cure period shall in no event exceed one-hundred eighty (180) Days. If the Facility Lender requires possession of the Facility in order to cure the Event of Default, and if the Facility Lender diligently seeks possession, the Facility Lender's additional thirty (30)-Day cure period shall not begin until foreclosure is completed, a receiver is appointed, any bankruptcy stay is removed, or possession is otherwise obtained by or on behalf of the Facility Lender.
4. The Facility Lender shall provide to Company a copy of any notices of default and/or intent to exercise remedies delivered to Seller under the Financing Documents.
5. Upon any foreclosure, deed-in-lieu or other exercise of the rights and remedies of the Facility Lender that results in a successor owner or operator of the Facility, the Facility Lender shall require and cause the successor (i) to assume all of Seller's prospective obligations under this PPA, (ii) to cure any then-existing defaults by Seller that are capable of cure by performance or the payment of money damages, (iii) to have substantial experience in the operation of power generation facilities akin to the Facility, either directly, through its Affiliates or through an operator acceptable to Company, and (iv) to enjoy (together with its parents and Affiliates) an Investment Grade Credit Rating or other creditworthiness satisfactory to Company. Except for the foregoing, the Facility Lender shall not be obligated to perform or be liable for any obligation of Seller under this PPA.
6. Upon any rejection or other termination of this PPA in connection with any bankruptcy or insolvency of Seller, the Facility Lender (or its successor) and Company shall enter into a new power purchase agreement on the same terms and conditions as this PPA and for the period that would have been remaining under this PPA but for such termination.

* * * * *

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EXHIBIT L-1 - EQUITY PURCHASE PRICE FORMULA

The “Equity Purchase Price” shall be determined in a manner substantially similar to the determination of the Purchase Price in Section 19.5(G), modified as required to take into account the structure of the sale as an equity purchase.

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EXHIBIT L-2 - PSA PROVISIONS

Any PSA executed to implement exercise of Company's ROFO or Option rights will include provisions substantially as follows:

Type of Transaction

The transaction will be structured as an asset acquisition. Company ("Buyer") shall purchase and Seller shall sell 100% of the assets ("Assets") of a completed, commercially operational, integrated [wind-powered]/solar-powered electricity generating plant with Nameplate Capacity of [XX] MW [solar AC] and all facilities [including energy storage facilities] and all other assets and rights relating to the project including any permits or other instruments necessary to operate and maintain the plant as designed and constructed (the "Project"), free and clear of all encumbrances and liabilities, except for permitted encumbrances and assumed liabilities as defined in the PSA.

Purchase Price and Payment Terms

Buyer shall pay Seller the "Purchase Price," which is determined pursuant to Section 19.5(C) of this PPA.

Buyer shall be entitled to withhold from the payment of the Purchase Price a total amount not to exceed 20% of the Purchase Price in the event of certain breaches of Seller's representations, warranties or covenants pending Seller's cure of any such breach, with Buyer's aggregate holdback amount not to exceed 20% of the Purchase Price.

Seller shall be responsible for all taxes relating to the pre-closing period and all transfer taxes and any sales, use or other taxes related to the purchase and sale of the Assets and any purchase or conveyance of real or personal property to be used in the Project.

Seller's Closing Deliverables:

Upon the terms and conditions to be defined within the PSA, the obligations of Buyer to consummate the transactions contemplated are subject to the satisfaction by Seller of certain closing conditions, including:

- Transfer of all of the Assets of the Project, which include all rights and title to assets necessary for the commercial operation of the Project, to Buyer or its designated Affiliate.
- An opinion of legal counsel that each material discretionary permit required for the Project has been obtained and is valid, binding, in full force and effect and non-appealable.
- Evidence that any liens on the Project, real property or any other assets or interests of the Project have been removed as of the closing other than permitted liens which have been scheduled or liens which have been scheduled and bonded to Buyer's reasonable satisfaction.
- Certain conditions do not exist at the time of closing including, but not limited to, the existence of a material adverse effect. A material adverse effect would be

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defined in the PSA and would include, in addition to other terms, a change in tax law that could have a negative impact on Buyer's business or the economic viability of the Project.

- All certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Seller pertaining to the closing.

Buyer's Closing Deliverables:

Upon the terms and conditions to be defined within the PSA, the obligations of Seller to consummate the transactions contemplated are subject to the satisfaction by Buyer of certain closing conditions, including:

- Delivery of the Purchase Price.
- All certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Buyer pertaining to the closing.

Required Approvals:

The transaction is subject to obtaining specified approvals, authorizations, or orders, including but not limited to the following (to the extent necessary):

- Approval of the board of directors of Buyer and the board of directors or similar governing body of Seller shall be obtained prior to execution of the PSA.
- Third party consents.
- Applicable governmental and regulatory approvals prior to closing, including to the extent necessary, any applicable state agencies or commissions regulating utility activities and any government agencies having approval, consent or authority over the transactions contemplated by the PSA, including but not limited to MPUC, NDPSC, the IRS, the FERC, the Department of Justice, the US Fish and Wildlife Service and the FAA.

Representations and Warranties

The transaction is subject to customary representations and warranties to be made by Buyer and Seller as of the execution date or the effective date of the PSA and the closing thereunder, including the following:

- Corporate existence and powers – Seller is a limited liability company validly existing and in good standing and has the power and authority to conduct its business as now conducted.
- Authority (execution and delivery)
- No conflicts - the transaction does not create any conflicts.
- Consents and approvals – no consent, approval or authorization is required in connection with the execution and performance of the PSA.
- Legal proceedings of Buyer– there are no legal proceedings pending, or to Buyer's knowledge, threatened in writing, against Buyer, that affect the consummation of the transaction contemplated by the PSA.

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- Legal proceedings of Seller and the Project – there are no legal proceedings pending, or to Seller’s knowledge, threatened in writing, against the Seller or the Project or affecting Seller’s ability to sell the Project.
- Sufficient funds – Buyer has available, or will maintain sufficient sources of, funds to complete the transaction.
- Compliance with Laws – Seller is in compliance with all laws applicable to the Seller, Project and the transactions contemplated by the PSA.
- Environmental – Seller and its Affiliates have no environmental liabilities and are in compliance with environmental requirements. Seller and its Affiliates have not received any notice of an alleged violation of environmental law pertaining to the Project from any governmental entity. There are no facts, circumstances, conditions or occurrences relating to the Project that could reasonably be expected to form the basis of a claim, requirement or obligation imposed by any governmental entity under any environmental law on Seller or its Affiliates.
- Contracts – Schedule of material contracts binding on the Seller or to which the Project is subject, and Seller has furnished to Buyer true, correct and complete copies of all material contracts. Each scheduled contract, including but not limited to the Generator Interconnection Agreement, is in full force and effect and neither Seller nor the Project is in material violation or default under such contracts.
- Land Contracts – The land contracts and real property owned by the Project are in full force and effect, and shall comprise all of the real property interests necessary in connection with the interconnection, operation and maintenance of the Project, all in accordance with all laws, and are sufficient to enable the Project to be commercially operable as contemplated in the PSA, including legal and physical ingress and egress rights to and from public right-of-way for operation, and maintenance of the Project.
- Data – Seller has delivered to Buyer true, correct and complete copies of all [wind/solar] data related to the Project.
- Permits - All permits required to own, operate and maintain the Project are held by Seller or an Affiliate, are final and non-appealable, are scheduled, and Seller has obtained and furnished to Buyer true, correct and complete copies of such permits. Such permits are in full force and effect and are legal, valid, binding and enforceable in accordance with their respective terms.
- Title – Seller or an Affiliate is in possession of and has good and marketable title to the Project free and clear of all encumbrances, except for permitted encumbrances. Seller and its Affiliates have no legal obligation or non-binding agreement in principle with any other person to sell or affect a sale of all, or any portion of, the Project.
- Other representation and warranties customary in a transaction of this nature, including those pertaining to taxes, title, finders, intellectual property, brokers and insurance.

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Termination Provisions

The PSA may be terminated prior to the closing upon written notice by the terminating party (as described below) in the event of certain occurrences, including:

- By either party, in the event the closing has not occurred by a date to be negotiated, regardless of the reason for such termination, provided that the terminating party is not in breach of the PSA.
- By either party in the event regulatory approvals for the transaction are not obtained on terms reasonably acceptable to Buyer.
- By Buyer in the event any authority has issued an order or taken any other action that restrains, enjoins, or otherwise prohibits the consummation of the transactions contemplated by the PSA, and such order or action is nonappealable.
- By Buyer in the event of material breach of the PSA by Seller.
- Security: Seller shall fund and maintain security in favor of Buyer, or a parent guaranty acceptable to Buyer, to secure Seller's obligations under the PSA including the indemnification provision below.

Indemnification

Each party shall indemnify and hold harmless the other party and its respective employees, representatives, officers, directors and agents from and against any and all damages arising out of the result of any breach or violation of any representation, warranty, covenant, inaccuracy within the PSA, or any liability not assumed as part of the PSA, or any fraud, willful misconduct, or negligence in performance of this PSA. Seller shall indemnify Buyer for any environmental (including hazardous material) claims arising prior to the closing date other than environmental claims resulting from Buyer's negligence. No claim for indemnification shall be brought against the Indemnifying Party until the total damages for which such party is liable exceeds in the aggregate a threshold amount to be negotiated, at which point indemnification may be sought for the full aggregate amount of damages, including those amounts that do not exceed the threshold. The aggregate damages to which the Indemnified Parties are entitled shall not exceed the indemnity cap, which shall be at least 30% of the purchase price. Such threshold and indemnity cap shall not apply to damages to the extent they arise from a breach of covenants required to be performed after the closing or from breach of certain "fundamental" representations (as applicable to each party) such as corporate existence, power, authority, conflicts, title, land contracts, real property, environmental, intellectual property or tax matters and shall not apply to liabilities arising prior to the closing date, which shall be the responsibility of Seller.

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EXHIBIT L-3- MIPS A PROVISIONS

Any MIPS A executed to implement exercise of Company's ROFO or Option rights will include provisions substantially as follows:

Type of Transaction

The transaction will be structured as an entity acquisition. Company ("Buyer") shall purchase and Seller shall sell 100% of its direct and indirect equity ownership interests of the project company ("Project Company") (including, if applicable, Seller's (or its Affiliates) direct and indirect equity ownership interest in any tax equity partnership (the "TE Partnership") that owns, directly or indirectly, equity ownership interests of the Project Company, together, the "Equity Interests"), which owns a completed, commercially operational, integrated [wind-powered]/solar-powered electricity generating plant with Nameplate Capacity of [XX] MW AC and all facilities [including energy storage facilities] and all other assets and rights relating to the project including any permits or other instruments necessary to operate and maintain the plant as designed and constructed (the "Project"), free and clear of all encumbrances and liabilities, except for permitted encumbrances and assumed liabilities as defined in the PSA.

Purchase Price and Payment Terms

Buyer shall pay Seller the "Purchase Price," which is determined pursuant to Section 19.5(C) of this PPA.

Buyer shall be entitled to withhold from the payment of the Purchase Price a total amount not to exceed 20% of the Purchase Price in the event of certain breaches of Seller's representations, warranties or covenants pending Seller's cure of any such breach.

Seller shall be responsible for all taxes relating to the pre-closing period and all transfer taxes and any sales, use or other taxes related to the purchase and sale of the Equity Interests and any purchase or conveyance of real or personal property to the Project Company to be used in the Project.

Seller's Closing Deliverables:

Upon the terms and conditions to be defined within the PSA, the obligations of Buyer to consummate the transactions contemplated are subject to the satisfaction by Seller of certain closing conditions, including:

- Transfer of the Equity Interests, which include all rights and title to assets necessary for the commercial operation of the Project, to Buyer or its designated Affiliate.
- An opinion of legal counsel that each material discretionary permit required for the Project has been obtained and is valid, binding, in full force and effect and non-appealable.
- Evidence that any liens on the Equity Interests, Project Company, Project, real

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property or any other assets or interests of the Project Company have been removed as of the closing other than permitted liens which have been scheduled or liens which have been scheduled and bonded to Buyer's reasonable satisfaction.

- Certain conditions do not exist at the time of closing including, but not limited to, the existence of a material adverse effect. A material adverse effect would be defined in the PSA and would include, in addition to other terms, a change in tax law that could have a negative impact on Buyer's business, the Equity Interests, or the economic viability of the Project.
- All certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Seller pertaining to the closing.

Buyer's Closing Deliverables:

Upon the terms and conditions to be defined within the PSA, the obligations of Seller to consummate the transactions contemplated are subject to the satisfaction by Buyer of certain closing conditions, including:

- Delivery of the Purchase Price.
- All certifications, affidavits, approvals and permits required to demonstrate satisfaction of all representations, warranties, and covenants made by Buyer pertaining to the closing.

Required Approvals:

The transaction is subject to obtaining specified approvals, authorizations, or orders, including but not limited to the following (to the extent necessary):

- Approval of the board of directors of Buyer and the board of directors or similar governing body of Seller shall be obtained prior to execution of the PSA.
- Third party consents.
- Applicable governmental and regulatory approvals prior to closing, including to the extent necessary, any applicable state agencies or commissions regulating utility activities and any government agencies having approval, consent or authority over the transactions contemplated by the PSA, including the MPUC, the NDPSC, the IRS, the FERC, the Department of Justice, the US Fish and Wildlife Service and the FAA.

Representations and Warranties

The transaction is subject to customary representations and warranties to be made by Buyer and Seller as of the execution date or the effective date of the PSA and the closing thereunder, including the following:

- Corporate existence and powers – Seller is a [corporation] validly existing and in good standing and has the power and authority to conduct its business as now conducted.

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- Project Company existence and powers – the Project Company is a limited liability company validly existing and in good standing and has the power and authority to operate and own the Project and has been engaged in no other business since its formation.
- (If applicable) The TE Partnership existence and powers – the TE Partnership is a limited liability company validly existing and in good standing and has the power and authority to own and manage the Project Company and the Project and has been engaged in no other business since its formation.
- Authority (execution and delivery)
- No conflicts - the transaction does not create any conflicts.
- Consents and approvals – no consent, approval or authorization is required in connection with the execution and performance of the PSA.
- Legal proceedings of Buyer– there are no legal proceedings pending, or to Buyer's knowledge, threatened in writing, against Buyer, that affect the consummation of the transaction contemplated by the PSA.
- Legal proceedings of Seller, TE Partnership (if applicable) and Project Company – there are no legal proceedings pending, or to Seller's knowledge, threatened in writing, against the Seller relating to the Project or affecting Seller's ability to sell the Equity Interests and there are no legal proceedings pending, or to Seller's knowledge, threatened in writing, against the Project Company or the TE Partnership (if applicable).
- Sufficient funds – Buyer has available, or will maintain sufficient sources of, funds to complete the transaction.
- Compliance with Laws – Seller, the TE Partnership (if applicable) and the Project Company are in compliance with all laws applicable to such entity and the transactions contemplated by the PSA.
- Environmental – Seller, the TE Partnership (if applicable), the Project Company and their respective Affiliates have no environmental liabilities (solely in the case of Seller relating to the Project) and are in compliance with environmental requirements (solely in the case of Seller relating to the Project). Seller and its Affiliates (including the TE Partnership, if applicable, and the Project Company) have not received any notice of an alleged violation of environmental law pertaining to the Project from any governmental entity. There are no facts, circumstances, conditions or occurrences relating to the Project, the TE Partnership, if applicable, or the Project Company that could reasonably be expected to form the basis of a claim, requirement or obligation imposed by any governmental entity under any environmental law on Seller or its Affiliates (including the TE Partnership, if applicable, and the Project Company) or Buyer.
- Contracts – Schedule of material contracts binding on the (x) Seller relating to the TE Partnership, if applicable, the Project Company or the Project), (y) TE Partnership, if applicable, the Project Company or the Project, or the assets of any of the TE Partnership, if applicable, or the Project Company, has been

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provided and Seller has furnished to Buyer true, correct and complete copies of all such contracts. Each scheduled contract, including but not limited to the Generator Interconnection Agreement, is in full force and effect and neither Seller, the TE Partnership, if applicable, nor the Project Company, nor to the knowledge of Seller any other counterparty thereto, is in material violation or default under such contracts.

- Land Contracts – The land contracts and real property owned by the Project Company are in full force and effect, and shall comprise all of the real property interests necessary in connection with the interconnection operation and maintenance of the Project, all in accordance with all laws, and are sufficient to enable the Project to be commercially operable as contemplated in the PSA, including legal and physical ingress and egress rights to and from public right-of-way for operation, and maintenance of the Project.
- Data – Seller has delivered to Buyer true, correct and complete copies of all [wind/solar] data related to the Project.
- Permits - All permits required to own, operate and maintain the Project are held by the Project Company, are scheduled, and Seller has obtained and furnished to Buyer true, correct and complete copies of such permits. Such permits are non-appealable, in full force and effect and are legal, valid, binding and enforceable in accordance with their respective terms.
- Title – The Project Company is in possession of and has good and marketable title to the Project free and clear of all encumbrances, except for permitted encumbrances. Seller has good and marketable title to the Project Company's equity interests, free and clear of all encumbrances. Seller and its Affiliates have no legal obligation or non-binding agreement in principle with any other person to sell or affect a sale of all, or any portion of, the Project or the Project Company.
- Other representation and warranties customary in a transaction of this nature, including those pertaining to taxes, title, finders, intellectual property, brokers and insurance.

Termination Provisions

The PSA may be terminated prior to the closing upon written notice by the terminating party (as described below) in the event of certain occurrences, including:

- By either party, in the event the closing has not occurred by a date to be negotiated, regardless of the reason for such termination, provided that the terminating party is not in breach of the PSA.
- By either party in the event regulatory approvals for the transaction are not obtained on terms reasonably acceptable to Buyer.
- By Buyer in the event any authority has issued an order or taken any other action that restrains, enjoins, or otherwise prohibits the consummation of the transactions contemplated by the PSA, and such order or action is nonappealable.
- By Buyer in the event of material breach of the PSA by Seller.
- Security: Seller shall fund and maintain security in favor of Buyer, or a parent guaranty acceptable to Buyer, to secure Seller's obligations under the PSA including the indemnification provision below.

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Indemnification

Each party shall indemnify and hold harmless the other party and its respective employees, representatives, officers, directors and agents from and against any and all damages arising out of the result of any breach or violation of any representation, warranty, covenant, inaccuracy within the PSA, or any liability not assumed as part of the PSA, or any fraud, willful misconduct, or negligence in performance of this PSA. Seller shall indemnify Buyer for any environmental (including hazardous material) claims arising prior to the closing date other than environmental claims resulting from Buyer's negligence. No claim for indemnification shall be brought against the Indemnifying Party until the total damages for which such party is liable exceeds in the aggregate a threshold amount to be negotiated, at which point indemnification may be sought for the full aggregate amount of damages, including those amounts that do not exceed the threshold. The aggregate damages to which the Indemnified Parties are entitled shall not exceed the indemnity cap, which shall be at least 30% of the purchase price. Such threshold and indemnity cap shall not apply to damages to the extent they arise from a breach of covenants required to be performed after the closing or from breach of certain "fundamental" representations (as applicable to each party) such as corporate existence, power, authority, conflicts, title, land contracts, real property, environmental, intellectual property or tax matters and shall not apply to liabilities arising prior to the closing date, which shall be the responsibility of Seller.

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EXHIBIT M - METHODOLOGY FOR ADJUSTING COMMITTED ENERGY

To determine whether a default by Seller has occurred under Section 12.1(A)insert references or an Energy Payment Reduction should be imposed under Section 8.4, Committed Energy shall be adjusted as follows:

A. Periods when the Facility is incapacitated in whole or in part due to Force Majeure shall be excluded from the calculation of Committed Energy. Seller Excuse Hours shall also be excluded from the calculation of Committed Energy. The Committed Energy required from Seller for such Commercial Operation Year shall be reduced by the quantity of MWhs that Seller can demonstrate, to Company's reasonable satisfaction, was specifically attributable to such Force Majeure or Seller Excuse Hours. Such quantity shall be calculated using Commercially Reasonable methods using measurable inputs at an hourly minimum granularity. For the avoidance of doubt, for any periods when metering or measuring equipment at the Site affecting such inputs is inoperable or mis-calibrated, for purposes of determining a default by Seller under Section 12.1(A), Parties shall exclude such data from the calculation unless agreed to otherwise by the Company.

B. The Committed Energy required from Seller for such Commercial Operation Year shall be reduced by the quantity of MWhs that Seller can demonstrate to Company's reasonable satisfaction was curtailed pursuant to Sections 8.3(A) 1. through 4.

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EXHIBIT N - SAFETY REQUIREMENTS

Seller shall design and construct the Facility in compliance with all Applicable Laws and shall ensure the Facility is operated in compliance with Good Utility Practices. Seller shall identify codes and standards that are applicable to the design of the Facility and ensure that upon substantial completion the Facility meets applicable codes and standards. [Technology specific codes and standards.] Seller shall design, construct, and install the Facility under the guidance of [insert code] and shall comply with all applicable portions of that standard. Seller is solely responsible for maintaining the Facility in compliance with all Applicable Laws. Seller will provide Company with an independent registered professional engineer's certification stating that the Facility has been completed in all material respects (including compliance with all Applicable Laws) prior to COD.

Prior to COD, Seller will provide documentation submitted as part of the permitting process and, if not otherwise submitted as part of such permitting process, the following additional documents:

1. Operations and maintenance documentation, including an operations manual and maintenance manual, and schedule for planned maintenance;
2. Safety procedures for personnel (may be included within the operations or maintenance manual), and supplier safety manual;
Training materials for local first responders, identifying known hazards and failure modes, and methods for approach and action, if appropriate;
3. Emergency management plan, including instructions on how to interpret alarms and faults, location of emergency stops, egress pathways, known hazards, and emergency contact information for a subject matter expert who can be available on site within 2 hours; and

System drawings and documentation, including all physical, electrical, mechanical, and communications diagrams for all Facility sub-components, to allow for confirmation of claimed safety features including but not limited to, respectively, sufficient spacing, security, and signage; appropriate electrical ratings, grounding, and interconnections; foundations and construction materials; awareness of system operation and alarms; and fault ranges and emergency stops, but excluding any vendor proprietary drawings. As applicable, certifications for all claimed standards compliance should be provided.

EXHIBIT O - METER AND COMMUNICATIONS REQUIREMENTS

These meter requirements shall apply to all Electric Metering Devices.

- Electric Metering Devices shall meet requirements set forth in American National Standards Institute (ANSI) C12.1 and 12.20. Current transformers and voltage transformers supplying this meter should meet requirements of IEEE/ANSI C57.13 and ANSI C57.13.6. In addition to meeting these requirements the current transformers should be high accuracy extended range transformers with at least 0.15% accuracy from 1% to full rating factor, and high voltage transformers should be at least 0.3% accuracy from 90% to 110% of rated voltage. Prior to the purchase of Electric Metering Devices, current transformers and potential transformers and associated communication equipment, Seller must submit relevant information such that Company can review and verify that the equipment meets Company requirements. For Company-owned meters, potential transformers will utilize nominal secondary voltages of 115 volts or 120 volts. Backup meters may utilize current transformers with a lower accuracy class than 0.15% upon mutual agreement of the Parties.
- No later than ninety (90) Days prior to generating any Test Energy, Seller shall provide to Company in mutually agreeable format all necessary specifications related to the Electric Metering Devices and/or communication therewith including, but not limited to, the make, model, port configuration, connection assignments, electronic security definitions, firewall definitions, and physical locations.
- Company may inspect and verify that the equipment was approved and properly installed. In addition, Company may elect to test the Electric Metering devices for accuracy, current transformers and potential transformers and verify that the communication circuits to Company are operational.
- Upon prior written notice, sufficiently in advance, Company shall have the right to make requests in regard to reasonable modifications to Seller's metering equipment and configurations in order to ensure accurate telemetering and communication.
- Company shall have the right to install any telemetering and communication equipment Company deems reasonably necessary for purposes related to this PPA. Seller shall, upon prior written notice sufficiently in advance, cooperate with any such installation.
- Electric Metering Devices shall be programmed to, at any time of remote electronic communications and access, provide a time and date stamp of downloaded delivery information.
- Electric Metering Devices shall be programmed to, at any time of manual read of the meter's display, provide the time and date of the information gathered. The Seller shall provide the communication channels for the Company's remote

terminal unit and the Company's Itron Enterprise Edition Meter Data Management Agent. The implementation of these communication paths and RTU shall follow Company's latest standard. The Seller must have these communication paths installed, tested, and functional prior to generating Test Energy.

- Company shall have the right, via read-only access, and upon prior reasonable written notice to Seller, to independently audit Seller's meters and any records pertaining to the amount of energy generated by the Facility and any associated losses. Any audit shall be performed at the Facility or if applicable, other location within the same state as the Facility which is mutually agreed upon by both Company and Seller. Records related to such audits, inspections, testing or adjustments shall be maintained and subject to audit by Company for a period of twenty (24) months. Company shall further have the right to request and receive in physical or electronic form any and all records or data files related to such audits, inspections, testing or adjustments.
- Seller shall provide secure and reliable communication from the Electric Metering Devices as follows:
 - Distributed Network Protocol ("DNP") output from the meter to Company's EMCC via a remote terminal unit located near the Electric Metering Devices and hardwired from the meter to the remote terminal unit.
 - Time stamped meter register and interval data from the meter to Company's Itron Enterprise Edition Meter Data Management Agent with servers located in [*insert current service location*] [or] [Denver, CO] or successive data software package and servicer as Company defines. Electric Metering Devices must have an Itron approved Translation Interface Module to facilitate correct data transmission over this communication path.
 - Prior to generating Test Energy, Seller shall provide to Company one-line electrical drawings of the Facility showing the electrical location of the Electric Metering Devices for Company's review and approval.

EXHIBIT A.1
SCOPE OF WORK: SOLAR, WIND, BESS

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EXHIBIT A.1
SCOPE OF WORK: SOLAR, WIND, BESS

1.0 EXHIBIT INFORMATION

1.1 Purpose

1.1.1 Without limiting the information summarized herein, the purpose of this document is (a) to summarize the minimum scope of work requirements for Contractor, which generally include the development, engineering, procurement, and construction of the generation and balance-of-plant infrastructure for the Project, as well as the installation; and (b) to summarize the minimum performance specifications, quality standards, and other criteria required for the engineering, procurement, and construction of the Project.

1.2 Project Description

1.2.1 The [Project Name] may be a solar photovoltaic, wind, Battery Energy Storage System (“BESS”), or any combination of these technologies thereof. Definitions of what constitutes the Project for each technology are provided below. If the proposed project is a combination of one or more of the technologies below, the Project definition will include the Project components listed for each included technology below.

1.2.2 Solar Projects: The Project includes the solar PV array, inverters, access roads, 34.5 kV energy collection system, collection substation, and interconnection line to the POI.

(1) For the purposes of initial project evaluation in Docket , PV array is to be designed based upon a DC to AC ratio of 1.3 (Array DC MW capacity rating / AC MW capacity rating at the POI = 1.3). If project is approved, Contractor is to work with Owner to optimize the final DC to AC ratio to achieve the Lowest Cost of Energy (LCOE) for the Project during the design phase of the project.

1.2.3 Wind Projects: The Project includes the wind turbines, access roads, the Aircraft Detection Lighting System (ADLS), and 34.5 kV energy collection system, collection substation, and interconnection line to the POI.

1.2.4 Battery Energy Storage System: The BESS is capable of being charged from the transmission grid and provides stored energy to the transmission grid. The Project includes the batteries, battery enclosures, Power Conversion System, Energy Management System (EMS), 34.5 kV energy collection system, collection substation, and interconnection line to the POI.

1.2.5 For Photovoltaic solar power generation Project(s) that include Battery Energy Storage Systems (BESS), the BESS is to be capable of being charged from either the PV solar array or the transmission grid.

(1) Contractor to consider the BESS operational requirements as identified in Table 13-1 (Minimum Battery Operational Requirements) and Table 13-3 (Minimum PCS Functional Specifications) in its alternate design option. Contractor to include the technical details for the alternate design such as: the DC Array rating; DC to AC ratio; type and quantity of inverters; etc. Contractor is to work with Owner to optimize the final DC to AC ratio to achieve the Lowest Cost of Energy (LCOE) for the Project during the design phase of the project.

1.2.6 For wind power generation Project(s) that include Battery Energy Storage Systems (BESS), the BESS is to be capable of being charged from either the wind power generation or the transmission grid.

- (1) Contractor to consider the BESS operational requirements as identified in Table 13-1 (Minimum Battery Operational Requirements) and Table 13-3 (Minimum PCS Functional Specifications) in its design.

1.2.7 Contractor to provide/perform all land use permitting, construction permitting, right-of-way permitting, land subdivisions (if necessary), interconnection agreement, engineering, labor, procurement of materials and equipment, and supervision required for the complete design and installation of a fully functional, and operational renewable power generation facility that is in full compliance with Company's requirements, applicable codes, standards, laws and regulations. The contractor shall enter into a Project Labor Agreement (PLA) with local unions capable of performing quality work on the project. The described facility, as further detailed in this specification, shall be designed for a 35-year operating life, unless explicitly stated otherwise, based on normal operation, and the performance of maintenance, repairs, and the replacement of parts according to manufacturers' recommendations and standard industry practices.

1.3 References

1.3.1 In addition to anything summarized herein, all Work related to the Project shall conform to the latest version of the following Owner standards as included in Exhibit E.2 (Owner Specifications):

- (1) EEC 7.970W01 Drawing Deliverables Standard
- (2) NSP Title Block Standard
- (3) XEL-POL-Facility Rating Methodology
- (4) EPR 5.200 – Facility Rating and Reporting Policy
- (5) EPR 5.201S – Stability Modeling Data Maintenance and Reporting Requirements
- (6) EPR 5.202S – NERC Protection Systems Coordination Relay Setting Reporting Requirements
- (7) EPR 5.220P01 – Facility Rating Methodology
- (8) EPR 5.704S – Battery Maintenance Standard
- (9) EPR 5.714S – Protective Relay
- (10) EPR 4.200 – Plant Process Network Security Policy

1.3.2 This exhibit shall also be used in conjunction with the documents in Exhibit D.3 (Preliminary Design Documents), which shall be used as the basis for developing quantities for the Proposal. The specifications provided herein and the documents in Exhibit D.3 (Preliminary Design Documents) are intended to supplement, but not necessarily duplicate, each other; any Work exhibited in one and not in the other shall be executed as if it had been set forth in both. In the event of any conflicts between the information in Exhibit D.3 (Preliminary Design Documents) or this exhibit, the more stringent requirement shall prevail.

1.3.3 As noted in Section TBD of the Agreement, the Contract Price is understood to be firm, fixed, and provided on a lump sum basis, inclusive of all labor, equipment, materials, services, taxes, fees, indirect costs, and other similar items required to complete the Work. In the event the Work indicated or specified herein is increased or decreased, which shall occur at Owner's sole discretion and direction, the Contract Price shall be adjusted in accordance with the unit rates set forth in Exhibit TBD (*Exhibit Name*) to the Agreement. For the avoidance of doubt, deviations in quantities shall not constitute a Change Order unless dictated by Owner, such as through a Wind Turbine location change, and only deviations in linear quantities (e.g., Site Access Road length, collection system length) shall be included in such Change Order; all other changes shall be at Contractor's sole risk and reflected in the Contract Price.

1.4 Definitions

1.4.1 Unless defined in this exhibit, terms that begin with an upper case shall have the meaning defined in the Agreement.

1.4.2 For purposes of only this exhibit, the following words shall have the respective meanings set forth below.

- (1) “**AC**” or “**ac**” shall mean alternating current.
- (2) “**AC Rated Plant Capacity at the POI**” shall equal the total net export capability at the Point of Interconnection as defined by the Interconnection Agreement.
- (3) “**AC System Losses**” shall mean the resistance losses (I^2R) through the AC cabling and magnetization and winding losses associated with the inverter step-up transformers and is exclusive of auxiliary loads.
- (4) “**ADLS**” means aircraft detection lighting system.
- (5) “**Agreement**” shall mean the Development, Engineering, Procurement and Construction Agreement to which this Exhibit A.1 is attached.
- (6) “**AHJ**” Shall mean any Authority Having Jurisdiction for the Facility.
- (7) “**Applicable Law**” has the meaning set forth in the Agreement.
- (8) “**Applicable Permits**” has the meaning set forth in the Agreement.
- (9) “**Applicable Standards**” means the minimum standards and industry codes by Contractor, including those set forth in Exhibit A.2.
- (10) “**As-Built Drawing**” means a complete set of drawings prepared by Contractor or a subcontractor using Owner's drawing standard which accurately and completely represents the Work as constructed and installed.
- (11) “**Auxiliary Loads**” shall mean power consumption not directly associated with power generation or transmission losses. These include, but are not limited to, inverter power. Communications System power, HVAC, and communications Equipment loads.
- (12) “**BESS**” means the battery energy storage system and includes the batteries, battery racks, power conversion system, a battery management system, and a site controller with pre-programmed BESS operating modes.

- (13) “**BMS**” means battery management system.
- (14) “**BTU**” shall mean British Thermal Unit
- (15) “**C**” or “**°C**” shall mean degrees Celsius.
- (16) “**Capacity Guarantee**” shall mean the guarantee by the Contractor for the total Power Rating of the Facility. It shall be verified by the Capacity Test in which the guaranteed Minimum Power Rating, as calculated with the Contractual Energy Model at the Reporting Conditions, is compared to the Power Rating, as measured by the AC power meter at the Point of Interconnection. The Capacity Guarantee shall be achieved if the Performance Criteria is greater than or equal to 98%.
- (17) “**Circuit**” shall mean all Equipment associated with medium-voltage AC loop (PV modules, trackers, combiner boxes, ISAs, MET Station, SCADA, cabling, etc.).
- (18) “**Collection System Circuit**” is one AC feeder with its own breaker and power meter connected to the Project Substation.
- (19) “**Communications System**” or “**SCADA**” means the supervisory, control, and data acquisition system for the Project equipment (including all inverters, transformers, breakers, switches, relays, and meters) and permanent meteorological towers / Met Stations, as well as all fiber optic cabling and supporting devices within the Collection System Circuits.
- (20) “**Contractor**” means the person, firm, or corporation with whom Owner has entered into the Agreement.
- (21) “**Contractor Permit**” means any permit that the Contractor is responsible for obtaining and maintaining, as more particularly described in Exhibit A.6 (Applicable Permits).
- (22) “**Contract Price**” means an amount to be paid to Contractor by Owner as full and complete payment for all Work to be performed by Contractor under the Agreement.
- (23) “**Contractual Energy Model**” shall mean the PVsyst model which characterizes the Facility’s energy performance inclusive of all modeling files (.MET, .PRJ, .PAN, .OND, etc.), DC and AC losses, soiling losses, auxiliary loads, etc. to accurately characterize the Facility. This model represents the project design and assumptions as of Agreement execution. In the event the Facility is modified by mutual agreement between the Contractor and Owner, the Contractual Energy Model inputs may be modified to match the constructed Facility if agreed upon by Owner and Contractor.
- (24) “**DC**” or “**dc**” shall mean direct current.
- (25) “**DC/AC ratio**” shall mean the ratio of DC power from the PV Array to the nameplate AC capacity of the Project at the POI.
- (26) “**DCP**” means dynamic cone penetrometer.
- (27) “**ECP**” means the electrical connection point.

- (28) **“Equipment”** means all of the parts, components, equipment, materials, apparatus, structures, tools, supplies, consumables, goods, and other items required or appropriate for a complete, fully-functional Project or that otherwise form or are intended to form part of the Work or the Project, *including* all equipment, materials, apparatus, structures, tools, supplies and other goods provided and used by Contractor and the subcontractors for performance of the Work, but that are not incorporated into the Project, and *excluding* all Owner-Supplied Equipment.
- (29) **“F”** or **“°F”** shall mean degrees Fahrenheit.
- (30) **“Facility”**, **“Site”**, or **“site”** shall mean all Equipment and systems outlined in this Exhibit A.1 including any Exhibits. The Facility shall meet all requirements as defined in the Agreement and the Exhibits.
- (31) **“FERC”** shall refer to the Federal Electric Reliability Council.
- (32) **“Final Completion”** means that each of the following has occurred: (a) the Substantial Completion Date has occurred; (b) all documents which are to be delivered to Owner by Contractor on or before the Final Completion Date pursuant to this Agreement have in fact been delivered to Owner, including, but not limited to, the As-Built Drawings and all manuals for the Work; (c) all of Contractor’s supplies, personnel and rubbish have been removed from the Project Site; (d) all items on the Punch List and Final Punch List have been completed; (e) Contractor has delivered all final Lien waivers; (f) Contractor has performed all Work such that the Project may be operated as a fully-integrated wind energy project; (g) all Owner Furnished Equipment has been constructed in accordance with the Requirements and is capable of being operated in a safe and proper manner; (h) [intentionally deleted]; (i) Contractor has delivered the Job Books; and (j) Contractor has issued a Certificate of Final Completion to Owner and such certificate has been accepted or deemed accepted pursuant to Section TBD of the Agreement.
- (33) **“GHI”** means Global Horizontal Irradiance.
- (34) **“FNTF”** shall mean Full Notice to Proceed.
- (35) **“HMI”** shall mean Human Machine Interface and shall refer to the user interface for the Owner, Contractor, and operator to interface with the Facility Communications System. The SCADA HMI shall be located in the Project Substation control building.
- (36) **“HVAC”** shall mean heating, ventilation, and air conditioning.
- (37) **“Hertz”**, or **“Hz”** shall mean hertz.
- (38) **“Interconnection Line”** means the 115-kV to 345-kV transmission line connecting the Project Substation with the Point of Interconnection as more particularly described in Section 7.0 herein.
- (39) **“Irradiance Band”** shall mean the range of irradiance values which are eligible to be included in the data analyses. Should be no less than the reference irradiance (Irr0) +/- 15%, and no greater than Irr0 +/- 40%.
- (40) **“ISO”** means Independent System Operator.

- (41) “**Job Book**” means a manual to be prepared by Contractor and approved by Owner, which will include all Contractor engineering, design, purchasing, and other information relating to the Work.
- (42) “**kV**” shall mean kilovolts.
- (43) “**kW**” shall mean a measure of instantaneous power as measured in kilowatts. If not specified in particular it shall be assumed to be in Alternating Current (AC).
- (44) “**kWh**” shall mean kilowatt-hours. If not specified in particular it shall be assumed to be in Alternating Current (AC).
- (45) “**LV**” shall mean low-voltage, generally referring to equipment and materials below 34.5kV.
- (46) “**Measured Data**” shall mean the meteorological data measured during the Capacity Test and used as inputs into the Contractual Energy Model to calculate the Predicted Energy.
- (47) “**MET Station**” shall mean the meteorological station/(s) installed within the solar field to measure critical weather data such as wind speed and direction, ambient temperature, solar irradiance, etc.
- (48) “**Minimum Capacity Guarantee**” shall be achieved if the Performance Criteria is greater than or equal to 98%.
- (49) “**Minimum Power Rating (PMIN)**” shall mean the expected power output of the Facility as calculated with the Contractual Energy Model at the Reporting Conditions.
- (50) “**MPH**” or “**mph**” shall mean miles per hour.
- (51) “**MPPT**” shall mean maximum power point tracking. It is the point on the output of the solar cell where the current and voltage output results in the maximum power output of the solar cell.
- (52) “**MV**” shall mean medium-voltage, generally referring to 34.5kV equipment and materials.
- (53) “**NERC**” shall refer to the North America Electric Reliability Corporation.
- (54) “**NRTL**” shall mean Nationally Recognized Testing Laboratory.
- (55) “**NTP**” shall mean Notice to Proceed.
- (56) “**O&M Building**” means the Project operations facility, as further described in Section 13.0 herein.
- (57) “**Owner**” means means Northern States Power Minnesota (NSPM) or Northern States Power Wisconsin (NSPW).
- (58) “**Owner Permit**” means those Applicable Permits that shall be acquired by Owner, as specifically set forth in Exhibit A.6 (Applicable Permits).

- (59) **“Owner-Supplied Equipment”** means the work, services, and equipment Owner is to provide (or cause to be provided) as expressly set forth in Exhibit B (Owner-Scope of Work).
- (60) **“PCC”** means the point of common coupling.
- (61) **“PCS”** means power conversion system and includes the inverter, harmonic filters, step-up transformer, AC and DC fault and overcurrent protection devices, and instruments and devices to interface with the Communications System. Bi-directional inverters are required on BESS inverters.
- (62) **“Performance Criteria”** shall mean the Power Rating (PRC) divided by the Minimum Power Rating (PMIN) for the Facility during the Capacity Test, expressed as a percentage.
- (63) **“Perimeter Fence”** shall mean a physical security fence that surrounds the property allocated for the Project. The fence shall be contiguous without interruption (except for personnel and vehicle gates).
- (64) **“POA”** means “plane of array” as in ‘plane of array irradiance’.
- (65) **“Point of Interconnection”** or **“POI”** shall mean the Point of Interconnection which defines the location of the physical electrical interconnection to the Transmission Provider as defined in the Interconnection Agreement.
- (66) **“Power Rating (PRC)”** shall mean the actual power output of the Facility at the Reporting Conditions, per ASTM E2848.
- (67) **“Predicted Energy”** shall mean the energy output from the Contractual Energy Model after inputting the Measured Data.
- (68) **“Primary Measurement Device”** shall mean an instrument which provides a measurement or reading that is used in calculating output power in the Capacity Test.
- (69) **“Progress Reports”** means the plan of the day, weekly, and monthly progress reports as prepared by Contractor detailing the actual progress of the Work in comparison to the Project Schedule.
- (70) **“Project”** means the Project as defined in the Agreement. The Project shall include all equipment and systems producing / storing energy, from the renewable generation technology / BESS up to the POI, including the collector system, collector substation, and interconnection line.
- (71) **“Project Schedule”** means the schedule of Project activities as more particularly described in Section 2.5.1(1) herein.
- (72) **“Project Site”** means the location of the Project.
- (73) **“Project Substation”** shall mean the interconnection facility(ies) which collect the feeders from the PCS / Wind Turbines / medium-voltage transformers / BESS and transforms the voltage (as required) for electrical interconnection to the Transmission Provider.
- (74) **“Prudent Wind / Solar / BESS Industry Practices”** means:

- (a) those practices, methods, equipment, specifications and standards of safety, performance, dependability, efficiency and economy as are acceptable for construction and professional engineering firms performing design, engineering, procurement and construction services in North America on facilities of the type and size similar to the Project, which in the exercise of reasonable judgment and in the light of the facts known at the time the decision was made, are considered good, safe and prudent practice in connection with the design, construction and use of electrical and other equipment, facilities and improvements, with commensurate standards of safety, performance, dependability, efficiency and economy, are in accordance with generally accepted national standards of professional care, skill, diligence and competence applicable to design, engineering, construction and project management practices, and are consistent with Applicable Laws; and
 - (b) those practices, methods, standards and acts that at a particular time in the exercise of reasonable judgment would have been acceptable to those engaged in, or approved by a significant portion of, the wind / solar / BESS power industry for similar facilities in similar geographic areas as a reasonable effort to accomplish the desired result in a manner consistent with Applicable Laws, Applicable Standards, safety, environmental protection, economy and expedition.
- (75) **"PSF"** or **"psf"** shall mean pounds per square foot.
 - (76) **"PV"** shall mean photovoltaic.
 - (77) **"PV Array"** shall mean the collection of solar modules connected in series and parallel via DC system, all tying into centralized inverters or PCS.
 - (78) **"Raceway"** means all conduit (rigid and flexible), underground duct, wireway, cabinets and boxes, and all materials and devices required to install, support, secure, and provide a complete system for support and protection of electrical conductors.
 - (79) **"Reporting Conditions"** shall mean the reference irradiance (Irr0), the reference temperature (T0), and the reference wind speed (WS0) as determined by the procedures outlined in the Capacity Test and referred to in ASTM E2848.
 - (80) **"Requirements"** means the Specifications in this Exhibit A.1, Prudent Solar / Wind / BESS Industry Practices, Applicable Law, Applicable Permits, Applicable Standards, the Project Schedule, the Interconnection Agreement, the preliminary designs in Exhibit D.3 (*Preliminary Design Documents*), the landowner requirements in Exhibit C.1 (*Landowner Requirements*), the Transmission Provider Specifications, Turbine Supplier requirements, all manufacturer recommendations, and the other requirements of the Agreement.
 - (81) **"Roads"** and **"roadways"** means all Site Access Roads, spur roads, Site Maintenance Roads, perimeter roads, substation roads, transmission line service roads, maintenance building roads, and temporary construction roads to be constructed for the Project by Contractor.
 - (82) **"ROW"** shall mean Right of Way or Rights of Way.
 - (83) **"Secondary Measurement Device"** shall mean an instrument which provides a measurement or reading that is not used in calculating the Power Rating (PRC) but is used as check on primary measurements in the Capacity Test.

- (84) **“Site Access Roads”** shall mean the Roads used to access the solar PV facility, Project Substation, or other Project Facility (excluding the O&M Building) that extends from the state or county road to immediately within the perimeter fencing of the Project Substation or to the inverters at the solar PV facility / or to each Wind Turbine / or to the BESS area.
- (85) **“Site Maintenance Roads”** shall mean the Roads in the corridors within the solar PV Array / BESS perimeter fence and between solar arrays / BESS used to maintain the equipment.
- (86) **“Special Tools”** means those tools as specifically set forth in Exhibit B (*Owner Scope of Work – Not Applicable*).
- (87) **“Standard Error”** or **“SE”** shall be defined per ASTM E2848.
- (88) **“STC”** shall mean standards test conditions, which is 1000 watts per square meter insolation, 25°C module temperature, 1.5 AM (air mass).
- (89) **“Submittal Schedule”** means the schedule for Contractor’s delivery of submittals, as set forth in Exhibit G.1 (*Submittal Schedule*).
- (90) **“Substantial Completion”** means [TBD Update with definition from the Agreement.]
- (91) **“Test Period”** shall mean the “data collection period” referred to in ASTM E2848 and utilized during the Capacity Test.
- (92) **“Transmission Provider”** shall mean the public utility (or its designated agent) that owns, controls, or operates transmission or distribution facilities used for the transmission of electricity in interstate commerce and provides transmission service under the Tariff.
- (93) **“Turbine SCADA System”** means the SCADA system provided by the turbine manufacturer for control and monitoring of the wind turbines.
- (94) **“Turbine Foundation”** means each Wind Turbine foundation to be completed in accordance with the Agreement.
- (95) **“Turbine Supplier”** means Vestas or General Electric as noted in exhibit A.3 (Approved Suppliers).
- (96) **“Turbine Supply Agreement”** or **“TSA”** means the agreement between Contractor and Turbine Supplier for the supply of the Project Wind Turbines and associated equipment and work.
- (97) **“UCS”** means unconfined compressive strength.
- (98) **“Wind Turbine”** means a wind turbine generator, including the following components: the tower sections, nacelle, hub, rotor blades, controller, control panels, wind vanes and anemometers, and associated accessories, in each case, to the extent provided by a Turbine Supplier under the terms of the applicable Turbine Supply Agreement.

- (99) **“Wind Turbine Pads”** means both crane pads and hardstands, where (a) **“crane pads”** refer to a hardstand area in connection with the erection or service of a Wind Turbine and (b) **“hardstands”** refer to any area where Wind Turbine components, Wind Turbine equipment, transport equipment, or storage equipment are stored, placed, or parked, and including parking areas, laydown areas, and other such working areas.
- (100) **“Work”** means all actions, contracts, labor, equipment, and materials necessary to construct the proposed Project and furnish the energy and any environmental attributes to Owner at the specified delivery point.

1.5 Interpretation

1.5.1 References herein to requirements to perform and/or provide work, services, equipment, or other similar items shall be understood to be the responsibility of Contractor, unless explicitly noted as being a responsibility of Owner.

1.5.2 Unless expressly noted otherwise, any requirement to “provide”, “supply”, or “furnish” goods or services herein shall be considered equivalent.

1.5.3 The headings of sections and subsections herein are for convenience only and shall be ignored in construing this exhibit.

1.5.4 Unless expressly noted otherwise, any number in decimal form herein shall not refer to the precision or significant digits of that number.

2.0 GENERAL SERVICES

2.1 General Provisions

2.1.1 Contractor shall perform and/or provide all work, design services, procurement services, construction services, permitting services, land development, land acquisition, Interconnect Agreement development, scheduling, supervision, management, labor, equipment, materials, parts, apparatus, tools, consumables, temporary structures, temporary utilities, storage, quality control and other items necessary or appropriate to complete the Work described herein, unless explicitly stated otherwise, and all such Work shall be included in the Contract Price.

2.1.2 Contractor shall perform all Work in conformance with the Requirements. In the event of any conflict or discrepancy between this exhibit and any Requirement, the more stringent or higher quality Requirement shall take precedence over the less stringent or lesser quality Requirement.

2.1.3 Contractor shall provide supervision, inspection, and quality control of the Work to ensure it is completed safely, competently, and efficiently. Contractor shall devote attention, skills, and expertise as is necessary to perform the Work in accordance with the Requirements. All materials shall be new, unused, of the highest quality, free of defects and irregularities, and consistent for use in solar generation facilities, wind generation facilities and battery energy storage facilities. All equipment and materials shall be installed, assembled, and tested in strict compliance with the manufacturer's drawings, code markings, and instructions, and any proposed materials, structures, and/or assemblies shall be maintainable in the simplest and most cost-effective manner possible.

2.1.4 All Work, including construction, materials storage, grading, landscaping, cut/fill, erosion control, and other similar or related activities, shall not extend beyond the designated disturbance limits shown on the Project Site Plan. Unnecessary disturbance of the existing Project Site conditions shall be minimized, and under no circumstance may Contractor perform any Work or cause any disturbance beyond these corridors without explicit written confirmation from Owner.

2.1.5 Contractor shall not construct any portion of the Work until the applicable issued-for-construction drawings have been approved by Owner. Turbine Foundations shall not be constructed until (a) the Turbine Foundation drawings and calculations have been approved by Owner, including its independent engineer; and (b) until pre-determined hold points have been approved by Owner, including inspection of rebar placement prior to pouring concrete.

2.1.6 Contractor shall design all aspects of the Project based on verifiable criteria that are specific to the Project and the Project Site, including elevation, corrosivity, precipitation, frost depth, seismic loads, and subsurface conditions. All such design criteria shall be clearly displayed on the design drawings.

2.1.7 Notwithstanding any reference to specific codes or standards herein, all Work shall comply with the latest revision of the Applicable Standards, including those set forth in Exhibit A.2 (Applicable Standards). The method for handling conflicts between Applicable Standards shall be as set forth therein.

2.1.8 Exhibit A.3 (Approved suppliers) contains a list of approved materials, equipment suppliers, and subcontractors. If Contractor is considering the selection of a material, equipment supplier, or subcontractor that is not listed herein, Contractor shall request approval from Owner prior to executing any contract for the procurement of such material or with such equipment supplier or subcontractor. Equipment catalog cut sheets shall be submitted for Owner review and approval prior to procurement.

2.1.9 Unless explicitly stated otherwise, the minimum design working life of the Work shall be 35 years.

2.1.10 Requirements for rigging, tooling, and testing equipment:

- (1) All rigging shall be rated; inspected daily; and load tested in accordance with the Applicable Standards or other more rigorous requirements set forth in the HSSE Plan. The manufacturer-rated capacities shall be legible and permanently affixed. Inspection reports shall be maintained at the Project Site and available for review by Owner.
- (2) All tooling and testing equipment shall be calibrated, at a minimum, in accordance with the manufacturer's recommendations. Copies of testing certificates and calibration records for all tooling and testing equipment shall be maintained at the Project Site, available for review by Owner, and included in the Project Job Books.
- (3) Contractor shall utilize tooling and testing equipment in accordance with manufacturer recommendations, including any supplier guidelines for use of special tools.

2.1.11 NERC compliance:

- (1) The Project shall be compliant with all NERC requirements, including specifically the following reliability guidelines and lessons learned in its most recent versions including:
 - (a) "Reliability Guideline – Improvements to Interconnection Requirements for BPS-Connected Inverter-Based Resources" included in Exhibit A.2.1
 - (b) "Reliability Guideline – BPS-Connected Inverter-Based Resource Performance" included in Exhibit A.2.2.
 - (c) "Lesson Learned – Battery Energy Storage System Cascading Thermal Runaway" included in Exhibit A.2.3.
 - (d) Comply with IEEE 2800 - Standard for Interconnection and Interoperability of Inverter-Based Resources (IBR) Interconnecting with Associated Transmission Electric Power Systems.
- (2) The Project shall be designed and constructed following the latest NERC guidance for the following parameters, at a minimum:
 - (a) Momentary cessation
 - (b) Phase jump immunity
 - (c) Capability curve
 - (d) Active power frequency controls
 - (e) Fast frequency response
 - (f) Reactive power voltage control
 - (g) Reactive current voltage control

- (h) Reactive power at no active power output
 - (i) Inverter current injection during fault conditions
 - (j) Return to service following tripping offline
 - (k) Balancing
 - (l) Monitoring
 - (m) Fault ride-through capability
 - (n) Protection setting
- (3) Contractor shall provide, or support Owner in the provision of, any NERC requirements, studies, or deliverables associated with providing a complete, working, safe, and compliant Project. All such deliverables shall be provided in a manner that is thorough, organized, complete, and suitable for use in presentation to NERC audit personnel. Conclusions provided in any deliverable shall be supported with explanations regarding how each conclusion was made. All materials and deliverables shall be provided to Owner for review and approval.
- (4) All Project drawings shall provide indication for those settings that are selectable (e.g., transformer tap settings) that are a reliance item for any part of a NERC compliance required setting position.
- (5) All NERC requirements, studies, or deliverables shall be consistent with the requirements in Exhibit A.2.4 (NERC Requirements).

2.2 Development Services

2.2.1 Not used.

2.3 Site Conditions

2.3.1 Contractor shall inspect the Project Site prior to initiating the Work to obtain, or plan to obtain, such additional or supplementary examinations, investigations, explorations, surveys, tests, studies, and/or data concerning conditions at or contiguous to the Project Site or otherwise, which may affect cost, progress, performance, or furnishing of the Work. All such inspections shall be obtained and/or executed pursuant to the Project Schedule.

- (1) Contractor shall provide the information for the Project Site in the form of Exhibit D.2 (Project Site Data).
- (2) All aspects of the Project design, construction, operations and maintenance, shall take the Project Site Data into consideration. The drifting and clearing of snow from the Project facilities shall be considered in all design aspects as may be applicable.

2.3.2 Contractor shall furnish weather equipment at the Project Site capable of measuring precipitation, wind speed, and other conditions as necessary to determine the occurrence of weather days and abnormally severe weather conditions, respectively.

2.3.3 Any existing infrastructure, including communications towers, pipelines, telephone lines, and electrical lines, shall be maintained in their current condition throughout the construction of the Project. Existing access to the Project Site, including along public roads, shall remain open throughout construction.

2.4 Construction Management

2.4.1 Contractor shall provide traffic control at and within the Project Site that comply with local regulations and/or permits, or as otherwise required to complete the Work, including, but not limited to, traffic control along any public roads, as required.

2.4.2 Contractor shall provide all necessary construction water, including, but not limited to, that which is required for temporary work, concrete preparation, dust control, rock drilling operations, and washing of equipment and components. For the avoidance of doubt, Contractor shall obtain and maintain any water permits necessary or required for completion of the Work.

2.4.3 Contractor is responsible for temporary power and communication services for Facility during construction including, but not limited to, that required for office trailers, temporary lighting, Project Substation, and commissioning/testing procedures. For the avoidance of doubt, Contractor shall be responsible for furnishing both the power supply and fuel source for such items. Owner shall be allowed access to such power and communication services on Site as may be required during construction.

2.4.4 Contractor shall provide all necessary fire management devices, per the fire management plan to be prepared by Contractor as a Contractor Deliverable, including water trailers, construction vehicle fire kits, or other similar devices, as applicable.

2.4.5 Contractor shall attend and actively participate in Owner-scheduled Project meetings. These meetings may include, but are not limited to, (a) engineering update meetings to review progress against the Project Schedule, address issues related to the Work, and other similar items prior to construction of the Project; and (b) Project management meetings during construction, including plan of the day, daily safety meetings, daily logistics planning, Project Schedule progress, weekly management updates, and monthly management updates.

2.4.6 Contractor shall ensure compliance with all landowner agreements and requirements thereof.

2.4.7 Contractor shall support Owner with providing timely responses to reasonable requests for information from Owner or Owner's contractors, including equipment suppliers.

2.4.8 Contractor shall contact local authorities, pipeline companies, and utility companies to locate conflicting underground facilities *prior* to starting any excavation or trenching Work. Contractor shall be responsible for all damages resulting from contact with identified underground facilities in the vicinity of each excavation. In the event of any conflict with an underground facility, Contractor shall immediately notify Owner and shall document the nature of the conflict, relocation of the conflicting facility or structure, any damages which occurred, and final resolution. This documentation shall be provided to Owner within 48 hours of such conflict.

(1) Contractor shall locate and maintain the location of all Contractor-installed underground facilities for purposes of Project closeout and restitution activities that may be required (e.g. drain tile repair).

2.4.9 Contractor shall regularly inspect Equipment delivery trucks and other equipment for leaks, including oil, coolant, and hydraulic fluid.

2.4.10 Contractor shall furnish and maintain throughout construction of the Project a construction radio system for use by Owner and Owner's representative(s), including access to Contractor's primary safety channel. At least five (5) fully functional radios shall be furnished for this purpose. This radio system shall be fully functional within 30 days of Contractor mobilization.

2.5 Project Documentation

2.5.1 Contractor shall prepare and submit all deliverables and submittals necessary for the successful completion of the Work, including, but not limited to, Job Books, As-Built Drawings, completion certificates, design documents, and all other manuals, drawings, plans, studies, calculations, safety-related documentation, reports, checklists, completion procedures, agreements, and other similar items (collectively, the “**Contractor Deliverables**”). All Contractor Deliverables shall be coordinated and discussed with all pertinent parties prior to and during the construction phase of the Project; shall be subject to review and/or approval by Owner, as applicable; shall be submitted by the applicable dates in the submittal schedule in Exhibit G.1 (Submittal Schedule); and shall meet the minimum requirements for submittals set forth in Exhibit A.5 (Submittal Requirements). OWNER REVIEW OF ANY OF THE CONTRACTOR DELIVERABLES SHALL NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR THE ACCURACY OR CORRECTNESS OF ITS WORK OR FOR THE PROPER CONSTRUCTION AND SUCCESSFUL PERFORMANCE OF THE EQUIPMENT IN ACCORDANCE WITH THE CONDITIONS SPECIFIED IN THE CONTRACT. The following list provides an indicative sample of Owner requirements for specific Contractor Deliverables for the sole purpose of ensuring clarity of expectations for the referenced submittals; *this list is not intended to be an exhaustive listing of all Contractor Deliverables or the requirements thereof.*

- (1) Contractor shall prepare, implement, and manage a detailed Project schedule that reflects the Project execution plan and anticipated sequence of site operations (the “**Project Schedule**”), and shall cause the reports summarized in Exhibit A.4 (Schedule Requirements) to be submitted with each Project Schedule update; the Project Schedule shall comply with the minimum requirements set forth in Exhibit A.4 (Schedule Requirements). Contractor shall also provide an individual (the “**Scheduler**”) who shall (a) be dedicated to the Project upon start of construction; (b) develop and maintain the Project Schedule; (c) be an experienced specialist that is skilled in critical path method scheduling; and (d) attend (either remotely or in person) and actively participate as needed in all Project meetings related to construction progress, alleged delays, or time impact.
- (2) Contractor shall prepare, implement, manage, and observe the health and safety plan, the security plan, and the environmental plan (collectively, the “**HSSE Plans**”). These plans shall conform to the minimum requirements set forth in Exhibit C.2 (Safety, Security, and Environmental Plan Requirements).
- (3) Contractor shall prepare, implement, and manage a detailed quality assurance plan that is specific to the Project and Project Site. This plan shall conform to the minimum requirements set forth in Exhibit C.3 (Quality Plan Requirements).

- (4) Contractor shall provide one (1) complete copy of Job Books in hard copy format including a complete color set of full-size (size D) as-built drawings, one (1) complete copy of Job Books in electronic format on a flash drive or external hard drive, and one (1) complete copy of Job Books in electronic format uploaded to the Contractor's web-based document management site. Job Books shall conform to the minimum requirements set forth in Exhibit C.4 (Job Book Requirements).
- (5) Contractor shall prepare a spill prevention, control, and countermeasure ("SPCC") plan in accordance with EPA requirements.
- (6) Contractor shall prepare, implement, and manage a detailed project execution plan that is specific to the Project and Project Site. The project execution plan shall be sufficient in scope and detail to convey the means and methods that will be employed by Contractor to perform all aspects of the Work. Key elements of the project execution plan shall include, but not be limited to, project management structure and key personnel; roles and responsibilities; staffing plans; communications protocol; engineering execution plans; security plans, including, but not limited to, guards / patrols, weapons, emergency procedures, and incident notification procedures; and construction management plans, including, but not limited to, cost controls, schedule controls, mobilization, document management, materials management, details for receipt and transport of equipment, traffic management (including concrete trucks), construction sequencing, movement of cranes during construction, and other similar items.
- (7) Contractor shall prepare, implement, and manage a detailed traffic management plan that is specific to the Project and Project Site. The traffic management plan shall clearly identify all haul routes from the nearest highway; proposed traffic flow within the Project Site, including public roads; plans for managing construction, delivery, public, and other traffic at the Project Site during construction; daily concrete truck delivery flow plans; speed limits; and mitigation measures to reduce risk and impact to non-construction vehicles due to construction activities. The traffic management plan shall be consistent with the requirements of Exhibit D.4 (Road Use Agreement) and any local AHJ requirements, including the Department of Transportation, at a minimum.
- (8) Contractor shall prepare, implement, and manage critical lift plans that are specific to the Project and Project Site per the Safety Plan as part of Exhibit C.2 (Safety, Security, and Environmental Plan Requirements). The critical lift plan shall clearly identify precautions for all critical lifts; coordination plans, including pre-lift meetings, with all participating personnel; and sample documentation/checklists for all critical lifts.
- (9) Contractor shall prepare, implement, and deliver pre- and post-construction visual surveys of the Project Site, documenting the Site conditions, with appropriate photographs/recordings. The pre-construction survey shall be delivered to Owner no later than five (5) business days prior to construction. A post-construction survey shall be delivered to Owner no later than five (5) business days of the last heavy truck leaving the Site. A final post-construction survey shall be delivered to Owner no later than ten (10) business days after all substantial construction traffic has left the Project Site.

2.5.2 Contractor shall upload electronic copies of all Contractor Deliverables (including drafts and final) to Contractor's web-based document management site and shall make documentation accessible to Owner.

2.5.3 Contractor shall prepare and maintain a documentation list for the Project. This list shall include, at a minimum, a listing of all Contractor Deliverables and the status (including responsible party) and revision number of each. The naming and labeling conventions for all Contractor Deliverables shall be coordinated with and approved by Owner. The documentation list shall be updated by Contractor each time a new or revised drawing or document is issued, at a minimum.

2.5.4 Contractor shall prepare and maintain a complete log, including supporting documentation, of all requests for information (each, an “**RFI**”) issued throughout performance of the Work. This log shall include, at a minimum, a listing of each RFI and the status (including responsible party) and revision number of each. The naming and labeling conventions for all RFIs shall be coordinated with and approved by Owner. The documentation list shall be updated by Contractor each time a new or revised RFI is issued, at a minimum.

2.5.5 Contractor shall provide to Owner periodic written reports as to the actual progress of the Work in comparison to the Project Schedule. These reports shall include, but are not limited to, the plan of the day report, the weekly progress report, and the monthly progress report each in accordance with Exhibit C.5 (*Progress Report Contents*).

2.5.6 Contractor shall maintain color hard copies of all issued-for-construction drawings at the Project Site during performance of the Work; such hard copies shall be updated by Contractor upon issuance of any revised issued-for-construction drawing. Contractor shall maintain separately a complete set of controlled redline drawings showing all Owner-approved changes made during construction, including an organized record log with reference to the applicable RFI number or other justification for the change; such redlines shall be included in the Job Books.

2.5.7 Contractor shall furnish and manage a web-based document management site such as Procore or Owner-approved equivalent. The document management site shall be capable of storing and sharing design and other applicable documents, managing workflows, and tracking financials and schedules, at a minimum. Contractor shall provide Owner and any Owner-requested subcontractors or representatives access to such site with permissions as necessary to perform their respective work.

2.6 Signage and Labeling

2.6.1 Contractor shall furnish, install, and maintain throughout the performance of the Work all signage required by the Applicable Permits, the Applicable Standards, and other applicable Requirements. All signage and equipment marking (including numbering and labeling) shall be weatherproof, UV resistant, and approved by Owner prior to installation.

2.6.2 Contractor shall furnish and install a permanent sign at each Wind Turbine string road listing the Company name, address, emergency contact #, and number(s) of all wind turbine(s) along that road. A separate sign shall warn of ice fall danger. . The signs shall be mounted on 4 by 4 wood posts or heavy duty wide metal posts that prevent vibration in high winds from destroying the sign, and be embedded in the ground at a substantial depth to prevent movement. The top of the sign shall be at a height of 4 feet above grade. The sign and post material shall be able to withstand all seasonal and earthly elements including but not limited to sun, wind, snow, ice, rain, acidic soils, etc.

2.6.3 Contractor shall furnish and install the turbine number on the base of all Wind Turbine towers facing the immediate tower access road at an elevation which is above the tower door.

2.6.4 Contractor shall furnish and install identification numbers and permanent, weatherproof labels on all Interconnection Line structures.

2.6.5 Contractor shall furnish, install, and maintain above-ground “buried cable” marker signs (a) at all locations where an underground Collection System Circuit crosses a road, fence, or underground utility respectively; (b) at a minimum of every 2,000 continuous feet of trench length; and (c) at all sharp turns in the Collection System Circuits.

2.6.6 Contractor shall furnish and install a permanent sign on the O&M Building fence indicating Project name, Owner name, address, and entry requirements. The location, contents, and format of this sign are subject to Owner approval.

2.6.7 Contractor shall furnish and install the following permanent signs at the Project Substation.

- (1) Project Substation identification sign shall be placed on Project Substation fence, be a minimum of 23 inches by 14 inches and shall indicate Project name, Project Substation name (if applicable), Owner name, and contact information. The location, contents, and format of this sign are subject to Owner approval.
- (2) Project Substation buried cable sign as shown in Figure 2-1 should be placed on Project Substation fence where buried cables are present. The signs should be mounted, back-to-back, on each side of the Project Substation fence fabric.

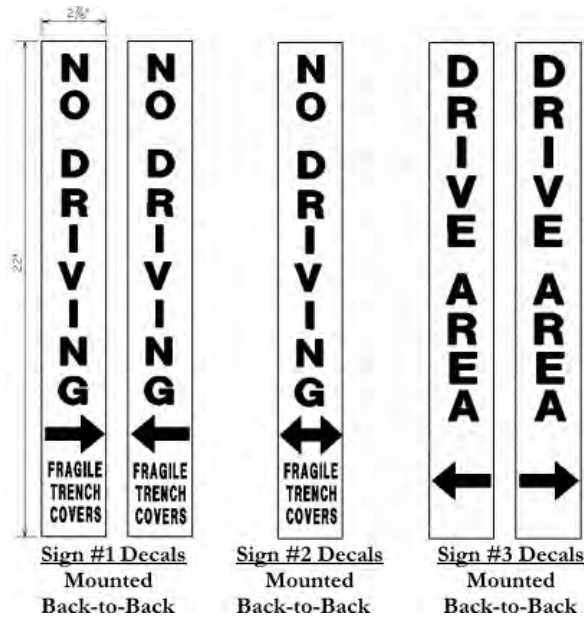
Figure 2-1: Substation Buried Cable Sign



10" x 7" Sign

- (3) Figure 2-2Project Substation precast cable trench no-drive signs in Figure 2-3 shall be posted in the Project Substation where vehicles could mistakenly drive over the precast cable trench.

Figure 2-3: Example Substation Precast Cable Trench No Drive Sign

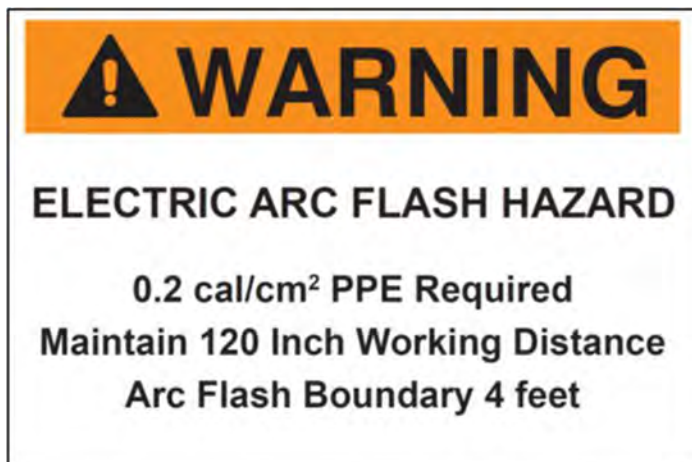


- (4) Substation Safety Signs as shown in Figure 2-4 shall be placed on Project Substation fence 30 to 45 feet apart and no more than 15 feet from the corners of the enclosure and approximately five (5) feet from grade to top of sign. Two (2) signs shall be placed on each drive gate, one on the inside and one on the outside, back-to-back, to be readable when the gate is open. One (1) sign shall be placed on the outside of each walk gate.

Figure 2-4: Example Substation Safety Sign



Figure 2-6: Example Arc Flash Hazard Label



2.6.10 Contractor shall, prior to the start of construction activities, measure the height of all overhead power lines or obstructions at the Project Site. Contractor shall furnish, install, and maintain signage at each such crossing and incorporate any measures necessary to operate, move, and mobilize cranes and other equipment to ensure safe passage with adequate clearance.

2.6.11 Contractor shall furnish, install, and maintain signage as needed for blind corners, dips, trucks entering roadways, restricted areas, and other potential hazards. Contractor shall also furnish, install, and maintain danger signs, signals, lights, guard rails, reflectors on curves, and notices as may be necessary to adequately protect the Work and personnel of any company at the Project Site, including visitors, against injury or property damage. All such signage shall be installed prior to commencing construction activities.

2.6.12 Contractor shall furnish, install, and maintain signage as needed to provide reasonable information and direction to Project Site personnel and to facilitate orderly entrance and egress from the Project Site. Contractor shall also furnish, install, and maintain signage identifying personnel assembly locations for use during emergencies or Project Site evacuations.

2.6.13 Contractor shall furnish and install emergency response (E-911) address signs in accordance with local authorities.

2.6.14 Contractor shall uninstall, remove, and discard of all temporary signage at the completion of the Work, or as otherwise prescribed in the Applicable Permits. Temporary signage shall be legible and of sufficient durability to last the duration of construction activities.

2.6.15 Requirements for Labeling:

- (1) Electrical equipment shall be labeled to meet applicable industry codes and standards.
- (2) All labels shall be weatherproof and either laminated black-phenolic plastic with white engraved letters or engraved (or embossed) stainless steel nameplates.
- (3) All cables shall have a label affixed to the outer jacket with a Brady or equivalent cable marker at each termination and shall not cover the barrel of the terminal lug or otherwise interfere in any way with access to the barrel of the lug.

- (4) Instrumentation and control cables and wires in the same circuit or grouping shall be identified by circuit numbers as indicated in the design documents. The circuit number shall be fastened to each cable or wire grouping at each terminal, cable trench, pull box, manhole, hand hole and junction point.
- (5) All Collection System Circuit power cabling labels shall be permanently attached at both ends. Labels shall be sequentially numbered.
 - (a) Each cable in a switch, sectionalizing cabinet, transformer, etc. shall be identified by circuit number, phase, and location of the opposite end with permanent plastic or corrosion resistant metal tags. Close to each cable termination, Contractor shall also mark the cable termination phase designation on the cabinet.
 - (b) Contractor shall use accepted NEC code practices for providing the required colors at the wire ends of AC power circuits.
- (6) All communications cables, including fiber cables, shall be appropriately labeled with a permanently attached label at both ends. Labels shall be sequentially numbered.
- (7) Labeling is required, at a minimum, on each of the following Project equipment:
 - (a) Nameplates for all electrical equipment in the Project Substation and MV transformers (as applicable).
 - (b) Indoor Substation Equipment
 - (c) Solar Combiner Boxes
 - 1. For diagnostic and troubleshooting purposes, all multi-string harness inputs to each combiner box and the combiner boxes themselves shall be uniquely tagged and identified with such tagging on the record construction drawings.
 - 2. The combiner box shall be properly labeled in the factory and/or field with permanent, sunlight-resistant labels made of laminated three-ply plastic (or better) and shall include all labels required by the NEC and NFPA 70E as well as equipment identification tags.
 - 3. Combiner Box labels shall include an electrical shock warning label, disconnect label, number label, and warning “Do not open under load” label, at a minimum. Labels shall be reviewed and approved by Owner prior to installation.
 - 4. All information and warnings required by the National Electrical Code sections 690 and 705 shall be provided on a permanent label attached to each combiner.
 - 5. Arc Flash PPE requirements shall be provided on a permanent label attached to each combiner in accordance with the section herein.
 - (d) Solar / BESS Inverters

- (e) Solar Modules shall be provided with a permanent label indicating, at a minimum, the following information
1. Make/model
 2. Electrical characteristics, including open circuit voltage (Voc); short circuit current (Isc); maximum power point voltage (Vmpp); maximum power point current (Impp); nameplate power (W), and maximum series fuse size
 3. Temperature coefficients of Isc, Voc and nameplate power
 4. Nominal power conditions (STC, NOCT, etc.)
 5. Environmental operating conditions
 6. Compliance with Exhibit A.2 (*Applicable Standards*)
 7. Warnings of electrical hazard
 8. Maximum system voltage
 9. Maximum Load Capacity
 10. Date and location of manufacture, manufacturing code
 11. Serial number
- (f) BESS Battery modules shall be provided with a permanent label to indicate the following:
1. Make/model
 2. Electrical characteristics: nominal voltage (V), minimum voltage (Vmin), maximum voltage (Vmax), nominal current (I), maximum current (Imax), short circuit current (Isc), nominal power (kW), nominal energy (kWh), nominal charge / discharge rates (C-rate (C), max C-rate (Cmax)).
 3. Physical characteristic: height (in), length (in), width (in), weight (lbs), max operating temperature (Tmax), min operating temperature (Tmin), ideal operating temperature (Tideal)
 4. Nominal power conditions (at specified testing conditions)
 5. Compliances with standards
 6. Warnings of electrical hazard
 7. Serial number
 8. Manufacturing date and location, manufacturing code

2.7 Permits and Agreements

2.7.1 Contractor shall obtain, pay for, and maintain all permits required for its performance of the Work, except those explicitly noted in Exhibit A.6 (*Applicable Permits*). Contractor shall provide copies to Owner of all permit applications promptly after such applications are submitted to the applicable authority.

2.7.2 Contractor shall maintain copies of all permits at the Project Site during construction of the Project and shall at all times comply with all permit requirements, including closeout of such permits, and shall transfer to Owner such permits required for the operation and maintenance of the Project.

2.7.3 Contractor shall provide reasonable assistance, including engineering support, to Owner in applying for, obtaining, and maintaining the Owner Permits.

2.7.4 Interconnection Agreement:

- (1) The Contractor shall be responsible for obtaining the interconnection agreement from the Transmission Provider. Contractor will coordinate with the Transmission Provider and provide all necessary work, support, and materials for interconnection of the facility on the Owner side of the Point of Common Coupling (POCC) as defined in the Owner scope in the Interconnection Agreement, and as defined in the electrical drawings and site plan.

2.8 Training

2.8.1 Contractor shall prepare and conduct comprehensive training of Owner and its operations and maintenance personnel in the safe operation and maintenance of the Project and its equipment, as further described in Exhibit J (*Contractor-Provided Training*). Such training shall cover, at a minimum, the Project Substation, the Collection System Circuits, the Communications System, the Interconnection Line, the MET Station, Project Substation meteorological towers, PV Array, PV Inverter, BESS and the PCS.

2.8.2 Contractor shall provide regular and ongoing lockout-tagout training to on-Site personnel throughout the performance of the Work.

2.8.3 BESS Training Requirements

- (1) The Contractor shall be responsible for providing training to first responders.
- (2) The Contractor shall provide an on-site training class for operators, engineers, technicians, and maintenance personnel for up to ten people on the operation, maintenance, and repair of equipment furnished as part of the Works.
- (3) Training shall include both classroom and hands-on training with all training materials also provided to Owner in a common electronic format (PDF, MP4, etc.) agreed upon by Owner.
- (4) Contractor shall allow Owner representatives to shadow / observe Contractor's startup personnel during commissioning activities. Participation by Owner's trainees is at Owner's option and does not relieve Contractor of responsibility to properly commission the facility.

2.9 Supervision and Engineer of Record

2.9.1 All engineering shall be performed under the supervision of and stamped by the engineer(s) of record, who shall be a registered professional engineer with a current license in the Project jurisdiction. Such professional engineer(s) shall be registered in the applicable discipline for the drawings being signed and sealed.

2.9.2 All Work concerning the geotechnical services shall be supervised and directed by a qualified, competent, practicing geotechnical engineer. A geotechnical engineer or engineering geologist shall observe, log borings, obtain soil samples, and record blow counts of the samples, drill rates, rock quality, depth to ground water, and other pertinent data under the direction of a licensed geotechnical engineer.

2.9.3 Contractor shall provide a qualified third-party environmental inspector to support any state-mandated environmental inspections.

2.10 Temporary Facilities

2.10.1 Contractor shall be responsible for designing and implementing temporary traffic control measures as required by applicable County or local agencies throughout construction duration for Contractor-provided Equipment and deliveries. Owner shall be responsible for ensuring any Owner-Provided Equipment deliveries that require temporary traffic control measures are provided by Owner's delivery contractor.

2.10.2 Contractor shall be responsible for establishing and maintaining temporary parking areas for construction and office personnel. Temporary parking areas shall be returned to design grades and surfacing at the termination of construction.

2.10.3 Contractor shall furnish and install two (2) 24-foot by 60-foot double-wide office trailer for Owner's exclusive use. Each trailer shall be at the locations as specified by Owner and shall be installed and ready-to-use no later than 10 days after the Contractor mobilization date or on the same date when Contractor's trailers are installed, whichever occurs first. Owner's trailer(s) shall be removed from the Project Site at Project Substantial Completion or when Contractor's trailers are removed from the Project Site, whichever occurs last.

- (1) Each trailer shall include at least four (4) offices, and Contractor shall furnish each such office with two (2) desks, two (2) two-drawer file cabinets, two (2) rolling armchairs, two (2) visitor chairs, and one (1) 4-foot by 6-foot white board.
- (2) Each trailer shall include at least one (1) conference area, and Contractor shall furnish each such conference area with six (6) 8-foot-long tables, 16 chairs, and one (1) 4-foot by 6-foot white board.
- (3) Not used.
- (4) Each trailer shall include at least one (1) full-size drawing table, one (1) full-size drawing rack, and two (2) 4-foot by 6-foot bookshelves, respectively.
- (5) Each trailer shall include one (1) full-size refrigerator with freezer and one (1) full-size microwave. All appliances shall be new and unused.
- (6) Each trailer shall be furnished with central HVAC.

- (7) Each trailer shall be furnished with at least one (1) first aid kit and one (1) fully-charged fire extinguisher, respectively. Contractor shall maintain and recharge such fire extinguishers throughout the duration of the construction activities, as required.
- (8) Each trailer shall be furnished with a Wi-Fi-enabled printer that includes scanning capabilities, and with 8.5-inch by 11-inch and 11-inch by 17-inch print sizes.
- (9) Contractor shall furnish and install phone service, broadband internet service, and electric service, for each Owner trailer, including connection of all communications (phone and internet) to the jobsite. Phone service may be VoIP and shall include at least one (1) four-line phone system up to the wall jacks in each trailer. Internet service shall include high-speed internet (minimum speeds of 100 megabits per second) infrastructure wiring up to the wall jacks in each trailer and high-speed wireless internet service (Wi-Fi) throughout the trailer compound, respectively. All utility services shall include use and service charges to Contractor's account, including for Owner's trailers.
- (10) Contractor shall furnish bottled water and ice in each Owner trailer and for Owner's exclusive use throughout the duration of the construction activities.
- (11) Contractor shall provide weekly cleaning services within each Owner trailer throughout the duration of the Work. This shall include cleaning restrooms and trash collection, pickup, and removal, respectively.

2.10.4 Contractor shall provide separate office trailers for their own use. Contractor shall be solely responsible for furnishing their trailer(s), including any utility services.

2.10.5 Contractor shall furnish, install, and maintain portable chemical toilets for use by site construction personnel, including Owner, Equipment suppliers, and subcontractors. This shall include cleaning (at least weekly), emptying, and disposal of such toilets through substantial completion of the Project or Contractor demobilization, whichever occurs last. Following such date, Contractor shall remove all such toilets from the Project Site.

(1) Portable chemical toilets shall be heated as may be necessary per OSHA requirements.

2.10.6 Contractor shall design, permit, furnish, construct, and maintain, as required, any temporary fuel containment facilities required to support ongoing construction activities. This shall include removal of all such facilities following substantial completion of the Project or Contractor demobilization, whichever occurs last.

2.10.7 Contractor shall design, permit, furnish, construct, and maintain (including disposal), as required, any hazardous materials/waste facilities required to support ongoing construction activities. This shall include removal of all such facilities following substantial completion of the Project or Contractor demobilization, whichever occurs last. Contractor shall provide Owner with a copy of all hazardous material manifests.

2.10.8 Wind Projects: As required to perform the Work, Contractor shall procure, permit, install, construct, and maintain batch plant(s) at the Project Site, including all necessary labor and materials related to the operation of the batch plant, and removal of the batch plant at the conclusion of the Work. The batch plant shall be removed from the Project Site by Contractor within 30 days of the final Project concrete pour utilizing the batch plant, not to occur after substantial completion of the Project. Power to operate the batch plant shall be the sole responsibility of Contractor.

2.10.9 Wind Projects: As required to perform the Work, Contractor shall procure, permit, install, construct, and maintain fixed and/or mobile rock crusher(s) at the Project Site, including all necessary labor and materials related to the operation of the rock crusher(s), and removal of the rock crusher(s) at the conclusion of the Work. The location of any fixed rock crusher(s) shall be at the temporary facility areas, and the location of any mobile rock crusher(s) shall remain within the designated disturbance areas. Power to operate the rock crusher(s) shall be the sole responsibility of Contractor.

2.10.10 Contractor shall design, furnish, construct, install, and maintain a minimum of one (1) temporary laydown yard.

- (1) The laydown yard shall be constructed at a location at the Project Site to be approved by Owner.
- (2) The laydown yard shall be sufficient in size to allow for simultaneous (a) storage of equipment, including any Owner-Supplied Equipment; (b) storage of office trailers and other temporary facilities; (c) portable restrooms; (d) parking for approximately ten (10) Owner vehicles; and (e) regular construction traffic; Contractor shall incorporate this into the design and construction of the laydown yard.
- (3) The laydown yard shall be covered throughout with at least six (6) inches of aggregate over a compacted subgrade. The maximum aggregate size shall not exceed three (3) inches.
- (4) The laydown yard shall be graded to drain and shall not exceed two percent (2%) grade, or less if required for the safe storage of equipment or to meet manufacturer's requirements for storage of equipment.
- (5) Temporary fencing shall be installed around the perimeter of the laydown yard, and vehicle gates shall be installed at all entrances to the laydown yard.
- (6) Any equipment or materials delivered to the Project Site shall be stored as necessary at the temporary laydown yard. Contractor shall provide weather resistant covers and adequate blocking for equipment and materials per the manufacturer's requirements, at a minimum.
- (7) Wind Projects: The laydown yard shall comply with the Turbine Supplier Project Site Requirements.

2.11 Debris

2.11.1 Contractor shall assume ownership of all construction-related debris and unsuitable materials generated by Contractor, and each shall be removed from the Project Site and be properly disposed of by Contractor.

2.11.2 Contractor shall maintain a continuous and regular clean-up program to avoid accumulation of debris, waste, wreckage, and/or rubbish within the Project Site resulting from the Work and shall maintain the Project Site in a neat and orderly condition throughout the performance of the Work.

2.11.3 Contractor shall provide all trash collection, pickup, and removal related to the Work, including all trash associated with Owner-supplied Equipment / Owner-supplied Work within Owner's office trailers and other temporary facilities, and including disposal of cable reels and pallets. Dumpsters and trash receptacles shall be provided in sufficient quantities and with sufficient volume to support timely trash removal from the Project Site and preclude windblown trash generated during construction activities. Dumpsters and trash receptacles shall be emptied at a reasonable frequency to prevent overflowing or accumulation of trash around the dumpster or receptacle. For the avoidance of doubt, Owner and subcontractors (of both Owner and Contractor) shall be provided with access to utilize such receptacles. Contractor shall provide Owner with their debris management plan and Owner shall be provided such plan for approval.

- (1) The debris management plan shall include consideration for recycling, reuse, and/or repurposing of debris as may be practicable (e.g. common recyclables, scrap metals, reuse items such as pallets).

2.11.4 Contractor shall cause its subcontractors, employees, and other representatives to refrain from littering at or within the Project Site, or within other areas (including along public roadways) used in conjunction with the Work.

2.11.5 Contractor shall use lined washout pits, washout dumpsters, or other suitable means to contain the excess concrete and runoff from the cleaning of concrete trucks. All washout waste shall be properly disposed of off-Project Site by Contractor in accordance with the Requirements.

2.12 Logistics & Deliveries

2.12.1 Contractor shall furnish and deliver all Equipment to the Project Site with the exception of only the Owner-supplied equipment as noted in Exhibit B (*Owner Scope of Work*).

- (1) All equipment and materials shall be delivered/shipped in a manner consistent with the manufacturer's recommendations and shall be protected or crated to prevent damage during shipment and handling. Wooden covers shall protect equipment flange faces.
- (2) Contractor shall offload and immediately inspect all equipment and materials delivered to the Project Site, including Owner-supplied equipment (unless explicitly noted otherwise), for incorporation into the Project. All equipment and materials required for the performance of the Work shall be stored as necessary at the temporary laydown yard. Contractor shall provide weather resistant covers and adequate blocking for equipment and materials per the manufacturer's requirements, at a minimum.
- (3) Any equipment or materials damaged or otherwise altered during shipment, delivery, and offload shall be recorded in a Contractor managed log and shall be accompanied with time-stamped photographs detailing the damage. Contractor shall notify Owner within five (5) business days of any damage to materials and shall provide a plan to repair or replace such items with Owner's approval.

2.12.2 Contractor shall perform all off-Project Site clearing necessary for the transportation of major Equipment to the Project Site, including, but not limited to, tree trimming / removal and clearing of overhead obstructions. Contractor shall also upgrade and maintain public roads, bridges, and culverts as required for the transportation of Equipment to the Project Site and including obtaining any necessary permits.

2.12.3 Contractor shall design and prepare the site roads at the Project to facilitate a smooth traffic plan for Equipment deliveries, especially deliveries of PV modules. Such traffic plan shall take into consideration back tracking, access for emergency vehicles, and shall be consistent with the *Road Use Agreement*, at a minimum.

2.13 Coordination

2.13.1 Contractor shall actively coordinate the sequence and the content of Work with Owner, Owner's contractors, and the interconnecting utility to support the Project Schedule. For the avoidance of doubt, this shall include coordination with the Equipment supplier's schedule for the delivery and commissioning of the Equipment. Contractor, Owner, and Equipment supplier shall meet (a) on a weekly basis before major deliveries begin and (b) as required by Owner after Equipment component deliveries begin; the purpose of such meetings shall be to coordinate schedule for delivery and commissioning of the Equipment. On a weekly basis, a meeting shall be held to reconcile all demurrage and delays for all parties regarding deliveries and offloading of components.

2.13.2 Contractor shall (a) comply with all crossing requirements and (b) coordinate with local utilities and pipeline companies to facilitate crossings and interconnections necessary to perform the Work. For the avoidance of doubt, this shall include contacting local authorities, pipeline companies, and utility companies to locate conflicting underground facilities *prior* to starting any excavation or trenching Work, as further described in Section 2.4.8 herein.

2.13.3 Contractor shall be responsible for site security throughout construction duration until Substantial Completion, at which time Owner will be responsible for site security.

2.13.4 Pre-construction meeting:

- (1) Contractor shall attend the Owner-scheduled pre-construction meeting at the Project Site. Such meeting will occur prior to the commencement of any major work activity by Contractor. The purpose of the meeting is to confirm all parties and personnel understand their responsibilities with respect to the Work and the procedures that will be followed for the safe and efficient completion of the Work.
- (2) Contractor shall include in their attendance the assigned project and site manager(s), safety professionals and leads, site superintendents, hazardous material manager(s), and any major subcontractor representatives, at a minimum.
- (3) Contractor shall prepare and or be prepared to address the following information during the meeting:
 1. Project Schedule and critical work sequencing
 2. Routine progress reports and meetings
 3. QA/QC plan compliance monitoring and reporting procedures
 4. Site safety and security plan procedures and processes
 5. Use of the Project Site including equipment, material storage and handling, staging areas, and temporary facilities
 6. Procedures and processes for change orders

7. Processes for drawings, submittals, and RFIs
8. Close-out procedures
9. Testing schedules
10. Display requirements for permits
11. Environmental permits, notifications, water and waste management, dust control, SWPP, and SPCC plans

2.14 Quality Control and Oversight

2.14.1 Contractor shall provide Owner with access to attend factory acceptance testing for any of the major Equipment. Contractor shall provide Owner with at least 30 days' notice of such testing, including a detailed testing schedule and summary of the tests that are planned for the Equipment.

2.14.2 Contractor shall provide the results of any factory acceptance testing performed on the Project Equipment within five (5) business days of receipt of such results from the applicable equipment manufacturer.

2.14.3 Owner may, at their reasonable request, coordinate direct, on-site expediting support at any of the Project's major Equipment manufacturing or logistics facilities to track the quality and progress of the work related to the Project-specific components. Such support shall be at Owner's expense. Contractor shall provide reasonable support to Owner or Owner's representative as may be required for coordination purposes with Contractor's suppliers.

2.14.4 Damage to any coating or finish of any of the equipment or material shall be repaired in a manner consistent with the original finish or coating (e.g., damage to galvanized surface shall be re-galvanized). Owner shall be notified promptly of all damage and subsequent repair work to any equipment or material.

2.15 Project Site Closeout and Restitution

2.15.1 Contractor shall document and repair all drain tiles damaged during performance of the Work, including during road installation, Collection System Circuit installation, Turbine Foundation installation, crane walks, or otherwise. Repairs shall be consistent with or better than the original tile installation.

2.15.2 Contractor shall remove all tools, equipment, surplus materials (including unused or useless materials), waste materials, temporary work (including temporary erosion control features and temporary roads or paths), temporary buildings, temporary facilities (including batch plants, rock crushers, and office trailers), and rubbish from the Project Site prior to final completion, and shall cause any facilities used by Contractor during the performance of the Work to be restored to the same or better condition that such facilities and the Project Site were in on the date the Contractor commenced work at the Project Site, ordinary wear and tear excepted.

2.15.3 Contractor shall perform restitution, restoration, and/or reclamation of Work areas to include, but not limited to, the following. Notwithstanding anything that follows, all Work areas at the Project Site shall be restored, at a minimum, in accordance with the requirements set forth in the Applicable Permits, the SWPPP, and the other Requirements, as appropriate, and shall be fully restored to their pre-construction condition, at a minimum.

- (1) Clean all drains and ditches at completion of the construction Work and leave the Project Site in a neat and presentable condition wherever construction operations have disturbed the conditions existing at the time of starting the Work.
- (2) Preserve and/or restore to their pre-construction condition all land and impacted water resources adjacent to construction areas.
- (3) Re-dress all road surfaces within the Project Site such that the final cross section meets the specifications in the Road Use Agreement.
- (4) Wind Projects: Notwithstanding the following paragraph (a), Wind Turbine Pads, laydown areas (including the laydown yard), roadway shoulders, and roadway turning radii shall be decompacted and reclaimed, including proper grading, aggregate touchup, and seeding with an approved mixture. For the avoidance of doubt, such areas shall not be reclaimed until applicable Wind Turbine erection activities have been completed.
 - (a) Crane pads shall be preserved in a suitable manner to support the use of cranes in ongoing Wind Turbine maintenance activities following construction (e.g., cranes required for gearbox removal and / or installation).
- (5) Seed all cut / fill slopes and the PV Array area utilizing an approved seed mixture. Seeding shall occur during a time / season when the probability of successful seed germination is maximized; hydro-seeding is acceptable for slopes. Seeding shall conform to landowner and SWPPP requirements. Contractor is responsible for any additional seed applications as necessary to meet the requirements of the SWPP restoration plan.
 - (a) The PV Array area shall be seeded with a low growth seed mix that is native to the state and area of its application.
- (6) Fill all depressions and water pockets caused by construction operations and remove all obstructions within waterways.
- (7) Spread surplus fill on-Project Site in areas and depths approved by Owner.
- (8) Spread recovered aggregate from laydown yard, if applicable, within approved disturbance limits at Owner-approved locations including but not limited to on Site Access Roads, beauty rings, and/or the O&M Building yard.
- (9) Collect large rocks (4-inches or larger in diameter) or boulders unearthed during excavation as part of the Work but not utilized in the construction of the Project and store at an Owner-approved location at the Project Site.

2.15.4 Contractor shall support Owner in performing a walkdown of each of the Project's major systems to review all As-Built conditions against the As-Built drawings.

3.0 GEOTECHNICAL SERVICES

3.1 General Provisions

3.1.1 Contractor shall conduct all geotechnical, geophysical, and other similar subsurface investigations and testing necessary for the complete engineering, procurement, and construction of the Project. For the avoidance of doubt, all such investigations shall be completed before commencing the applicable Work.

3.1.2 All Work concerning the geotechnical services shall be supervised and directed by a qualified, competent, practicing geotechnical engineer. A geotechnical engineer or engineering geologist shall observe, log borings, obtain soil samples, and record blow counts of the samples, drill rates, rock quality, depth to ground water, and other pertinent data under the direction of a licensed geotechnical engineer.

3.2 Submittals

3.2.1 Contractor shall submit to Owner, *prior* to initiating subsurface investigations, the name and qualification statement for proposed geotechnical engineer.

3.2.2 Contractor shall submit to Owner, *prior* to initiating subsurface investigations, the proposed scope of subsurface investigation, including number, location, and depths of borings; anticipated plan for laboratory testing; and detailed descriptions of additional site investigation techniques, including thermal and electrical resistivity or other necessary testing.

3.2.3 Contractor shall submit a complete geotechnical engineering report containing the required information summarized below, at a minimum. The geotechnical engineering report shall be utilized for the design and construction of all Project structures, including Foundations.

- (1) Subsurface and groundwater conditions encountered.
- (2) Description of the geology, including areas of landslides, potential landslides, potential geologic hazards, past (historical) earth movements, and transitions between geologic units; special consideration shall be given to identify active and potential landslide zones.
- (3) Description of the drilling and sampling program.
- (4) Field photographs.
- (5) Boring coordinates, boring location drawings, and final boring logs.
- (6) Summary of results of field and laboratory tests performed.
- (7) Specific design criteria for the Project, including (a) impacts of new construction on existing facilities; (b) factors of safety used in determining allowable foundation loads; (c) recommended foundation types for all structures; (d) discussion of the dynamic soil properties at the Project Site, including dynamic shear modulus, Poisson's ratio, Young's Modulus, and shear wave velocity; (e) recommendations for designing for seismic issues, including liquefaction potential and the identified building code site coefficient/site classification for seismic design; and (f) recommendations for site dewatering and construction practices, including design water level.

- (8) For shallow foundations, (a) allowable soil bearing values and minimum bearing depths; (b) anticipated total and differential settlements; (c) uplift resistance; (d) lateral resistance; (e) subgrade modulus; and (f) dynamic spring constants for foundations supporting vibrating machines, if applicable.
- (9) For deep foundations, (a) type of deep foundation (e.g., drilled shaft, rock anchor); (b) diameter (or dimensions) and depth of foundation members; (c) minimum spacing and group reduction factors; (d) allowable compressive, uplift, and lateral capacities including allowable skin friction and end bearing capacities, anticipated settlements and lateral deflections; and (e) static and dynamic spring constants.
- (10) For driven piles, (a) embedment acceptance criteria; (b) drive time acceptance criteria, including target drive time (reference time); and (c) pile driving equipment.
- (11) Recommendations for slopes, including (a) temporary excavation slopes and OSHA soil types; (b) permanent slopes; and (c) temporary and permanent excavation support requirements.
- (12) Corrosion potential and chemical attack to construction materials.
- (13) Recommended cement type in concrete and corrosion protection for buried steel, based on chemical test results. Recommended cement type shall be based on soluble sulfate content in the soil and ACI recommendations.
- (14) An evaluation of the expansive, dispersive, and collapsing nature of the on-Site soil materials and discussion of design features to resist these tendencies.
- (15) Recommendations for earthwork including acceptable fill materials (including structural fill if materials fail testing), moisture contents, compactive effort, lift thickness, proofrolling, equipment, and compaction testing, and recommended aggregate gradations for general fill, load bearing fill, granular road base, and granular surfacing.

3.3 Field Investigations

3.3.1 Contractor shall drill geotechnical borings and conduct material sampling at the locations and minimum frequencies set forth below:

- (1) Solar PV Array: minimum of one (1) location per 20 acres of installed PV panels.
- (2) Wind Turbines: one (1) per Wind Turbine location.
- (3) BESS: minimum of five (5) locations at each BESS site.
- (4) Project Substation: minimum of five (5) locations at the Project Substation.
- (5) Interconnection Line: each angled and dead-end structure, respectively, as well as any additional borings and samplings necessary to ensure that adjacent borings are no more than one (1) mile apart.
- (6) O&M Building: minimum of one (1) location at the O&M Building.
- (7) Collection System Circuits: minimum of one (1) location per circuit, preferably on home runs or other larger cable spans.

3.3.2 Contractor shall perform soil electrical resistivity measurements at the location of the Project Substation; along the underground Collection System Circuits; and along the Interconnection Line. Soil electrical resistivity testing shall be completed using the Wenner Four-Electrode method or Owner-approved equal.

3.3.3 Contractor shall perform soil thermal resistivity measurements at the location of the Project Substation and along the underground Collection System Circuits in accordance with IEEE 442. Sufficient soil sample locations shall be taken to account for variation in soils encountered at a site. Soil samples shall be taken at depths that are representative of the installed depth of the applicable infrastructure and above in order to model the heat transfer from the circuits to the surface of the earth. No laboratory adjustment of the soil moisture content is allowed to maximize the dry density of compacted soil in the laboratory. See Section 5.1.17 for additional information on geotechnical data required.

3.3.4 Contractor shall obtain 24-hour water level readings in boreholes or install piezometers for long-term water level readings as required to determine prevailing groundwater levels.

3.3.5 Contractor shall perform a pre-design pile test for driven piles.

3.3.6 Contractor shall perform any additional geophysical or other site investigations, including, but not limited to, standard penetration tests, Shelby tube samples, deepened borings, additional borings, test pits, seismic refractions, cone penetrometer soundings, *in situ* testing, and other similar or related methods, as necessary to supplement the required geotechnical investigations summarized herein or to otherwise provide the data and recommendations required in the geotechnical engineering report.

3.3.7 Other boring and material sampling requirements:

- (1) Borings shall be backfilled with cement-bentonite grout and in a manner and with materials required under the Applicable Laws of the location of the Project Site. Excess cuttings shall be disposed of by Contractor in accordance with the applicable Requirements and subject to Owner approval, and the Project Site premises shall remain free from accumulations of waste materials or rubbish resulting from the geotechnical field investigations.
- (2) Existing utilities near borings or other subsurface test locations shall be identified and protected.
- (3) Each Wind Turbine boring shall be to a minimum depth of the greater of (a) 35 feet; (b) at least one (1) foundation diameter for spread footer foundations; or (c) at least 10 feet beyond the anticipated depth of the foundation at such location (including anchors, if applicable) for rock anchor foundations. All other borings shall be to a depth of at least 35 feet below the base of the applicable foundation / structure.
- (4) Sufficient rock core samples shall be obtained from each boring to adequately characterize and test the material, including coring from the point at which competent rock is encountered and until the appropriate boring depth is achieved (at a minimum). All core samples shall be delineated and digitally photographed in color. Unaltered rock core samples shall be placed in a core box and taken to a laboratory for analysis.

- (5) If using rock anchor foundations, Contractor shall perform a rock analysis to identify the presence of fissures, rock joints, or other discontinuities that will control the overall strength of the rock mass, including, but not limited to, rock mass rating, rock classifications, depth of overburden, rock quality designation, joint spacing and orientation, stratifications, rock material strength, and water pressure in joints.

3.4 Lab Testing

3.4.1 Contractor shall perform all laboratory testing necessary to classify the materials and to obtain physical characteristics of the subsurface materials. At a minimum, laboratory testing shall include (a) moisture content per ASTM D2216; (b) grain size analysis per ASTM D422; (c) dry unit weight tests per ASTM D7263; (d) Atterberg limits per ASTM D4318; (e) unconfined compressive strength per ASTM D2166; (f) compaction characteristics / standard proctor density of the soil per ASTM D698; (g) soil corrosiveness (chloride, sulfate, and pH) per ASTM D4972 and USEPA methods; (h) unconsolidated-undrained triaxial compression per ASTM D2850; (i) direct shear per ASTM D3080; (j) one-dimensional consolidation per ASTM D2435; (k) one-dimensional swell or collapse of soils per ASTM D4546; and (l) thermal resistivity testing per IEEE 442.

- (1) It is explicitly noted that thermal resistivity testing be performed per IEEE 442 and not ASTM D5334.

3.4.2 All testing described herein shall be performed by an independent, experienced third party.

4.0 CIVIL / STRUCTURAL WORKS

4.1 General Provisions

4.1.1 All civil and structural works, including, but not limited to, Site Access Roads, foundations, piles, and the laydown yard, shall conform to Equipment supplier's requirements and the final Geotechnical report.

4.1.2 The design working life of the civil and structural works shall be a minimum of 35 years.

4.1.3 All permanent drainage facilities, including culverts, ditches, and swales, shall be designed and constructed to withstand a 100-year, 24-hour storm event.

4.1.4 In areas where drain tile or other horizontal irrigation structures and wells are present, all tile and structures shall be located prior to construction. All drain tile shall be re-routed as needed to avoid any structures or cable installed underground. All tile breaks or re-routes shall be documented via GPS and include photos showing the location of the tile. All repairs shall be of equal capacity or greater and completed to the satisfaction of the landowner and warranted for five (5) years.

4.1.5 Requirements for road crossings:

- (1) All road crossings, including public roads, railroad, pipeline, utilities, and property lines, shall be as close to 90 degrees as reasonably practicable. All road crossings of buried facilities (e.g., pipeline, utility line) shall maintain at least 48 inches of cover or per the crossing agreement, whichever is more restrictive.
- (2) All road crossings of buried facilities (e.g., pipeline, utility line) shall be marked on each side with an above-ground cable marker, each meeting the requirements in Section 5.1.7 below.
- (3) Contractor shall coordinate with local utilities and pipeline companies as set forth in Section 2.13.2 herein.

4.1.6 Requirements for Site Access Roads:

- (1) Roads shall be designed, constructed, and maintained adequately to support all anticipated construction loads, equipment delivery (including Owner-Supplied Equipment), crane crawling, construction traffic usage (including concrete trucks), and weather conditions to be expected. Maintenance shall include the requirements set forth in Section 4.4 herein.
- (2) Roads shall comply with the Geotechnical Report (for subgrade and cross-section requirements), the Turbine Supplier Project Site Requirements, and the drainage and erosion control requirements in Section 4.1.7 herein.
- (3) Roads shall be designed to minimize the risk of materials entering public waters and minimize disturbance to streams, channels, lakes, wetlands, and/or floodplains. Where viable alternatives exist, roads shall not be located on steep slopes, slide areas, or high-risk sites, or in wetlands, riparian management areas, channels, and/or floodplains.
- (4) Roads shall comply with Equipment supplier project site requirements, including Turbine Supplier.

- (5) Road entries, intersections, and turns shall be designed to accommodate the longest vehicle anticipated to utilize the road so that it will be able to maneuver through the entire Project Site without leaving the graveled road area. Cantilevered loads (e.g., Wind Turbine blade ends) shall be considered to ensure obstructions adjacent to the roadway are cleared and will not endanger the equipment delivery. Wind Turbine spur roads shall have a minimum turning radius of 25 feet from other roads at final construction.
- (6) Approaches shall be located and designed to meet state and county setback and sight requirements.
- (7) Site Access Roads shall be a minimum of 16 feet wide, except for meteorological tower roads which shall only be 12 feet wide. Where crane walks are to be utilized, roads shall have a minimum 10-foot temporary compacted earthen shoulder on each side. Roads shall be widened through turns and curves, as necessary.
 - (a) Solar or BESS Site Maintenance Roads shall be a minimum of 10 feet wide and may be compacted native soil. Roads shall be widened through turns and curves, as necessary.
 - (b) Solar or BESS Site Access Roads that extend to a Inverter or PCS shall be designed to provide a turnaround loop or adequate space for a maintenance truck to perform a three-point turn.
- (8) Site Access Roads shall be covered with at least six (6) inches of aggregate over a compacted subgrade, including geotextile fabric (or equivalent) as required. If geotextile fabric is not utilized, Site Access Roads shall be covered with at least 12 inches of aggregate over a compacted subgrade. All crushed rock surfacing shall conform, at a minimum, to the specifications prescribed in Section 4.1.9 (Crushed Rock Surfacing).
- (9) Wind Projects: Roads shall be designed and constructed with a maximum grade of eight percent (8%). Approaches to Wind Turbine Pads from access / spur roads shall be designed and constructed sufficiently level to allow transport vehicles, including Wind Turbine transport vehicles, to park on a flat surface during offloading.
- (10) Maximum vertical crest and dip on roads is six (6) inches vertical to 50 feet horizontal, or less if required by the supplier Project Site Requirements.
- (11) Wind Projects: The longitudinal radii (convex or concave) of roads shall not be less than 750 feet.
- (12) All roadways shall be able to accommodate light traffic consisting of general-purpose pickup trucks, SUVs, and bucket trucks, or as required during construction to perform the Work. During construction, equipment delivery trucks shall also be able to safely travel these roadways.
- (13) Roads shall be designed with turnarounds to assist in truck and trailer flow throughout the Project Site, as well as lay-bys as required by Equipment supplier site requirements. Backup motions for tractor trailers shall be kept to a minimum and are subject to Owner approval; if backup motions for tractor trailers are necessary, the backup path shall be as straight and short as possible. Dead-end roads shall be designed with adequate turnaround space for a tractor/trailer to turn around.

- (14) Roads shall be cleared of overhead obstructions (e.g., power lines) as necessary to complete the Work, including to support Wind Turbine deliveries.
- (15) Proof rolling shall be performed in the presence of a qualified, competent, practicing geotechnical engineer or his qualified representative. Proof rolling shall be performed using a fully-loaded tandem-axle truck with a minimum gross weight of 25 tons. An acceptable proof roll shall produce rutting of no greater than 2.0 inches and no “pumping” of soil beneath and/or behind the wheels of the loaded truck.
- (16) Roads shall meet all required design elements at Substantial Completion (as defined in the Agreement). For the avoidance of doubt, this shall include replenishing road aggregate, repairing road damage, repairing subgrade damage, and other loss of strength or stability that may have occurred during the course of construction.
- (17) Stabilization (e.g., cement, lime) of road subgrades shall be used as recommended in the Final Geotechnical report as may be beneficial to provide additional bearing capacity for permanently installed site roads.
 - (a) The civil engineer of record shall specify the quantity (percentage) of stabilization material to be used on the site roads as well as specify the process of installation, including testing.

4.1.7 Requirements for drainage and erosion control:

- (1) The working areas of the Project Site shall be well drained during and after construction, respectively. All drainage shall be away from buildings and foundations.
- (2) Erosion and sediment control, both during and after construction, shall be provided as required by the Requirements and the Contractor-provided SWPPP to retain sediment onsite and to control the erosion of embankments, temporary and final exposed slopes, and temporary stockpiles, as well to protect water quality as applicable. Silt fences, check dams, drainage ditches or swales, straw mulch, and pre-manufactured geotextiles, geotubes, geogrids, cellular geoweb, and other similar items (collectively, the “**Best Management Practices**” or “**BMPs**”) shall be utilized as appropriate.
 - (a) Temporary BMPs shall be biodegradable where possible.
- (3) Roadway cross sections shall be shaped to move water away from the road, such as crowning or cross-slopes, and roads shall be designed and constructed to prevent water ponding. Stormwater shall not channel flow across constructed roads. Sheet flows shall be collected and conveyed to culverts or low water crossings to safely pass stormwater flows.
- (4) Roads shall have no more than two percent (2%) crown, unless such roads will be utilized as crane paths, in which case the maximum crown shall be one percent (1%).
- (5) All stormwater flows shall be returned to their original drainage patterns and the Project shall not increase flow rates from their historic levels.

- (6) Culverts or low-water crossings shall be installed / constructed where required to pass existing stormwater concentrated flows. Culvert pipe ends, swales, and ditches shall be designed and constructed to control concentrated flow velocities and minimize erosion and siltation. Only culverts shall be used at entrances; low-water crossings are not allowed at entrances.
 - (a) Low-water crossings shall be installed in areas where a more diverse water flow during storm events would be beneficial (e.g., agricultural fields). Construction of drainage ditches or culverts is not allowed in agricultural fields unless explicitly approved by Owner.
 - (b) Low-water crossings shall be constructed with rock-filled geocells or 4.5” minimum thickness concrete blocks interlocked by woven stainless steel cables embedded within each block. Riprap and concrete geogrid mats are not allowed for use on low-water crossings.
 - (c) Culverts shall be corrugated galvanized metal pipe unless specified by the AHJ.
- (7) Wetlands impacts shall be avoided to the maximum extent practicable and are subject to regulatory approval or other applicable Requirements.
- (8) Synthetic, toxic, or otherwise harmful erosion-control materials shall be made inaccessible to livestock on or adjacent to the Project Site during the construction period.
- (9) Contractor may utilize an annual cover crop (e.g., oats) after any site grading activities to mitigate erosion. Such planting shall be consistent with the Requirements, including the SWPPP, environmental plans, and any landowner requirements.
- (10) Riprap used for drainage control measures shall be of a type and class approved by Owner prior to use.

4.1.8 Requirements for excavation and fill/backfill:

- (1) Materials suitable for use as fill or backfill at the Project Site shall include only materials that are free of debris, roots, stumps, organic matter, frozen matter, coal, ashes, cinders, stones larger than two (2) inches in diameter, slag, other deleterious materials, and as recommended by the Geotechnical Report. Surplus fill shall be spread on-Site and in areas and depths approved by Owner; surplus materials shall not be exported off-Site without the approval of Owner.
- (2) Permanent slope and rock stability measures shall be part of the Project design and shall incorporate the recommendations and requirements set forth in the Geotechnical Report. Safe stabilization for all slopes, regardless of the type of rock or soil conditions, shall be guaranteed including protection of all personnel and structures against any damage from cave-ins, heaving, or other earth movements.
- (3) Structural fill lifts shall not exceed a thickness of 8 inches. Other fill lifts shall not exceed a thickness of 12 inches.
- (4) Turbine Foundation embedment depth shall consider final height requirements for the applicable Turbine’s FAA DNH letter.

4.1.9 Requirements for crushed rock surfacing:

- (1) The maximum aggregate size for surface fill (i.e., crushed rock surfacing) shall not exceed 1.5 inches with less than ten percent (10%) particles passing the No. 200 sieve, including, but not limited to, that used for roadways, O&M Building, and laydown yard. Deviations shall be explicitly approved by Owner.
 - (a) Aggregate shall be MnDOT Class 5Q or Owner-approved equal and shall have a minimum of three (3) fractured faces.
- (2) Unless explicitly stated otherwise, all crushed rock surfacing shall be of thickness required by Project Site loading requirements, including those set forth in (i) the supplier Project Site Requirements and (ii) the geotechnical engineering report.
- (3) Unless explicitly stated otherwise, all aggregate shall conform to local department of transportation requirements and shall be free of debris, roots, organic matter, frozen matter, coal, ashes or cinders, or any other deleterious material.
- (4) An aggregate job mix formula shall be established prior to the start of fill operation based on recommendations from the final geotechnical engineering report. This mix shall not be changed without prior approval of Owner. Testing data, including sieve analysis, shall be submitted for all aggregate sources.

4.1.10 Requirements for fencing and gates:

- (1) All permanent fencing and gate materials, including for the Project Substation, O&M Building, and solar PV Array, and BESS shall be constructed in accordance with Applicable Permits and shall be galvanized in accordance with ASTM A392. All permanent fencing shall be appropriately grounded in accordance with the NESC, including any applicable rulings.
 - (a) Grounding shall be electrically separate for each continuous set of fencing/gates (e.g., Substation fencing shall be grounded separate from O&M Building fencing.
 - (b) If fencing for different parts of the Project is close in proximity, Contractor shall perform grounding studies to consider the potential contribution of electrical characteristics for each system in whole and in part.
- (2) Unless stated otherwise, permanent fencing shall be 8-foot-high (7-foot fence plus height of outrigger barbed wire), anti-climb, chain link, perimeter fencing with 2-inch diamond mesh. Fencing fabric or other visual screening shall be in accordance with the Applicable Permits, if applicable.
 - (a) Fencing fabric shall be 1- or 2-inch diamond mesh, #9 AWG, galvanized after weaving, Class II, conforming to ASTM A392, "Zinc-Coated Steel Chain-Link Fence Fabric".
- (3) Barbed wire shall be 45-degree outrigger and a minimum of 3-strand, #12-1/2 steel wire gauge with four (4) half-round barbs of #14 steel wire gauge at 5-inch spacing. After weaving, the wire shall be galvanized per ASTM A121. Barbed wire fencing posts shall be galvanized, standard-weight steel pipe.

- (4) For PV Array only, the permanent fencing shall be 8-foot-high galvanized steel game fence.
- (5) Unless otherwise noted, all vehicle gates shall be 16 feet wide (minimum), manual, swing gate that locks at the center (i.e., two 8-foot sections).
- (6) All pedestrian gates shall be 3 feet wide (minimum), locking, manual swing gate for personnel access.
- (7) Sufficient space and graded area shall be provided near each gate to allow truck turning.
- (8) All gates shall have tamper proof gate hinges and hardware. Gates along the perimeter fence shall include heavy duty bolt-cutter resistant padlocks, except for motorized-gates.
- (9) All corner posts and gate posts shall be set (embedded) in concrete.
- (10) All gates shall adequately contain livestock without being pushed open, bending, or otherwise failing. Further, all gates shall adequately prevent opening due to wind conditions expected at the Project Site.
- (11) Unless prohibited by the landowner, cattle guards shall be used along fields containing livestock and shall cover the full road width and be installed level and provided with a stable base capable of sustaining heavy loads without shifting or settling.

4.1.11 Requirements for structures:

- (1) All buildings, support structures, and equipment pads shall be constructed on competent material. All loose materials shall be removed from excavation bottoms. Unsatisfactory foundation subgrade material shall be removed and replaced with compacted structural fill material or with suitable concrete, as approved by Owner and the engineer of record.
- (2) Foundation designs shall neglect or degrade soil strength properties at the top of the foundation as a result of frost or disturbance during drilling per recommendations of the geotechnical engineer. All foundations shall be designed with consultation of a licensed geotechnical engineer as well as in consideration of the final geotechnical report.
- (3) All foundations and slabs-on-grade shall have a minimum projection of 6 inches above adjacent grade, except that concrete pier-type foundations shall have a minimum projection of 12 inches of concrete above adjacent grade.

4.1.12 Requirements for concrete:

- (1) Concrete for foundations shall have a specified compressive strength of not less than 5,000 psi Concrete.
- (2) Concrete materials shall be in accordance with the requirements set forth in Table 4-1 (Summary of Requirements for Concrete Materials) herein, at a minimum.
- (3) A nominal slump at the point of delivery shall be as shown in Table 4-2 (Slump Requirements) herein, as tested in accordance with ASTM C143.

Table 4-1: Summary of Requirements for Concrete Materials

Material	Material Requirements
Cement	ASTM C150, Type I, II, or V (as required)
Water	Clean, potable, and free from injurious amount of oil, acid, alkali, organic matter or other deleterious substances.
Coarse aggregate	Crushed stone, washed gravel, or other acceptable inert granular material conforming to ASTM C33
Fine aggregate	Clean natural sand, ASTM C33
Fly ash	ASTM C618; determined by Contractor and approved by Owner
Air-entraining agent	ASTM C260
Chemical admixture	ASTM C494; determined by Contractor and approved by Owner
Plasticizer	ASTM C494 / ASTM C1017; determined by Contractor and approved by Owner
Form oil	Light colored paraffin oil or other acceptable non-staining material
Curing agent	ASTM C309; determined by Contractor and approved by Owner
Floor sealer	ASTM C1315; determined by Contractor and approved by Owner
Concrete repair	Determined by Contractor and approved by Owner
Compound	Determined by Contractor and approved by Owner
Joint sealant	ASTM C1193; determined by Contractor and approved by Owner
Non-shrink grout	Determined by Contractor and approved by Owner
Pre-formed joint filler	Determined by Contractor and approved by Owner
Concrete / Grout	Minimum concrete and grout compressive strength to be determined by Contractor and approved by Owner, subject to minimum requirements specified herein

Table 4-2: Slump Requirements

Description	Minimum (inches)	Maximum (inches)
Reinforced walls and footings	2.0	5.0
Slabs on-grade	2.0	4.0
Drilled piers (dry, uncased, or permanent casing drill method)	4.0	6.0
Drilled piers (temporary casing drill method, wet and dry)	6.0	8.0
Drilled piers (slurry displacement drill method)	7.0	9.0

- (4) Cast-in-place concrete shall be in accordance with the latest applicable requirements of the ACI, ASTM, and CRSI, at a minimum.
- (5) Ready-mixed concrete manufacturing and delivery shall conform to ASTM C94.
- (6) Concrete for foundations shall have a specified compressive strength of not less than 5,000 psi. Non-structural concrete shall have a specified compressive strength of not less than 3,000 psi.

- (7) Concrete mix designs and concrete placement procedures shall be approved by Owner prior to use.
- (8) Aggregates shall be tested per ASTM C33 for potentially reactive materials. If such test results indicate that aggregates are reactive, an alkali-silica reaction (“**ASR**”) mitigation plan shall be provided.
- (9) Concrete shall be placed only in the presence of a duly-authorized representative of Contractor.
- (10) Concrete placement shall not be permitted when weather conditions or other pertinent factors prevent proper placement and consolidation.
- (11) Concrete shall be placed at a sufficient rate to ensure that lifts below have not taken initial set before fresh concrete is deposited. In any event, concrete shall be placed within 45 minutes after mixing. This period may be extended to 90 minutes provided that the combined air temperature, relative humidity, and wind velocity are such that the plasticity of the fresh concrete is satisfactory for placement and consolidation, and that the specified mixing water is not exceeded. Concrete which has partially set shall not be retempered but shall be discarded.
- (12) Concrete requirements shall be adjusted for hot weather:
 - (a) When hot weather conditions exist, including those that may impair the quality or strength of concrete, the concrete shall be placed in compliance with ACI 305R and as specified herein.
 - (b) Ingredients shall be cooled before mixing to maintain concrete temperature at time of placement below 90°F.
 - (c) Mixing water may be chilled, or chopped ice may be used to control the concrete temperature, provided the water equivalent of the ice is calculated to the total amount of mixing water.
 - (d) Reinforcing steel and formwork shall be cooled as required in accordance with ACI 305R, including through the use of a fog nozzle. Care shall be taken to avoid excessive fog application, causing surplus water to cling to reinforcement or stand on the concrete, or causing the concrete to wash away.
 - (e) Retarding admixtures shall not be used unless otherwise accepted in mix designs and shall be approved by Owner prior to use.
- (13) Concrete requirements shall be adjusted for cold weather:
 - (a) Cold weather concreting shall be in accordance with ACI 306R.
 - (b) After the first frost and until the mean daily temperature in the vicinity of the Work falls below 40°F for more than 24 hours, the concrete shall be protected against freezing for not less than 48 hours after it is placed.

- (c) Whenever the mean daily temperature in the vicinity of the Work falls below 40°F for more than 24 hours, the concrete shall be maintained at a temperature not lower than 50°F for at least 72 hours after it is placed and shall be protected against freezing for five (5) days immediately following the 72 hours of protection at 50°F. This continuance of protection against freezing shall be such that the drop in temperature of any portion of the concrete will be gradual and will not be lower than 40°F in 24 hours.
 - (d) When artificial heat is employed, special care shall be taken to prevent the concrete from drying.
 - (e) The use of calcium chloride will not be permitted.
 - (f) A non-corrosive, non-chloride set accelerating admixture may be used when approved by Owner.
 - (g) Concrete damaged by freezing shall be removed and replaced at Contractor's expense.
 - (h) Concrete shall not be permitted to freeze for at least seven (7) consecutive days following placement.
- (14) The maximum aggregate size for concrete shall not exceed 1.5 inches, unless otherwise specified with the exception of transmission line foundations where it shall not exceed 0.75 inches.
- (a) Smaller maximum aggregate size, such as 0.75 inches, may be necessary for pumped or tremie concrete.
 - (b) Rounded aggregates may be necessary to produce desired workability.
 - (c) Interconnection Line foundation aggregate shall not exceed 0.75 inches.
- (15) All exterior exposed concrete shall have an air content of 4.5 percent (4.5%) to 7.5 percent (7.5%).
- (16) Concrete shall be conveyed from mixer to forms as rapidly as practicable without segregation or loss of ingredients. Concrete shall be placed in forms nearly as practicable in final position to avoid re-handling.
- (17) Chutes, if used, shall slope sufficiently to ensure flow of properly proportioned concrete and must be kept free of hardened or partially set concrete.
- (18) Concrete shall be carried in at such a rate that the concrete is at all times plastic and flows readily into the spaces between the bars. No concrete that has partially hardened or been contaminated by poor material shall be used nor shall re-tempered concrete be used.

- (19) Immediately after depositing, concrete shall be compacted by agitating thoroughly in an approved manner to force out air pockets. The mixture shall be worked into corners around reinforcement and inserts to prevent formation of voids. Tapping or other external vibration of forms will not be permitted. Care shall be used in use of vibrators to prevent segregation of sand pockets or bleeding. Vibrators shall be moved continuously in and out of concrete, keeping stationary only a few seconds in any position. Vibrators shall not be used to transport concrete within forms.
- (20) For concrete poured within forms and not involving drilled pier construction, concrete shall not drop freely over five (5) feet in unexposed work or over three (3) feet in exposed work. Where greater drops are required, tremies, concrete pump, or other approved methods shall be used.
- (21) Concrete may be dropped into drilled piers installed using the dry method under the conditions that concrete shall not hit any reinforcing bars or sidewalls and that concrete with all aggregates shall be able to flow freely into the spaces between the reinforcing bars. The concrete shall be placed in the pier in one continuous operation unless agreed otherwise by Owner.
- (22) For concrete involving massive structures, including Foundations, concrete mix or construction procedure shall be modified such that excessive heat produced by hydration shall be prevented.
- (23) Cast-in-place concrete, at Contractor's option, may be placed by pumping in accordance with ACI 304; however, it shall use a specifically-designed mix for pumping concrete, as fine aggregate gradation and water and cement content are more critical and different from the regular concrete mix. The mortar used for lubricating the pumping equipment shall be discarded.
- (24) Concrete shall not be conveyed through aluminum or aluminum alloy pipes.
- (25) Maximum water/cement ratio: 0.45.
- (26) Joints:
 - (a) A good bond and watertight joint are required at construction joints.
 - (b) Joints shall be obtained by adequately preparing and protecting the surface of the first pour or lower part of the construction joint.
 - (c) Joint surface shall be level and reasonably rough, clean, moist and some aggregate particles should be exposed. Any laitance or soft layers shall be removed from the top surface of the hardened concrete.
 - (d) Foundations shall not have joints, unless approved by Owner and only for the base and pedestal interface in a spread footer foundation.
- (27) All fins and other surface projections shall be removed from all formed surfaces.
- (28) All surfaces are to be at the specified elevation and left true and level.

- (29) Surfaces that will be exposed shall be cleaned and rubbed to produce a smooth, uniform surface that is free of marks, voids, surface glaze, and discoloration. Slab foundations shall receive a light broom finish. Care shall be taken to see that all excess water is removed before making any finish.
- (30) The unformed surfaces of concrete shall be screened and given an initial float finish followed by additional floating and troweling as required. Precaution shall be taken by Contractor to protect the finished surface from stains and abrasions.
- (31) The removable ends of all form ties shall be removed and the recesses resulting from such removal shall be filled with dry patching mortar.
- (32) “Cure & Seal 1315 UV” curing compound, manufactured by Symons Corporation, or an approved equal, shall be applied to all outside foundations to a depth of 12 inches below final ground grade.
- (33) Concrete shall be protected from loss of moisture by membrane curing compound and the curing medium shall be maintained so as to prevent detrimental loss of water from the concrete for the duration of the entire curing period.
- (34) Unhardened concrete shall be protected from heavy rains, flowing water, excessive heat, or mechanical damage. Finished surfaces shall be protected from stains, abrasions, or physical damage.
- (35) Defects:
 - (a) Defects in formed concrete surfaces shall be repaired within 24 hours, and defective concrete shall be replaced within 48 hours, after the adjacent forms have been removed.
 - (b) All concrete which is porous, honeycombed, or otherwise defective shall be repaired.
 - (c) Defective concrete shall be repaired by chipping out the unsatisfactory material to a minimum depth of 0.5 inches and placing new concrete, which shall be formed with keys, dovetails, or anchors to attach it securely in place with Owner approval.
 - (d) Concrete surfaces, including structural concrete, that contain defects which adversely affect durability, strength, and/or appearance shall be repaired by a method approved by Owner or replaced.
- (36) Concrete testing:
 - (a) Prepare concrete test cylinders conforming to ASTM C31 prior to the first pour of each day, and at a rate of not less than one set of cylinders for each 50 cubic yards or fraction thereof and not less than one set for each foundation or structure.
 - (b) Field slump tests in accordance with ASTM C143 shall be performed, at a minimum, prior to the first batch of concrete produced each day and with each set of test cylinders. Adjustment or fixing of concrete *in situ* shall not be allowed.

- (c) Air content, concrete temperature, and air temperature tests shall be performed for the first batch of each day and with each set of test cylinders. All testing shall be done in accordance with the requirements of ASTM C231 (air) and ASTM C1064 (temperature).
- (d) Concrete test reports shall be provided to Owner within 72 hours of testing but not less than 24 hours in advance of commencing placement of equipment at that location. In the event of failure of any concrete test, Owner shall be immediately notified and a repair/remediation plan shall be provided.

4.1.13 Requirements for grout:

- (1) Grout shall be (a) cementitious grout conforming to ASTM C1107 or (b) epoxy grout with a coefficient of expansion (as determined by ASTM C531) as determined by the engineer of record. All grout shall be non-ferrous, non-shrink, prepackaged/factory-packaged grout and fit for purpose.
 - (a) Type of grout utilized should consider freeze/thaw cycles and the use of de-icing agents.
 - (b) The engineer of record shall specify the required permanent strength as well as the strength required during construction (e.g., bolt post-tensioning).
 - (c) Grout strength shall be greater than the strength of the concrete it is placed on.
- (2) Grout specifications and grouting plans/procedures shall be approved by Owner prior to use.
- (3) Grouted surfaces that contain defects which adversely affect durability, strength, and/or appearance shall be repaired by a method approved by Owner or they shall be replaced.
- (4) Grout shall be tested in accordance with ASTM C109 (for cementitious grout) or ASTM C579 (for epoxy grout) and at a frequency as specified by the engineer of record.
- (5) Grout test reports shall be provided to Owner within 72 hours of testing but not less than 24 hours in advance of commencing placement of equipment at that location. In the event of failure of any grout test, Owner shall be immediately notified and a repair/remediation plan shall be provided.

4.1.14 Requirements for forms:

- (1) Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the drawings.
- (2) Forms shall be substantial and sufficiently tight to prevent leakage and shall be properly supported and braced to maintain position and shape. Forms for all exposed surfaces shall produce smooth, dense, and true finishes free of fins, imperfections, or other defects.
- (3) Forms shall be cleaned and oiled before concrete is placed. Oil is to be applied before reinforcement is placed.

- (4) Formwork for walls, columns, sides of beams, gravity structures, slabs-on-ground, and other vertical-type formwork not supporting the weight of concrete shall remain in place for at least 24 hours after concrete placement is completed.
- (5) Formwork supporting weight of concrete and shoring shall not be removed until structural members have acquired sufficient strength to safely support their own weight and any construction or other superimposed loads to which the supported concrete may be subjected.
- (6) Forms may be of wood, plywood, concrete-form-grade hardboard, metal or other acceptable material, which will produce smooth, true surfaces.
- (7) Metal forms shall have smooth surfaces free from any pattern, irregularities, dents, or sags.
- (8) Commercial formulation form-coating compounds shall be used that will not bond with, stain, nor adversely affect concrete surfaces, nor impair subsequent treatments of concrete surfaces requiring bond or adhesion, nor impede wetting of surfaces to be cured with water or curing compound.
- (9) Form ties shall be factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal. For concrete that will be exposed, provide ties so portion remaining within concrete after removal is at least 1.5 inches inside concrete. Form ties shall not leave holes larger than 1 inch in diameter in concrete surfaces.
- (10) Remove forms in a manner to avoid damage to the structure, with particular care for corners and edges.

4.1.15 Requirements for drilled piers:

- (1) All drilled piers shall be designed consistent with the primary load application, either as laterally loaded piers or as compression/uplift piers.
- (2) Circular shafts shall be dug by means of a power driven rotary bucket or auger type drilling rig.
- (3) Diameter and location of piers shall be as per the design.
- (4) A steel lining shall be used for soil conditions that make it necessary to protect personnel, prevent cave-ins, or hold out ground water. Linings shall be withdrawn concurrent with placement of concrete in such a manner as to prevent formation of rock pockets or ground water mixing with concrete. Concrete shall have sufficient head above bottom of lining being withdrawn to hold out water and maintain shaft diameter.
- (5) Concrete reinforcement shall be placed in dry pier excavation, unless otherwise approved by Owner, clear of all loose earth, gravel, and rock.
- (6) Concrete shall be placed in continuous operation to top of pier elevation, using an elephant trunk, concrete pump, or other approved method. Time delays between shaft drilling and concrete placement shall be minimized particularly in unstable and/or granular type soils prone to sloughing or caving.

- (7) When it is necessary to place concrete under water, a tremie pipe or concrete pump shall be used. The lower end of the tremie pipe shall be kept submerged in the concrete throughout concrete placement.
- (8) All methods used to design and construct drilled piers shall be in accordance with ACI 336.1.
- (9) Permanent casings shall not be used without prior approval by Owner.
- (10) The volume of concrete required for each drilled shaft shall be plotted on a graph of concrete volume versus depth.

4.1.16 Requirements for driven piles:

- (1) All driven piles shall be designed consistent with the primary load application, either as laterally loaded piles or as compression/uplift piles.
- (2) Driven piles shall be galvanized (or equivalent) corrosion resistant, including as required and/or recommended by geotechnical investigations.
- (3) Driven pile foundations shall be designed to consider dead loads, live loads, snow loads, wind loads, seismic loads, thermal loads, vehicle loads, soil and hydrostatic pressure loads, combinations of loading conditions, and any other loading conditions applicable to the Projects Site. Such loads shall be consistent with geotechnical investigations and recommendations.

4.1.17 Requirements for reinforcing bar:

- (1) All reinforcing bars shall conform to ASTM A615 and have a minimum yield strength of 60 ksi. All reinforcing steel, including welded wire mesh, shall be accurately located and held in position using proper reinforcing steel supports, spacers, and accessories in accordance with ACI SP-66 “*Detailing Manual*” and CRSI’s “*Manual of Standard Practice*”.
- (2) At time of placing concrete, all reinforcing shall be free of loose rust, scale, oil, paint, mud or other coatings which may destroy or reduce the concrete bond.
- (3) Where not otherwise specified, the minimum coverage of concrete over steel shall be as follows:
 - (a) Concrete cast against and permanently exposed to earth: 3 inches.
 - (b) Formed concrete exposed to earth or weather: 2 inches.
 - (c) Concrete in beams and columns not exposed to ground or weather: 1.5 inches.
 - (d) Concrete slabs and walls not exposed to weather: 1.5 inches.
- (4) Concrete shall be placed at a consistent coverage thickness / depth over all rebar (e.g., all areas with a required minimum of 3 inches of cover shall have a consistent thickness of 3 inches, without significant increases).

4.1.18 Requirements for anchor bolts:

- (1) Cast-in-place:
 - (a) Anchor bolts shall be properly located, accurately positioned, and maintained securely in place before placing of concrete. The threads on the upper end of each anchor bolt shall protrude sufficiently to satisfy the Requirements and adequately complete tensioning activities.
 - (b) Prior to setting anchor bolts, the threads on the upper end of each anchor bolt shall be given a light coat of oil or grease to prevent adherence of concrete. When installed, anchor bolts shall be cleaned and the portions to be embedded in concrete shall be cleaned and free of oil or other deleterious substances which would adversely affect the bond between the bolt and concrete, unless otherwise specified by the Equipment suppliers.
 - (c) During the concrete finish and clean-up, concrete adhering to the portions of the anchor bolt extending above finished concrete grade shall be removed giving particular attention to concrete at the finish grade line which would prevent base plates from seating fully on the finished concrete elevation.
 - (d) Furnish sizes, types, and quantity as required by the Equipment supplier and to transfer the necessary loads to the concrete.
 - (e) Galvanize all anchor bolts, nuts, and washers except stainless steel.
- (2) Post-installed:
 - (a) Furnish sizes, types, and quantity as required by the Equipment supplier and to transfer the necessary loads to the concrete.
 - (b) Furnish and install manually expanded and adhesive anchor types.
 - (c) Install to conform to manufacturer's printed instructions.
 - (d) Installed adhesive anchors shall not be disturbed or loaded until the anchor has been in place longer than the manufacturer's cure time for the adhesive.
 - (e) Anchors shall be hot-dipped galvanized or stainless steel as required by the Equipment supplier.

4.1.19 Requirements for steel:

- (1) Design of hot-rolled structural and miscellaneous steel shall be in accordance with the American Institute of Steel Construction (AISC) "Manual of Steel Construction". Design of structural and miscellaneous steel shall also be in accordance with National Electrical Manufacturers Association (NEMA) "SG6" and "TT1", American Society of Civil Engineers (ACSE) "Guide for the Design of Steel Transmission Towers, Manual No. 52" and the International Code Council "International Building Code". Design of cold-formed steel shall be in accordance with the American Iron and Steel Institute (ANSI) "North American Specifications for the Design of Cold-Formed Steel Structural Members".
- (2) Materials for structural steel and miscellaneous steel shall conform to the following requirements of the American Society for Testing and Materials:

- (a) Wide Flange (WF) Shapes and Tees cut from WF: ASTM A992, Grade 50 or multi-certification A36/A572, Grade 50.
 - (b) M shapes, S shapes, HP (Bearing Piles), Channels, and Angles: ASTM A36
 - (c) Structural Plates and Bars: ASTM A36
 - (d) Square/Rectangular Hollow Structural Sections (HSS): ASTM A500 Grade B
 - (e) Pipe: A53, Grade B
- (3) High strength bolts, nuts, and washers shall conform to ASTM A325, ASTM A563, and ASTM F436 respectively and shall be galvanized in accordance with ASTM A2329.
 - (4) Bolts, nuts and washers under one-half inch in diameter shall conform to ASTM A307, Grade B, ASTM 563 and ASTM F844 respectively and shall be galvanized in accordance with ASTM F2329.
 - (5) Anchor bolts, anchor bolt assemblies and concrete embedments shall be galvanized.
 - (6) Anchor bolts shall conform to ASTM A449, ASTM F1554, Grade 36, or A307. Anchor bolt sleeves shall conform to ASTM A501.
 - (7) Design and fabrication shall be according to AISC 360 “Specification for Structural Steel Buildings”, AISC 303 “Code of Standard Practice for Steel Buildings and Bridges”, and AISC 341 “Seismic Provisions for Structural Steel Buildings”.
 - (8) High-strength structural steel shall be identified according to ASTM A6/A6M and maintain markings until structural steel has been erected. Materials shall be marked and match-marked for field assembly.
 - (9) Structural-steel assemblies shall be completed, including welding of units, before starting galvanizing operations.
 - (10) High-strength bolts shall be shop installed according to the RCSC’s “*Specification for Structural Joints Using ASTM A325 or A490 Bolts*” for type of bolt and type of joint specified.
 - (11) Built-up sections shall be assembled and welded by methods that will maintain true alignment of axes without exceeding tolerances of AISC’s “*Code of Standard Practice for Steel Buildings and Bridges*” for mill material.
 - (12) Weld connections shall comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding Work.
 - (13) Weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel shall be verified that they will limit distortions to allowable tolerances. Butt welds shall be ground flush. Exposed fillet welds shall be ground or filled to smooth profile. Exposed welds shall be dressed.
 - (14) Zinc coating shall be applied by the hot-dip process to structural steel according to ASTM A123/A123M.

- (15) All structural welding shall conform to the requirements of AWS D1.1.
- (16) Galvanizing, as specified herein, shall conform to the requirements of ASTM A123, ASTM A153 or ASTM A2329, as applicable.
- (17) Stainless steel shall conform to ASTM A167.
- (18) Vent holes shall be filled and ground smooth after galvanizing.
- (19) Equipment support structures shall be low profile (non-lattice) framing consisting of galvanized structural steel tubing and rolled shapes as the basic structural element. Steel support structures shall be designed, fabricated, and erected in accordance with the provisions of the AISC.

4.1.20 Requirements for aluminum:

- (1) Design of structural and miscellaneous aluminum shall be in accordance with the latest version of the Aluminum Association – “Aluminum Design Manual” and “Aluminum Standards and Data”.
- (2) Materials for structural and miscellaneous aluminum, including structural shapes and plate, shall conform to ASTM B209 and ASTM B308 and shall be aluminum alloy 6061-T6.
- (3) Bolts and nuts shall conform to ASTM F468 and ASTM 467, respectively and shall be aluminum alloy 6061-T6. Washers shall be aluminum-clad steel Alclad 2024-T4 or approved equal.

4.1.21 Requirements for structural loading:

- (1) Contractor shall determine all Site data for the design and construction of the plant. This shall include determination of local code requirements for seismic and wind design loads. It is the Contractor’s sole responsibility to ensure that the plant structural and architectural facilities comply with all federal, state, and local code requirements and all industry codes and standards.
- (2) Structural loads shall be applied with post embedment depth accounting for maximum scour associated with 100-year storm event.
- (3) Dead loads shall include all vertical loads due to weight of permanent structural and nonstructural components, including permanent hung loads.
- (4) Live loads shall be in accordance with the IBC and the most recent ASCE 7 standard as modified by the applicable agency local additions and addenda.
- (5) Snow loads shall be in accordance with the IBC and the most recent ASCE 7 standard as modified by the applicable agency local additions and addenda

- (6) Wind loads shall be in accordance with the adopted versions of the IBC and the most recent ASCE 7 standard, as modified by the applicable agency local additions and addenda. PV module wind tunnel testing method is permitted upon explicit Owner consent. Irrespective of any wind tunnel testing results, the minimum design wind pressure shall be no less than 10 psf applied normal to the face of each PV module. The PV module rack shall be designed in such a way that deflections due to wind will not damage the PV modules. Contractor shall ensure that the PV modules support foundations can withstand the uplift due to wind loading.
- (7) Seismic loads shall be in accordance with the adopted versions of the IBC and ASCE 7, as modified by the applicable agency local additions and addenda. The soil profile type shall be determined by the Contractor based on the results of a subsurface investigation, which shall be obtained by the Contractor.
- (8) Buildings and structures shall be designed for forces and/or movements resulting from changes in temperature. Induced thermal loads (i.e., thermal loads induced by equipment operating temperatures) shall be considered in design of applicable structural elements.
- (9) Design loading for areas accessible to vehicles loads shall be in accordance with AASHTO HS20.
- (10) Earth pressure and hydrostatic pressure loads shall be based on the geotechnical conditions and groundwater levels at the project site.
- (11) In addition to the aforementioned loading criteria, overhead transmission loads shall also conform to ASCE Manuals and Reports on Engineering Practice No. 74 “Guidelines for Electrical Transmission Line Structural Loading”, NESC requirements, and Section 4.14 of this specification. Where there is a conflict between requirements, the more stringent requirement shall apply.
- (12) Load combinations shall be in accordance with the IBC and ASCE 7-05. Contractor shall be responsible for determining and complying with any additions or addenda to this code as may be applicable to the County or AHJ in which the Project is located.

4.1.22 Requirements for bollards:

- (1) Bollards shall be a minimum 3-inch diameter steel or PVC pipe, concrete filled for equipment protection (minimum 2000 psi), safety yellow (either painted or with a plastic sleeve) and extend four (4) feet above grade with at least six (6) inches below the bollard for concrete. Bollards shall be installed no closer than two (2) feet from equipment.

4.2 Submittals

4.2.1 Contractor shall prepare the civil works design documents per the submittal schedule in Exhibit G.1 (Submittal Schedule) and containing the following information, at a minimum: (a) design basis; (b) plan views of Project Site, including all access / site roads, crane paths, staging / laydown areas, Project Substation location, and Interconnection Line route; (c) grading and drainage plans; (d) details for erosion control, fencing, gates, compaction, and road cross sections; (e) properties for backfill / fill and road materials; (f) public road improvements; (g) drawing index; and (h) inspection, testing, and quality control requirements.

4.2.2 Contractor shall prepare foundation and structural design documents per the submittal schedule in Exhibit G.1 (Submittal Schedule) and containing the following information, at a minimum: (a) design basis; (b) plan and profile view of foundation and structural steel design, including cross sections; (c) details for reinforcing steel, conduit, and grouting; (d) civil works requirements; (e) structural calculations, to be provided with each set of foundation design drawings; (g) rebar shop drawings; (h) drawing index; (i) bill of materials; and (j) inspection, testing, and quality control requirements.

4.2.3 Contractor shall provide a pre- and post-construction hydrology study for the Project. Such study shall include a two-dimensional analysis of the Project area to determine specific flooding hazards (depth, velocity) at all locations within the Project Site boundary; such information shall be presented in a maximum 50-foot grid size and native (*.SHP) files shall be included. The hydrology study shall include an analysis of the following storm events: (a) 10-year, 24-hour; and (b) 100-year, 24-hour.

- (1) The hydrology study shall make recommendations for flood mitigation and permitting for the applicable jurisdiction.
- (2) The hydrology study shall identify any existing drainage structures within the Site and provide information on incoming stormwater flows for the storm events noted herein.

4.2.4 Contractor shall provide a stormwater pollution prevention plan (the “SWPPP”) for the Project and shall maintain all aspects of the SWPPP, including the maintenance of the BMPs, during the entire course of construction and site restitution/reclamation process. Contractor shall maintain all SWPPP BMPs until the construction stormwater permit and/or local erosion control permit is terminated.

4.2.5 Contractor shall prepare concrete mix designs and placement procedures. All such submittals shall be approved by Owner prior to use. Each mix design submitted by Contractor shall be accompanied by documentation of achieving Project-specific compressive strength requirements per ACI procedures.

4.2.6 Contractor shall prepare an aggregate job mix formula based on recommendations from the final geotechnical engineering report. Each formula shall be approved by Owner prior to use and shall be accompanied by testing data, including sieve analysis, for each aggregate source.

4.2.7 Contractor shall submit all manufacturer’s product sheets (material cut sheets), mill certificates, warranties, and operations and maintenance manuals (as applicable) for all permanently-installed equipment and materials. This shall include, but is not limited to, geotextile fabric, permanent gates, permanent culverts, block mesh / flexamat (or similar) if used for low-water crossings (if allowed), anchor bolts, rebar, curing compounds, joint compounds, crack repair compounds, sealants, corrosion inhibitors, and grout.

4.2.8 Contractor shall submit all quality control field test reports or inspections and any of the testing and quality control documentation noted in Section 4.14 within three (3) days of receipt of such report and within one (1) day of receipt of a failed test result.

4.3 Construction Surveys

4.3.1 Contractor shall provide boundary and topographical survey(s) for the design of the civil site work. Contractor may utilize surveys of applicable Right of Way (ROW) dedication prepared by Owner as may be available and required for the performance of the Work.

4.3.2 Contractor is responsible for the construction surveying and staking. All construction surveying and staking shall be performed under the supervision of a surveyor licensed in the applicable state. Environmentally sensitive areas shall be flagged in a color different from other flagged items.

4.3.3 Contractor shall be responsible for clearing the Site of any sensitive species as may be required of local, state, or federal permits or other such agency or plan for the protection of such sensitive species.

4.3.4 Contractor shall provide, as necessary, a qualified archaeological monitor to evaluate any potentially significant archaeological material identified during construction activities. Significant archaeological material is not anticipated, but unknown significant resources may be unearthed during site preparation activities. Contractor shall avoid disturbing significant archaeological material if identified in the field, shall allow the archaeological monitor to evaluate the material, and shall follow the instructions of the archaeological monitor regarding avoidance or treatment of the resource(s).

4.4 Project Site Preparation

4.4.1 Contractor shall provide all Project Site preparation as necessary to complete the Work, including, but not limited to, all clearing, grubbing, stripping, grading, compaction, demolition, blasting, excavation, soil stabilization, and drainage.

- (1) Topsoil shall be stockpiled for later use at the Project Site during landscape reclamation activities. Topsoil shall not be moved or transported to other areas from which it was originally removed. Topsoil shall be stockpiled only in areas designated where it will not interfere with construction operations or existing facilities. Stockpiled topsoil shall be reasonably free of subsoil, stumps, roots, debris, and stones larger than two (2) inches in diameter. Topsoil shall not be used as structural fill. Appropriate erosion control measures shall be utilized on stockpiled topsoil.
- (2) Root mats and stumps shall be completely removed from the Project Site construction areas; holes refilled with select material and compacted adequately for the ultimate expected loading for the material used; and graded to drain.

4.4.2 Contractor shall provide and maintain throughout the duration of construction activities all necessary construction surveying and marking necessary to construct the Project and complete the Work, to include, but not limited to, (a) grading limits; (b) limits of disturbance; (c) laydown and storage areas; (d) culturally-, archeologically-, and/or environmentally-sensitive areas; (e) utilities, pipelines, and other buried facilities; (f) major Equipment locations; (g) Site Access Roads and crane paths; (h) Project Substation pads; (i) Collection System Circuit routing; (j) Interconnection Line routing, including centerline and structure locations; and (k) O&M Building, including pads and parking area.

- (1) Contractor shall be solely responsible for locating any survey monuments at or near the Project Site and shall replace such monuments if they are disturbed during performance of the Work.
- (2) All structure foundations shall be surveyed and staked prior to excavation. The methods of staking and final alignment shall be designed such that the finished condition of the Work meets the requirements for alignment, position, elevation, and rotation.

4.4.3 Contractor shall maintain all construction areas throughout the duration of the Work. Maintenance of such areas shall include washboard removal, pothole removal, snow removal, cleaning of silt and debris from cattleguards, and other similar items, in a condition suitable for daily construction traffic. Maintenance by Contractor of graveled roads at the Project Site is included in these maintenance requirements.

4.4.4 Contractor shall furnish, install, and maintain temporary orange snow fencing around all archeologically-, culturally-, and environmentally-sensitive areas at the Project Site, including those identified in the Applicable Permits. All temporary fencing shall be removed at the completion of construction.

4.4.5 Contractor shall excavate and remove all rock as necessary to complete the Work, including any necessary blasting. Contractor shall notify Owner prior to the use of explosives at the Project Site; no blasting shall be performed without explicit written confirmation by Owner.

4.4.6 Contractor shall leave no rocks greater than 4 inches in diameter on the ground surface and shall leave the site in such a condition that it is easily walkable and can easily be transited by construction buggies. Larger rocks shall be crushed or removed from site.

4.4.7 Contractor shall minimize grading of the site to the degree practical in an effort to minimize potential drainage impacts.

4.4.8 Contractor shall control invasive weeds during construction through final completion. Special emphasis shall be given to non-native species.

4.4.9 Contractor shall be responsible for reporting the discovering of any cultural or historic resources including potential human remains and managing their discovery in accordance with AHJ requirements. Contractor shall inform all persons working on the Project Site that knowingly disturbing cultural resources or collecting artifacts is prohibited and shall ensure that any cultural resources discovered in the process of construction are protected by halting work within 100 meters of the discovery until receiving a notice to proceed from Owner or Owner's representative.

4.5 Site Roads

4.5.1 Contractor shall design, furnish, construct, and install all roads, including Site Access Roads and Site Maintenance Roads, temporary turnarounds, intersection/radius improvements, crane paths, and transitions to/from existing roads in conformance with the minimum requirements below. Access roads shall include a road to each Wind Turbine, solar array section, BESS module, Project Substation, O&M Building, at a minimum.

- (1) Roads shall be constructed within permitted boundaries and shall be subject to grading permit review and approval, if required, from the agency(ies) having jurisdiction.
- (2) Roads shall be installed parallel- or orthogonal-to existing roads, fence lines, property lines etc. wherever possible and shall consider the surrounding land use impacts (e.g., farming of row crops) during the Project's operation.
- (3) Road design shall consider the potential for snow drifts developing across the road and include measures to limit its impact on the road.

4.5.2 Contractor shall repair all wear, tear, and other damage to roads during and throughout construction of the Project, including, but not limited to, that which is caused by traffic, weather, and installation activities of Project infrastructure (e.g., collection trenching). Maintenance of Project roads by Contractor shall include, but not be limited to, washboard removal, pothole removal, snow removal, and dust control. Contractor shall propose a plan for remediation of damaged roads and Owner shall review and approve such plans prior to application.

4.5.3 Contractor shall furnish and install a gate and/or cattleguard at every location where a roadway penetrates an existing fence line at the Project Site, in accordance with the requirements in Section 4.1.10 and the landowner requirements.

4.5.4 Contractor shall design and prepare the site roads at the Project consistent with the traffic management plan as further described in Section 2.5.1(7) and to facilitate a smooth traffic pattern for Equipment deliveries, especially deliveries of PV modules. Such design shall take into consideration back tracking, access for emergency vehicles, and shall be consistent with the Road Use Agreement at a minimum.

4.6 Public Roads

4.6.1 Contractor shall design, furnish, construct, and install all public road improvements in accordance with any road use agreements, including upgrading and maintaining any public roads, bridges, and culverts as specified therein.

4.6.2 Contractor shall maintain graveled public roads within the Site boundary throughout construction of the Project, including dust control, washboard removal, and pothole removal.

4.6.3 Contractor shall, prior to mobilization to the Project Site, digitally video and document the condition of existing public roads and perform and pre-construction testing to provide a baseline to quantify the extent of any Contractor-caused wear and tear. Following construction and demobilization of all large vehicles from the Project Site, Contractor shall perform the same series of road tests post-construction.

4.7 Equipment Foundations

4.7.1 Contractor shall design, furnish, construct, and install foundations as required for Equipment, in conformance with the minimum requirements set forth herein.

- (1) Contractor shall furnish all labor, equipment, and materials that are necessary for a complete, fully-functional, and safe Equipment Foundation configuration.
- (2) Equipment foundations shall, at a minimum, be designed using the final Geotechnical Report, including allowable soil bearing pressure values determined by geotechnical investigation from soil borings at each specific equipment site/locations and equipment loads provided by the suppliers.
- (3) Foundation materials, including rebar, anchor bolts, forms, concrete, and grout, shall comply with the applicable structural requirements in Section 4.1 herein.
- (4) Contractor shall provide all necessary dewatering of foundation excavations.
- (5) Foundations shall be designed and installed to prevent frost heave.

4.8 Building Foundations

4.8.1 Building and equipment foundations shall be of reinforced concrete and shall include all formwork, rebar, waterstop, etc.

4.9 Corrosion Protection

4.9.1 In general, all exposed carbon steel surfaces shall be treated for corrosion protection, if applicable. Contractor shall design and specify corrosion protection systems, which shall include surface preparation measures, for the following conditions:

- (1) Carbon steel exposed to ambient environmental conditions (i.e. PV module support structure, if applicable)
- (2) Carbon steel exposed to soil conditions below grade (i.e., driven or augured piles, if applicable). This coating shall be designed such that it is not damaged during installation. The Contractor shall consult a corrosion engineer to recommend corrosion protection measures based on the soil conditions. Submit the corrosion engineer's recommendations to the Owner for information and acceptance of the recommendations.

4.9.2 Stainless steel and galvanized steel shall not be painted.

4.10 Drainage and Erosion Control

4.10.1 Contractor shall furnish, construct, install, and maintain all temporary construction and permanent drainage or erosion and sediment control, as necessary to control the erosion of embankments, temporary and final exposed slopes, and temporary stockpiles, and including the use of Best Management Practices (as defined above) all in conformance with the minimum requirements set forth herein, including Section 4.1.7 and the preliminary design documents in Exhibit D.3 (Preliminary Design Documents).

4.10.2 Contractor shall furnish, construct, and install any necessary controls to protect water quality.

4.10.3 Contractor shall continuously monitor construction operations to avoid creating conditions that could lead to excessive erosion of soil with surface runoff from Work areas.

4.11 Dust Control

4.11.1 Contractor shall provide construction dust control at the Project Site throughout the duration of the Work, including furnishing of all labor, equipment, and materials, including water and/or palliatives, necessary for dust control and as necessary to reduce the risk of dust becoming a nuisance. Water used for dust control shall be treated to ensure no negative impacts to human health and ecology, including downstream environments; for the avoidance of doubt, potable water is not required for dust control, and treatment of the water source utilized by Contractor for dust control is only required to the extent necessary to comply with the Requirements.

4.12 Wind Turbine Foundations

4.12.1 Contractor shall design, furnish, construct, and install one (1) Turbine Foundation per Wind Turbine location, including grounding, in conformance with the minimum requirements set forth herein.

- (1) Contractor shall furnish all labor, equipment, and materials that are necessary for a complete, fully-functional, and safe Turbine Foundation configuration.
- (2) Turbine Foundations shall be conventional spread footing / gravity-type foundations. No alternate Turbine Foundation type, including P&H or rock anchor, shall be utilized without Owner approval.
- (3) Turbine Foundations shall be reinforced concrete designed in accordance with Turbine Supplier Project Site Requirements, the Applicable Standards, and the Requirements.
- (4) Turbine Foundations shall, at a minimum, be designed using the final Geotechnical Report, including net allowable soil bearing capacity values determined by geotechnical investigation from soil borings at each specific Wind Turbine site and equipment loads provided by Turbine Supplier. No portion of Turbine Foundations shall be constructed on fill material or within ten (10) feet of a fill slope without Owner approval.
- (5) Turbine Foundations shall include a grounding grid. The design and construction of the grounding system in such foundations shall meet or include the following requirements, at a minimum: (a) Turbine Supplier Project Site Requirements; (b) incorporate the recommendations, values, and minimum requirements set forth in the Geotechnical Report; (c) installation of adequate ground for personnel safety, including touch and step potentials (to be demonstrated by Contractor via calculations in the grounding study); (d) incorporate local resistivity measurements; and (e) a ground resistance ≤ 10 ohms.
- (6) Turbine Foundation anchor bolts shall have a minimum projection of two (2) anchor bolt diameters beyond the tightened anchor nuts. After all anchor bolts have been tensioned or torqued; a minimum of ten percent (10%) of the anchor bolts shall be tested to verify that the final design tension has been achieved. Tensioning records shall be maintained for initial tensioning and subsequent verification testing. Exterior foundation anchor bolt projections shall be coated with UV-resistant anti-seize coating applied to all exposed metal and covered with climate appropriate bolt covers that seal to the tower flange. Prior to coating, anchor rods shall be clean and free of oil and foreign materials.
- (7) Turbine Foundation materials, including rebar, anchor bolts, forms, concrete, and grout, shall comply with the applicable structural requirements in Section 4.1 herein.
- (8) The area surrounding the Turbine Foundation shall be constructed with a grade of two percent (2%) sloping away from the Turbine Foundation for the greater of (a) 25 feet from the edge of the pedestal or (b) the distance calculated as 1 foot from the bottom outer edge of the base plus the distance to the surface at a slope of 1H:2V from the bottom of the excavation.
- (9) Contractor shall provide all necessary dewatering of the Turbine Foundation excavation.
- (10) Each Turbine Foundation shall include thermocouples for concrete temperature monitoring in accordance with ACI 306R and ACI 308R and at a minimum one (1) near the center of the foundation and one (1) near the mid-point of the slope of the foundation spread footing near the concrete surface.
- (11) Turbine Foundations shall be designed by a professional engineer with experience designing wind turbine foundations

- (12) After placement of concrete, seal the space between the anchor bolt and the anchor bolt sleeve to prevent water from entering the sleeve annulus prior to setting of tower and grouting of baseplate.

4.12.2 Contractor shall furnish and install the subgrade improvements set forth in the Geotechnical Report, including overexcavations, geopiers, and subgrade densification as described therein.

4.13 Wind Turbine Pads

4.13.1 Contractor shall design, furnish, construct, and install one (1) Wind Turbine Pad per Wind Turbine location in conformance with the minimum requirements set forth herein and the preliminary design documents in Exhibit D.3 (Preliminary Design Documents). Contractor shall maintain the Wind Turbine Pads throughout the duration of the Work.

- (1) Wind Turbine Pads shall be sufficient in size to allow for simultaneous offloading, storage, and assembly of all Wind Turbine components, including, but not limited to, rotor, nacelle, and tower sections.
- (2) Wind Turbine Pads shall comply with the Turbine Supplier Project Site Requirements and the applicable erection crane bearing pad and critical lift requirements.
- (3) Wind Turbine Pads shall be cleared of crops, brush, boulders, and other debris around each Turbine Foundation, up to the pad limits, and shall be continually maintained to ensure a safe working environment.
- (4) Wind Turbine Pads shall not exceed two percent (2%) grade, or less if required for the safe execution of Work, including Wind Turbine assembly, storage, or erection.
- (5) Wind Turbine Pads shall have a competent, compacted soil working surface with subgrade cleared and compacted to at least 95 percent (95%) of the maximum density within the moisture content of two percent (2%) below optimum to two percent (2%) above optimum, as determined by ASTM Standard D698, unless a higher level of compaction is required by the Geotechnical Report or the Turbine Supplier Project Site Requirements.
- (6) Crane pads shall be designed and constructed to allow for use of cranes in ongoing Wind Turbine maintenance activities following construction (e.g., cranes required for gearbox removal and / or installation).

4.13.2 Contractor shall design, furnish, construct, and install a gravel ring (i.e., “beauty ring”) at each Wind Turbine location in conformance with the minimum requirements set forth herein and the preliminary design documents in Exhibit D.3 (Preliminary Design Documents).

- (1) Each beauty ring shall be installed after the applicable Wind Turbine is installed and after the removal (including decompaction) of the Wind Turbine Pad at such location.
- (2) Each beauty ring shall be installed around the perimeter of each Wind Turbine location beyond the Turbine Foundation pedestal wall, Wind Turbine tower stairs, and any ancillary equipment (e.g., pad-mounted transformer, junction box) in all directions. The beauty ring shall have a minimum width of 20 feet. The beauty ring shall be constructed such that a maintenance truck can drive completely around the turbine base and ancillary equipment.

- (3) Each beauty ring (a) shall have an identical cross section as the Site Access Roads (i.e., same thickness, same surfacing material, same fabric, if applicable); (b) shall be shaped to move water away from the Turbine and pad-mount transformer (if any); and (c) shall be constructed to prevent water ponding. If geotextile fabric is utilized in the Site Access Road cross section, such fabric shall be limited to extend a width of 15 feet (i.e., 5 feet less than the extents of the beauty ring aggregate).

4.14 Interconnection Line Structures

4.14.1 Contractor shall design, furnish, construct, and install a foundation and structural supports for each Interconnection Line structure. Structure foundations shall be in conformance with the preliminary design documents in Exhibit D.3 (*Preliminary Design Documents*), and the minimum applicable requirements set forth herein.

4.14.2 Interconnection Line structure foundation holes shall be considered any hole excavated for the purpose of installing a footing, direct embedment, pre-cast, stub angle or anchor bolt foundation. Foundations shall be excavated at the locations specified and as detailed on the design drawings and as described herein.

- (1) Contractor provided covers shall be placed over open holes. Open holes shall be protected from flooding. Accumulated water shall be removed from the hole prior to setting the foundation. In no case shall the depth of the hole be such that the entire corrosion treated area of any pole is below or above the ground line.

4.14.3 Interconnection line direct embedment, steel pole foundation requirements:

- (1) Drilled caisson foundations shall be used on steel pole foundations with concrete backfill. The steel poles shall be square with the centerline and plumb on both the longitudinal and transverse faces.
- (2) Contractor shall supply suitable templates or other means prior to the placement of the backfill material to support the steel poles.
- (3) When corrosion sleeves are provided on steel pole bases, the final grade of the backfill shall be between 9 and 15 inches from the top of the corrosion sleeve.

4.14.4 Interconnection line anchor bolt, steel pole foundation requirements:

- (1) Drilled caisson foundations shall be used on steel pole foundations with anchor bolts. Steel anchor bolt rebar cages shall be supported by suitable templates and other means prior to placement of concrete. A bolt pattern template shall be used. Additional supporting templates or bracing materials shall be used as necessary to maintain design locations, clearances, and the straightness of foundation components
- (2) Anchor bolt projections shall be no more than 4.5 inches between the top concrete and the bottom of the base plate, and there shall be a minimum of 0.25-inch projection of the anchor bolts above the top nut.
- (3) Any damage to the bolt pattern template or anchor bolts which prevents properly aligned, plumbed and level anchor bolts, shall be corrected.

- (4) The concrete cap shall be square or round in shape and large enough such that the base plate of the steel pole does not overhang the concrete cap.

4.14.5 Interconnection line anchor holes, anchors, and guying:

- (1) All transmission structure guys will be a minimum of 0.5-inch EHS galvanized steel strand with a minimum length of 10 feet; rods will vary in length to gain sufficient ground cover.
- (2) Conductor and static guys shall be un-insulated. All overhead guys shall be installed un-insulated. All anchors are to be set in accordance with the design drawings.
- (3) Anchors shall be thoroughly rocked in before backfilling. Anchors are to be thoroughly compacted with a mechanical tamper. Only mechanical tamping is acceptable with a fill lift of no greater than 6 inches.
- (4) Where solid rock conditions exist, expanding rock anchors shall be installed per the design drawings.
- (5) Anchor rod slot or rod hole is to be aligned and dug before the disc is placed in the hole. Hole shall be deep enough that the anchor rod remains straight when the guy is pulled. When slots or trenches are dug, they shall be properly backfilled and tamped mechanically with a maximum lift of 6 inches. The eye of the rod at no time shall be struck to drive the rod in to meet the specification.
- (6) A minimum of one (1) anchor shall be test pulled at each guyed anchor grouping to no less than 20,000 pounds for 30 seconds before the conductor is strung. Anchor shall be in line with the strain. No more than eight (8) inches or less than four (4) inches of the rod shall remain out of the ground after test pulling. Contractor shall submit to Owner for review methods and devices used for test pulling anchors and the results of each test.
- (7) Backfill shall not be placed in contact with the guy strand or guy grip at the rod eye.
- (8) Where two grips are used on one rod, the grips shall be properly seated in the rod eyes and shall not cross. Both grips shall not occupy the same eye.
- (9) Preformed guy grips shall be used on all guys at the structure attachment; guy rollers or thimble clevises shall be used in all cases.
- (10) Guy grips shall be installed with the end of the guy strand extending a minimum of one (1) inch and a maximum of three (3) inches into the eye of the grip. Guy attachment at anchor rods shall also be pre-formed guy grips.
- (11) One (1) guy guard shall be installed on the top guy at each anchor rod.
- (12) Guy wires shall be cut to proper length and the scrap ends disposed of.
- (13) Contractor is responsible for supply and installation of any temporary guys and anchors necessary for stringing the conductors.
- (14) Screw anchor installation shall be performed by an experienced operator with the objective of disturbing the soil as little as possible; avoiding damage to the anchor; and maintaining the alignment during the installation of the centerline of the anchor with the guy incline.

4.14.6 Interconnection line structural loading shall comply with this specification and in addition, shall comply with the minimum applicable requirements set forth in the NESC.

- (1) Foundations shall limit the total lateral deflection at grade to 3 inches maximum and total foundation rotation to 1.5 degrees maximum. Both limits shall be met under all NESC load cases including the NESC overload factors on applied loads.
- (2) Interconnection Line Table 1 summarizes weather cases used for structural design. This table is for use in PLS-CADD.

Table 4-3: Weather Cases for Interconnection Line Structural Design

Weather Case Description	Wind Velocity (mph)	Wind Pressure (psf)	Wire Ice Thickness (inch)	Wire Temp. (°F)	Wire Wind Height Adjust Model	Wire Gust Response Factor	Final/ Initial
NESC Rule 250B	Reference NESC Rule 250B, Figure 2501-1, General loading map of United States with respect to loading of overhead lines				None	1	I
NESC Rule 250C	Reference NESC figures 250-2(a) & Figure 250-2(b), Basic wind speed maps. 0 inches Ice Thickness; Wire Temperature = 60°F				NESC	NESC	I
NESC Rule 250D	Reference NESC Rule 250D, Figures 250-3(a) and Figure 250-3(b): Uniform ice thickness with concurrent wind maps. Wire Temperature = 15°F				None	1	I
Construction	28	2	0	—20 (PSCO, NSP) 0 (SPS)	None	1	I
Uplift	0	0	0	—20 (PSCO, NSP) 0 (SPS)	None	1	I
Deflection	0	0	0	40 (NSP) 45 (PSCO) 55 (SPS)	None	1	F

Notes:

[1] Wind pressure, $Q = 0.00256 \cdot V^2$, with Q in psf, and V in mph. Ice density is 57 lbs/ft³.

[2] Final = Final after Creep.

- (0) Table 4-4 summarizes the load cases, with the appropriate weather case, structure load factors, and the structure types to which they apply.

Table 4-4: Interconnection Line Structural Load Cases

Load Case	Case Description	Load Factors ¹			Structure Groups		
		Vertical	Transverse	Longitudinal	Terminal Deadend	Switch Structure	All Other Structures
1	NESC Rule 250B	1.5	2.5	1.65	X	X	X
2	NESC Rule 250C	1.0	1.0	1.0	X	X	X
3	NESC Rule 250D	1.0	1.0	1.0	X	X	X
4	NESC Rule 261D5a(1)(a)	1.0	1.0	1.0			
5	Anti-Cascading	See NESC Case	See NESC Case	See NESC Case	X	X	
6	Differential Ice	1.0	1.0	1.0			X
7	Construction Snubbing	1.0	1.0	1.0	X	X	X
8	Construction - Rigging	1.0	1.0	1.0			
9	Deflection	1.0	1.0	1.0	X	X	X

Notes:

[1] For PLS-CAD, assume structure weight load factor and wind area load factor are 1.0.

[2] If stringing from a tangent location, the engineer must consider the load case.

- (1) Load Case 1 – NESC Rule 250B. Owner territory is currently located in the NESC Heavy and Medium loading zones. For loading maps, refer to the NESC C2. For an interconnection line located in more than one loading district, Contractor shall use the more conservative district for the entire line unless explicitly approved by Owner.
- (2) Load Case 2 – NESC Rule 250C. This load case is for an extreme wind (summer) load case. For a line located in more than one region, Contractor shall use the more conservative region for the entire line unless explicitly approved by Owner. Apply this load case to all Xcel Energy structures regardless of height.
- (3) Load Case 3 – NESC Rule 250D. This load case is for an extreme ice and wind (winter) load case. For a line located in more than one region, Contractor shall use the more conservative region for the entire line unless explicitly approved by Owner. Apply this load case to all Xcel Energy structures regardless of height.

- (4) Load Case 4 – NESC Rule 261D5a(1)(a). NESC Rule 261D5a(1)(a) requires that “crossarms” on grade B and C structures be designed to withstand a longitudinal load of 700 pounds applied at the outer conductor attachment point. Owner interprets this requirement to apply to structures with a crossarm, including all H-frames. This load case shall be applied using the deflection weather case with all intact wires, and a minimum of 700 pounds longitudinal load at each conductor position simultaneously. NESC Rule 261F1a has a similar requirement for “pin type insulators”, however pin type insulators are not allowed.
- (5) Load Case 5 – Anti-Cascading. The design engineer shall check all Terminal dead-end structures for anti-cascade loading. Anti-cascade loading consists of all wires removed in the ahead or back direction. The loading condition shall be each of weather cases NESC 250B, 250C, and 250D, with all appropriate load factors as defined in Interconnection Line Tables 1 & 2. To limit cascade damage, there shall be an upper limit to the length of line segment between terminal dead-ends of ten (10) miles.
- (6) Load Case 6 – Differential Ice. Differential ice loading can occur at any structure from uneven ice melting or shaded areas. Differential ice loading applies the ice thickness from NESC Rule 250B or 250D (apply the greater ice thickness). Design engineer shall apply full ice thickness in the ahead span and one-half of the ice thickness in the back span, apply the inverse as well. Certain structures, such as H-frames, have less longitudinal stability and are susceptible to differential ice loading. Uneven spans are also susceptible to longitudinal loading due to differential ice. This load case does not apply to post or braced post insulators. This load case also does not apply to terminal deadends or switches.
- (7) Load Case 7 – Construction Snubbing. All structures must be capable of withstanding construction activities. This includes simultaneous application of stringing snub loads and worker loads. While coworkers will be on structures other than during initial construction and stringing, this combined load case will govern. The construction loading shall be calculated as follows:
 - (a) Wire condition: Construction weather case in Interconnection Line Table 1.
 - (b) Additional vertical load of 750 pounds (two workers plus equipment) shall be included at each wire attachment point.
 - (c) A vertical load from a wire snub shall be calculated based on a 2H:1V ratio from ground to the snub attachment point using the wire tension from the intact wires. (If a more stringent slope is needed on a project, that specific slope should be used to calculate wire snub loading. If in the NESC Medium district, a 3H:1V ratio is acceptable on tangent structures provided there is adequate construction area).
 - (d) The final point load at the snub attachment point is the sum of the 750-pound vertical load, the vertical load from the wire snub, and the intact wire point load (transverse, vertical, and longitudinal) for the specified weather case. This is a conservative and simplified method. The location of the wire snub loading shall be applied as follows:

1. For braced line post or post insulators, the snub load shall be applied at the wire attachment point for design of the structure. During construction, wires shall not be snubbed from braced line post or post insulators unless the engineer has determined the strength of the insulator will not be exceeded. Braced line post or post insulators are not required to be analyzed with construction loading, only the supporting structure is required to be.
 2. For suspension insulators, apply the snub load at the wire attachment point.
 3. For all other designated structure attachment points provided for attaching the wire stringing equipment (i.e., dead-end vangs, arm pit of pole to arm connection, shield arms, etc.), the snub load shall be applied to this location for structure design.
- (e) Contractor shall Design structures for the construction load case assuming it is being applied to all wire attachment points on a structure simultaneously. Note the following:
1. The intent of this load case is to provide sufficient capacity of structure arms or other working attachments. The added vertical loads from wire snubbing and workers should not be controlling the design of the pole shaft or foundation for typical structure configurations.
 2. Contractor shall call out snub location on the construction drawings that are provided in the construction package.
- (8) Load Case 8 – Construction: Rigging from Shield wire Arms. This load case applies to structures that have the shield wire(s) supported on a custom steel arm, and the conductors supported by post or braced post insulators. This load case does not apply to any terminal dead-end structures. This load case is used to simulate a single phase of conductor(s) being temporarily rigged off the upper shield wire arm.
- (a) Calculation method: A 750-pound vertical worker load and the total calculated load for the intact single phase will be added to the intact loading of the shield wire above. The PLS-CADD criteria file is set up to calculate this load when using version 16.51 or higher. Use the construction weather case for calculating this load case.
- (9) Load Case 9 – Deflection. Deflection requirements are listed in Interconnection Line Table 1. Pole raking in the field is not allowed to meet these deflection limits. For structure deflection values to use in the calculation of required clearances or ROW (Right of Way) widths, see Owners Transmission Line Clearance Criteria.
- (a) Note that the deflection limit for terminal dead-ends using the construction weather case is meant to provide more stiffness in dead-end structures that could be used for stringing operations to reduce the need for temporary guy wires and iterating sagging actions.

Table 4-5: Interconnection Line Deflection Limits

Structure Type	Allowable Deflection	Weather Case	Application
Switch Structure	2% of Height	NESC 250B No Overload Factors	Remove all wires which result in the largest moment at the structure base.
Terminal Deadends	1% of Height	Construction	All wires removed one side. For multi-circuit structures, remove all wires which result in the largest moment at the structure base.
	1.5% of Height	Deflection	All wires intact
All other Structures	1.5% of Height	Deflection	All wires intact

4.15 Testing and Quality Control

4.15.1 Contractor shall inspect and test each roadway, except for public roads, in accordance with the following minimum requirements. All testing shall be performed by an independent, experienced third party.

- (1) All roadways and compacted areas shall be tested to demonstrate they meet stated design criteria and are fit for purpose.
- (2) Testing standards: (a) maximum dry density and optimum moisture content per ASTM D698 or ASTM D1557; (b) in-place density by nuclear methods (shallow) per ASTM D2922 every 1000 square yards; (c) aggregate sampling per ASTM D75; (d) sieve analysis of fine and coarse aggregates per ASTM C136; (e) sand equivalent value per ASTM D2419; and (f) liquid limit, plasticity limit, and plasticity index per ASTM D4318.
- (3) Fill material / embankments: (a) proof roll over entire length; (b) grain size analysis, moisture content, Atterberg limits on fines contents, and two (2) standard proctor test on each material type; (c) if proof roll fails, moisture density test at four (4) per lift or every 1,000 feet of road, whichever is greater; and (d) dynamic cone penetrometer (“**DCP**”) test at any location where moisture density testing fails. The civil engineer of record shall specify passing criteria for the DCP test (e.g., minimum blows per 6 inches).
 - (a) If on compacted fine-grained soil subgrades, contractor shall utilize the SCP to provide undrained shear strength. A correlation from UCS to CBR is preferred.
 - (b) If on compacted coarse-grained soil or cement-stabilized subgrades, contractor shall utilize the DCP to provide friction angle and CBR results.
- (4) Compacted subgrade (including stabilized subgrade): (a) proof roll over entire length prior to placement of aggregate base; (b) moisture density test every 1,000 feet or three (3) per road, whichever is greater; and (c) DCP test (recorded to a minimum depth of 2 feet) every 500 feet if moisture density testing fails. The civil engineer of record shall specify passing criteria for the DCP test (e.g., minimum blows per 6 inches).

- (5) Aggregate base: (a) proof roll over entire length; (b) DCP test (recorded to a minimum depth of 2 feet) every 1,000 feet or minimum three (3) per road, whichever is greater; (c) sieve analysis, liquid limit, and plasticity index every 2,500 cubic yards; and (d) wet ball mill or Los Angeles abrasion test, as applicable, every 5,000 cubic yards. The civil engineer of record shall specify passing criteria for the DCP test (e.g., minimum blows per 6 inches).
- (6) Geogrid membrane: all testing included in (4) above and additional DCP testing every 500 feet regardless of failed proof roll.
- (7) Stabilized subgrade: (a) testing in accordance with the engineer of records procedures; (b) DCP testing for every 500 feet five (5) days after final compaction; (c) a minimum 20 CBR prior to proof rolling; and (d) proof roll over entire length prior to placement of aggregate. If a CBR of 20 is not achieved, additional gravel surfacing will be required and the material stabilization content for future stabilization shall be adjusted.
- (8) Crane paths (including shoulders): proof roll over entire length.

4.15.2 Contractor shall inspect and test foundations in conformance with the minimum requirements below. All testing shall be performed by an independent, experienced third party.

- (1) All foundations shall be tested to demonstrate they meet stated design criteria and are fit for purpose.
- (2) Concrete / grout strength and properties, including break tests, grout cubes, slump, air, and temperature, each at the minimum frequencies specified in Section 4.1 herein.
- (3) Foundations shall be tested in accordance with the recommendations set forth in the geotechnical engineering report.
- (4) Ground grid testing to confirm grounding is in compliance with the Requirements, including Turbine Supplier requirements.

4.15.3 Contractor shall perform pile load testing if driven piles are planned for the PV Array.

- (1) All required construction pile tests shall be performed in the presence of an Owner representative. All load tests shall be in accordance with the design documents, the final geotechnical report, and ASTM D1143 and D3689.
- (2) Excavators and other heavy equipment may be used for the load reactions but cannot be used to actively load the pile. Loads shall be applied and controlled with both calibrated jacks and in-line load cells.
- (3) Piles shall be driven to the final embedment distance as indicated in the design drawings. Any pile that drives with an install time less than the reference time or less than the required embedment depth shall be flagged for testing.
 - (a) Failed load test: If a pile cannot be driven to the design embedment depth due to suspected subsurface obstruction (boulder, cobble, shallow bedrock), or the drive time for the pile is less than the shortest drive time identified for the test pile program, Contractor shall implement the following:

1. The tested pile shall be load tested to 100% of the design compression and uplift capacity, in increments of 25%, 50%, 75%, and 100% design capacity with two (2) minute hold times per increment up to the final increment, and then hold for five (5) minutes at maximum design capacity. The movement shall be recorded at the beginning and end of each load increment, and at every minute for the final hold at maximum design capacity.
 - (b) Successful load test: If a pile is driven to the design embedment, then the reference time and embedment may be adjusted as needed for a particular geotechnical zone with the approval of the engineer of record and Owner.
 - (4) Load testing data and results shall be provided to Owner for review and acceptance. If a pile test fails or is not accepted by Owner, Contractor shall provide a remediation plan for the failed pile for Owner's review and approval.
- 4.15.4 All concrete, reinforcing bar, anchor bolts, embedment plates, formwork, etc. shall be inspected per the current International Building Code, Chapter 17, "Special Inspections".
- 4.15.5 Contractor testing plan shall be submitted to Owner for review and approval. Contractor shall notify Owner of all testing schedules at least 30 days in advance of testing activities and copies of testing reports (including a summary of testing procedures and acceptance criteria) shall be submitted to Owner within ten (10) days of completing such test. Notwithstanding the preceding requirements, a copy of test results for foundations shall be provided to Owner *prior* to erection of the applicable major Equipment.

5.0 COLLECTION SYSTEM CIRCUITS

5.1 General Provisions

5.1.1 Contractor shall relocate, drop, or cross power lines as needed and as appropriate to complete the Work, with prior approval of the appropriate authority(ies). Contractor shall be responsible for obtaining and maintaining any necessary permits and / or easements for such work.

5.1.2 Contractor shall design and construct the Project such that the total annual energy losses under fully-loaded conditions:

- (1) [measured between the PV arrays and its DC bus and the inverters and the low side of the main power transformer at the Project Substation shall not exceed 2.5 percent (2.5%) (the “**Electrical Loss Limit**”). For the avoidance of doubt, the DC losses shall not exceed an average of 1.5 percent (1.5%) and no one circuit shall have a loss exceeding 2.5 percent (2.5%). The losses on the medium-voltage cabling up to the low side of the main power transformer at the Project Substation shall not exceed 0.5 percent (0.5%). The Electrical Loss Limit specifically excludes the losses in the main power transformer.
- (2) measured between the generator leads of each Wind Turbine and the Point of Interconnection shall not exceed 2.0 percent (2.0%) (the “**Electrical Loss Limit**”). For the avoidance of doubt, this shall include all medium-voltage transformers, Wind Turbine cabling, Collection System Circuit cabling, and the Interconnection Line up to the Point of Interconnection. The Electrical Loss Limit specifically excludes the losses in the main power transformer.
- (3) measured between the BESS and the Point of Interconnection shall not exceed 2.0 percent (2.0%) (the “**Electrical Loss Limit**”). For the avoidance of doubt, this shall include all medium-voltage transformers, Collection System Circuit cabling, and the Interconnection Line up to the Point of Interconnection.] The Electrical Loss Limit specifically excludes the losses in the main power transformer.

5.1.3 Contractor shall design, furnish, construct, and install the Collection System Circuits in conformance with the minimum requirements set forth herein and the Contractor-prepared Collection System Circuit design documents, including the Collection System Electrical Studies, as defined herein.

- (1) The Collection System Circuits shall be installed within the permitted corridors shown on Exhibit D.1 (Project Site Plan).
- (2) The Collection System Circuits shall not cross through (under / over) the O&M Building yard.
- (3) Contractor shall furnish all labor, equipment, and materials that are necessary for a complete, fully-functional, and safe Collection System Circuit configuration, excluding only the Owner-Supplied Equipment.

5.1.4 Requirements for AC power cabling:

- (1) All Collection System Circuit power cabling shall be 35-kV, 3-phase, 60 Hertz.

- (a) Cabling shall be jacketed, Class B, aluminum or copper single-conductor, TRXLPE insulated, with moisture block designed to prevent longitudinal migration of water along stranded conductors (water blocking tapes installed between conductor layers are not allowed as a water blocking system) with appropriately-sized and evenly-spaced copper concentric neutrals. All underground Collection System Circuit power cabling shall be supplied with a minimum of 100 percent (100%) insulation that meets or exceeds all requirements of applicable AEIC, IEEE, ICEA, NEMA, and UL standards. All Collection System Circuit cables shall be UL listed.
 - (b) Cabling located in burrowing rodent prone areas shall consider mitigation measures such as increased burial depths and protection with conduit for cables that rise to the surface.
 - (c) Conductor and concentric neutrals shall be sized according to the Collection System Electrical Studies.
 - (d) Certified test reports to be provided by the manufacturer for each cable shipping reel.
- (2) Collection System Circuit shall be of a discharge-free design and suitable for direct burial, installation in duct and exposure to sunlight on an alternating current, 3-phase, 34.5-kV nominal, 60-Hertz power system.
 - (3) All central conductors shall be Class B stranded. No more than one (1) conductor per cable shall be allowed. Conductor material shall be aluminum or copper. Allowable conductor sizes are 1/0 AWG through 1500 kcmil.
 - (4) Cable ampacity shall not exceed 95 percent (95%) of the rated value without explicit Owner approval, based on Project Site-specific thermal resistivity and in consideration of all external heat sources.
 - (5) Notwithstanding the following sentence, all underground Collection System Circuit cabling shall be direct buried at a depth of at least 48 inches below final grade. Notwithstanding any additional Requirements (e.g., utility crossing agreements, road crossing agreements) all crossings, including, but not limited to, road and utility crossings, shall be installed in conduit or HDPE pipe and buried at a depth of at least 48 inches below final grade.
 - (6) A sufficient amount of cable slack shall be provided to allow installation of elbows and termination of the cables to the appropriate junction box terminal and permit ready disconnection of the elbows and mounting on the parking stands. For the avoidance of doubt, such slack shall allow for the installation / service disconnection of connectors, dead breaks, and other similar devices.
 - (7) Excess slack shall be provided to allow re-termination in the event of failure. The excess slack shall be in the form of a maintenance loop. Sufficient cable length shall be provided such that the cables may be re-terminated at least two (2) times after installation.
 - (a) A minimum of 10 feet of cable slack shall be installed (coiled) in the basement of the transformer or junction box vault or inverter foundation or otherwise buried directly adjacent to any such component if a vault is not available.

- (8) All Collection System Circuit power cabling provided with terminators and labels. Labels shall be in accordance with Section 2.6.
- (9) The installation of splices shall be minimized on underground cabling. Underground splices shall be completed in enclosures in dry, windy areas to minimize dust particles within the splice. Underground splices shall be identified using GPS-located marker balls, and splices shall only be performed by a skilled, qualified craft worker who shall receive training at the Project Site from the splice kit manufacturer prior to performing splices; the coordinates of each splice shall be recorded and noted within the As-Built Drawings.
- (10) Excessive bending of cabling shall be avoided, and the manufacturer recommended bending radius shall not be exceeded.
- (11) BIL voltage rating: 200 kV.
- (12) Maximum normal conductor operating temperature: 105°C; Maximum emergency overload conductor temperature: 140°C; Maximum short-circuit conductor temperature: 350°C.
- (13) No more than 28 MWac may be installed on a single AC feeder cable. No more than 56 MWac may be installed on a single AC substation feeder breaker.
- (14) For hybrid or co-located projects, the AC feeder cables from each generation resource shall be evenly distributed between the 34.5kV buses.

5.1.5 Requirements for trenches:

- (1) Collection System Circuits shall be installed via trenching. Excavation by blasting for the Collection System Circuits is strictly prohibited. Trench widths shall be kept to a minimum to allow sufficient space for equipment installation. The trench bottom shall be firm for the entire length and width. Trenches shall be kept free from water. Conduit and cable shall not be placed on frozen ground.
- (2) Bedding and/or backfill material shall be installed around all buried Collection System Circuits to provide physical and/or thermal protection for buried cable. All trench bedding and/or backfill materials shall be screened and visually inspected for materials in excess of two (2) inches within six (6) inches of the buried cable. All bedding and/or backfill material shall be composed of materials that are native to the Project Site. Such materials shall be free of debris, roots, organic matter, frozen matter, coal, ashes or cinders.
 - (a) Backfill shall be compacted per the engineer of records requirements or to a minimum of 85 percent (85%) standard proctor per ASTM D698.
- (3) Open trenches shall not be left uncovered overnight or for any extended period of time.

5.1.6 Requirements for plowing:

- (1) Plowing in cables is not allowed unless explicitly approved by Owner.

5.1.7 Requirements for markers:

- (1) Cable marking tape shall be furnished and installed in all trenches. Such tape shall be metallic and detectable. Marking tape shall be placed 12 to 18 inches above cable.

- (2) All crossings, including road and utility crossings, shall be marked on each side using a cable marker. Cable markers shall be fireproof and have the generating plant name, state, and the locating service telephone number clearly identified on it.
- (3) GPS-located marker balls shall be placed within all cable trench at the following: (a) all crossings (road, pipeline); (b) every splice location; (c) all 90-degree turns in a Collection System Circuit; and (d) minimum of every 1,000 feet of trench length.

5.1.8 Requirements for fiber optic cabling:

- (1) Fiber optic cable shall be installed in the same trench as the Collection System Circuit power cabling.
- (2) See Section 9.1.119.1.11 for additional fiber optic cabling requirements.

5.1.9 Requirements for junction boxes:

- (1) Junction boxes shall meet the requirements of ANSI C57.12.28, including water resistance.
- (2) Junction boxes may be steel or fiberglass. Junction boxes shall be steel if installed within 500 feet of a Wind Turbine.
- (3) Junction boxes shall be lockable with a padlock and shall be NEMA 3R rated.
- (4) Junction boxes shall be installed level and plumb, and set on a minimum 2000 psi concrete slurry with a rock base at grade.
- (5) Junction boxes shall be clearly marked with an appropriate high-voltage sign identifying the junction box number and Collection System Circuit number. The letters/numbers on the junction box shall be reflective and at least 4-inches tall.
- (6) Junction boxes shall be located near other equipment, along fence lines, along field edges, along generation plant Site Access Roads, near but outside of public road ROW or as approved by Owner. Junction boxes shall not be located in wet areas or areas that are expected to be drainageways or will otherwise collection water. In all cases junction box placement must be accessible to maintenance personnel via public roadway or Site Access Road.
- (7) Junction boxes shall be installed frequent enough that partial discharge testing of the cables may be performed. The maximum distance between junction boxes or a junction box and other termination shall be 8000 feet.

5.1.10 Requirements for medium-voltage step-up transformers:

- (1) Medium-voltage step-up transformers shall be sized appropriately for the Project output and in accordance with the requirements set forth in Table 5-1 (*Summary of General Requirements for Medium-voltage Step-up Transformers*) herein, at a minimum.

Table 5-1: Summary of General Requirements for Medium-voltage Step-up Transformers

Description	Value
Quantity	[TBD] plus [TBD] spares
Type	Mineral oil filled or less flammable oil filled, hermetically sealed, outdoor installation. Dry-type construction must be approved by owner.
Voltage ratio	34,500 / [TBD] Volts
MV Switch	Under Oil – Disconnect, Load Break
MV Bushings	Dead front, Loop feed, (6) 600A bushings
LV Bushings	Spade
Phases	3
Windings	2 (MV, LV)
Winding electrostatic shield	Yes, drain to core ground
Steady state temperature rise	65°C above ambient at rated kVA
Maximum temperature rise	80°C above ambient at rated kVA
Frequency	60 Hz
HV / LV Impulse levels	200 kV / TBD kV
Vector group HV / LV	Grounded wye/delta
Cooling	ONAN [NTD: May consider the use of KNAN as an option in highly environmentally sensitive areas.]
Tapping range	±5%, 2.5% steps, manual control
Paint finish	Powder coated, Munsell Green or as required by the AHJ
Guaranteed losses	Not used (see Electrical Loss Limit)
Temperature gauge	Required; Provide option pricing for located in external padlockable compartment.
Nitrogen pressure level indicator	Required; Provide option pricing for located in external padlockable compartment.
Pressure relief device	Required
Oil sampling valve	Required (located on end of drain valve inside LV compartment); Provide option pricing for located in external padlockable compartment.
Nitrogen filling orifice	Required; Provide option pricing for located in external padlockable compartment.
Tank ground tag	Required
Oil level indicator	Required
Grounding	Solid (MV source, LV winding), un-grounded delta (MV winding)
Infrared viewing windows with metal cover	Optional – Provide pricing for MV and LV compartment viewing windows large enough to infrared scan all terminations in each cabinet.

- (2) The transformer shall be connected to the inverter, and other transformers, in such a way that the transformer(s) may be subject to harmonic currents and/or abnormally high voltages associated with an inverter load rejection, switching surge, and other transient conditions. Therefore, the transformer shall be designed to withstand the harmonic currents and voltage stress associated with 1.4 times the rated voltage applied to the transformer terminals for 5 seconds.
- (3) Transformers shall be handled carefully to avoid internal damage to the transformer or damage to the finish and shall be positioned in accordance with the plans and specifications. Only qualified and experienced personnel shall be allowed to make connections and cable terminations.
- (4) Auxiliary equipment and accessories:
 - (a) Internal expulsion cartridge fuse x3
 - (b) Parallel oil-immersed partial range current limiting fuse x6
 - (c) Hook stick operable, two position, amperage rating per the engineer of record, under oil, loop feed switches. Switch positions shall be labeled “open” and “closed.” Switch position labels shall be readable from 2 feet away.
 - (d) Hook stick operable tap change switch located at an accessible location which does not require reaching behind cables. The tap change switch shall snap into each voltage setting. The switch shall be visible indicating from 2 feet. Provisions, such as a spring loading locking pin or set screw shall be made to assure that accidental operation of the tap changer will not occur.
 - (e) Low-voltage surge arrester: As specified by the engineer of record. The low voltage surge arrester shall be mounted in an easily viewable and accessible location and shall not be mounted behind cables.
 - (f) Low-voltage power breaker: per Exhibit A.3 (*Approved Suppliers*) or as specified by the engineer of record
- (5) Enclosure:
 - (a) The MV transformer shall include a fully-enclosed, transformer mounted, MV and LV termination, steel cabinet, suitable for outdoor installation, as per ANSI C57.12.28. The cabinet must be so designed as to fully enclose all cable tails, cable terminations, grounding tags and transformer fittings within a tamper and rodent resistant, secure enclosure.
 - (b) The cabinet shall extend to floor level, fully shrouding all cable tails, having the facility for being directly bolted to the supporting pad. The cabinet depth shall be 24 inches.

- (c) The MV and LV compartments shall be partitioned such that access to each compartment is via a separate door. External access shall be available through the LV compartment door only, with access to the MV compartment door lock being available within the LV compartment. The doors shall be fitted with an all steel, robust, tamper proof, three point (i.e., top, mid, and bottom) integral locking system. Each door shall have the facility of being securely locked shut via the application of a dedicated pad lock.
 - (d) The transformer name plate and all transformer indication fittings (e.g., oil level indicator, oil temperature indicator) shall be located within the LV compartment, while all transformer operational fittings (e.g., tap changer switch, isolation switch etc.) shall be located within the MV compartment. Option pricing shall be provided for locating the oil sampling device, oil level indicator, and temperature gauge.
 - (e) The cabinet doors shall be fitted with anti-close stays designed such that both doors can be held open at right angles. The anti-close stay design shall be sufficiently strong enough to withstand the prevailing wind conditions.
 - (f) When installation is complete, the cover of the enclosure shall not be lower than two (2) inches above the specified grade.
- (6) Foundations / vaults:
- (a) Pad-mount transformers may be installed with a fiberglass or concrete box pad, steel skid, or concrete slab foundation (pre-cast or cast-in-place).
 - (b) Box pads shall be installed level and plumb, and set on concrete with a rock base. Excavations shall be filled with a minimum 2,000 psi slurry mix.

5.1.11 Requirements for surge arresters:

- (1) Surge arresters shall be provided along at the end of each collection string. Surge arresters shall be 35-kV class, 600A, 30kV/24.4kVMCOV (or greater if required by the Contractor-provided TOV study) equipment meeting the requirements of ANSI C62.11 for Station Class installation in a 60-Hertz outdoor installation, unless a greater rating is required by the Contractor-provided transient overvoltage study.
- (2) Surge arresters shall provide overvoltage system protection in an insulated, fully shielded, submersible, dead-front device. Surge arresters shall be provided in pre-molded rubber elbows.

5.1.12 Requirements for grounding:

- (1) Grounding connections to equipment including junction boxes, central inverters, and MV transformers (if any) shall be bolted to facilitate separation of grounds from the equipment for continuity testing and ground mat testing.
 - (a) Contractor shall minimize the amount of exposed ground conductors and utilize approaches that hide ground conductors to minimize the potential for theft.
- (2) Ground rods shall be incorporated into the grounding system. Ground rods shall be copper-clad, 3/4-inch diameter, 10-foot-long rods at a minimum.

- (3) Foundations shall include a grounding grid, as further described herein.
- (4) Underground ground connections on the collection system shall be exothermically welded or a listed irreversible crimp connection. Mechanical connections are not allowed for underground ground connections.
- (5) Ground electrodes and groundable parts of equipment shall be interconnected. All interconnections shall be made as shown in the Design Documents. Where shown on the Design Documents, power system neutrals shall be bonded to ground. Ground rods shall be installed at all equipment locations as shown in the Design Documents. All underground ground connections on the collection system shall be exothermically welded or utilize an irreversible crimp. Grounding connections to equipment including junction boxes, central inverters, and MV transformers (if any) shall be bolted to facilitate separation of grounds from the equipment for continuity testing and ground mat testing.
- (6) Grounding conductor shall not be less than 1/0 AWG.
- (7) Grounding conductor may be copper, or an equivalently-sized copper-clad conductor with a suitable estimated design life (consideration for soil corrosivity shall be considered in conductor selection).

5.1.13 Requirements for bollards:

- (1) See Section 4.1.22 herein.
- (2) Bollards shall include a mechanism to allow for the connection of lengths of chain.

5.1.14 Requirements for conduit:

- (1) All above-ground power and communications cabling shall be installed in conduit. All below grade crossings, including road and utility crossings, shall be installed in conduit. Conduit shall be installed from each MV transformer.
- (2) Conduit size / fill ratio shall be in accordance with ANSI / NFPA 70, at a minimum.
- (3) The location of all conduit shall be recorded within the As-Built Drawings.
- (4) Non-metallic conduit shall be protected from sunlight.
- (5) The interior surface of all conduits shall be smooth to prevent damage to the cables. When cable is pulled into a duct, a suitable pulling lubricant shall be used.
- (6) HDPE conduit shall be SDR13.5 or heavier if needed to avoid damage when pulling into the bored hole. HDPE shall be one continuous length or connected together with fused joints.
- (7) Use suitable temporary plugs or caps to protect installed conduit against entrance of dirt, moisture, and debris.
- (8) All conduit materials required shall be furnished new and undamaged in accordance with the following requirements, at a minimum:
 - (a) Duct: polyvinyl chloride, Schedule 40 PVC in accordance with NEMA TC-2.

- (b) Couplings: plastic, for use with duct previously specified and “Duct-to-steel” adapters as required, including joint cement.
 - (c) Spacers: plastic high impact, interlocking, base and intermediate type
 - (d) Factory bends and sweeps: Schedule 40 PVC, 3-foot minimum radius (or greater if required to not violate the minimum bending radius of the cable being installed in it).
 - (e) End bells: plastic.
 - (f) Plugs: plastic, high impact, tapered to fit end bell provided.
 - (g) Duct binder: hemp or sisal twine coupling.
- (9) Conduit duct seal shall be used to prevent rodent intrusion. Spray insulating foam is not an approved product for this application.
- (10) Riser shield or conduit shall extend at least eighteen 18 inches below grade at all riser poles. If full round conduit is used as a riser shield, an end bell shall be installed on the lower end to prevent damage to the cable.
- (11) Wind Turbine Foundation conduit:
- (a) Conduit design shall show the routing and controlling dimensions of the conduit from the exterior of the foundation to the interior of the Wind Turbine pedestal.
 - (b) Design of the conduit layout shall consider magnetic induced heating effects such as hysteresis, and eddy current losses with their associated heating of the anchor bolts and rebar in the foundation.
 - (c) Conduit arrangement shall route the cable through the wind turbine foundation, including exit through the pedestal, the sloped portion of the foundation base, or below the entirety of the foundation base. The use of junction boxes to facilitate larger cable sizes shall be strictly minimized.

5.1.15 Requirements for equipment pads:

- (1) The site for the pad shall be adjacent to but not over cable trench. The site shall be cleared of all debris and excavated to the specified depth. Cohesionless soils shall be added to the site and thoroughly compacted. The pad shall be installed level at the specified elevation.
- (2) Sleeve-type sectionalizing cabinet excavation pads and other below-grade enclosures shall be made so as to disturb the surrounding earth as little as practicable. Enclosures shall be installed with side walls plumb and without any panel distortion. When installation is complete, the cover of the enclosure shall not be lower than and not more than two (2) inches higher than specified grade. Soil in the immediate vicinity shall be tamped and sloped away from the enclosure. The excess soil shall be spread evenly over the surface of the ground to the design requirements.

5.1.16 Requirements for miscellaneous material:

- (1) Cable accessories, terminators, dead front, load break and/or dead break elbows shall be designed and manufactured for the cable to be utilized and rated 600-amp for outdoor 34.5-kV use.
- (2) Dead front, load break, and/or dead break elbows shall be supplied with test ports.
- (3) Cable fault indicators shall be capable of being reset and installed strategically in the substation and at each collector circuit including at each collector circuit branch and junction boxes including two-way junction boxes to assist in locating electrical faults during operation. At junction boxes, fault indicators shall be exterior indication. Fault indicators to be labelled with 4-inch-tall reflective letters that indicate which branch of the circuit they are connected to. At junction boxes next to a wind turbine or inverter a fiber innerduct shall be installed between the two locations.
- (4) Cable caps (3M) shall be supplied when cables are waiting to be terminated in the field after installation.
- (5) Each equipment enclosure or junction box shall display a “Caution” sign placed so that it is visible to anyone attempting entry to the enclosure. Also, the equipment inside the enclosure shall display a “Danger” sign so that it is visible when the enclosure is open.

5.1.17 Solar / BESS Requirements for inverters:

- (1) Central inverters shall be used for the Project.
- (2) For Owner-approved inverter suppliers, refer to Exhibit A.3 (Approved Suppliers). The inverter shall have a minimum of 5 years of service history unless explicitly approved by owner.
- (3) Environmental operating ratings: -20 to +50 degrees C (-4 to 122 degrees F), humidity: 15% - 95%, non-condensing, up to 6500 feet elevation without derating or as required by Exhibit D.2 (Project Site Data), whichever is more restrictive.
- (4) If inverter is not contained within a fully enclosed shelter, the inverter enclosure shall be NEMA 3R and padlockable.
- (5) Current harmonics: Percent THD and individual harmonic levels in accordance with IEEE 2800.
- (6) California Energy Commission weighted efficiency: > 98 percent without medium voltage step-up transformer.
- (7) Inverter shall be designed to Industry Codes and Standards, including IEEE 2800 (IEEE Standard of Interconnection and Interoperability of Inverter-Based Resources (IBR's) Interconnecting with Associated Transmission Electric Power Systems), IEEE-1547 (IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces) and FCC Part 15 Class A standards.
 - (a) Cyber security capabilities of inverter shall align with Industry Codes and Standards, including guidelines specified in IEEE-1547.3
- (8) Inverters shall be programmed in accordance with the requirements of the Owner and Interconnection Agreement.

- (9) Notwithstanding any Requirements, including the Interconnection Agreement, inverter shall be capable of power factor control to a minimum of 0.90 leading/lagging (at inverter output terminals) to support voltage regulation as required by Owner.
- (10) Inverter shall have voltage and frequency ride-through capabilities in accordance with the Requirements, including NERC guidelines or requirements and the Interconnection Agreement.
- (11) Inverter shall be compatible with the Communications System described herein and shall comply with remote control of kW/kVAr/Volt output per the Interconnection Agreement. This shall be accomplished on a Facility level by use of a Power Plant Controller.
- (12) Inverters shall be provided with current transducers on each DC feeder in order to provide monitoring of each feeder; CTs shall have an accuracy of 3 percent or better.
- (13) LCD screens, if installed, shall be protected from the sun.
- (14) Inverter shall be designed such that the controls and auxiliary equipment (SCADA interface, LCD, communications boards, etc.) can be accessed without being exposed to the DC and/or AC bus arc flash potentials.
- (15) Inverter shall include DC circuit breakers / switches and AC circuit breakers / switches that can be operated to minimize DC and/or AC bus arc flash potential exposure. DC breakers or disconnects shall include the ability to be padlockable in the open position and provide a visible means of isolation for personnel safety in lock-out tag-out.
- (16) Inverters shall be listed to UL-1741 SA (Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources) or equivalent successor standard. Any variance to this standard is subject to Owner approval.
- (17) Inverter AC output circuit breaker shall include an adjustable relay with long time, short time, instantaneous, and ground fault protection features. The relay shall include a metering display and the ability to turn un-used protection functions off.
- (18) The inverters shall provide all required reactive power to comply with the Requirements, including the Interconnection Agreement without the use of switched capacitor banks or switched reactor banks in the Project Substation. For solar and storage hybrid projects, the solar array and BESS array shall have the ability to provide all required reactive power independently.
- (19) Solar Inverters shall be capable of providing their full reactive power capability (leading and lagging) at zero real power output. This feature is also known as night-time var capability or Q at night.
- (20) BESS Inverters shall be designed for four-quadrant, bi-directional operation (Inverter provides DC current to charge the battery modules from the AC collection system, and also delivers AC power from the DC battery modules to supply the transmission grid).

5.1.18 Solar / BESS Requirements for Power Conversion Systems:

- (1) The PCS, in conjunction with the BESS site controller when applicable, shall be capable of automatic, unattended operation. The PCS shall include all necessary self-protective and self-diagnostic features to protect itself from damage in the event of component failure or from operating beyond equipment ratings, whether due to internal or external causes.
- (2) The PCS system shall include provisions for isolation on both the AC and DC terminals. Disconnecting provisions shall be capable of being locked out to facilitate Company's lockout-tagout process for maintenance work. Harmonic filter capacitors shall be provided with bleeder resistors or other means of discharging to less than 50 volts within approximately one minute of de-energization.
- (3) The PCS shall include DC circuit breakers / switches and AC circuit breakers / disconnects that can be operated to minimize DC and/or AC bus arc flash potential exposure. Breakers and disconnects shall be padlockable.
- (4) The PCS internal cooling system design may be the manufacturer's standard, provided that failure of a single cooling fan does not cause more than 50% derating of the affected PCS's power rating.
- (5) PCS shall include Maximum Power Point Tracking ("MPPT") capability.
- (6) The PCS transformer shall have the specifications as noted in Section 5.1.10.
- (7) The PCS inverter shall have the specifications as noted in Section 5.1.17.
- (8) PCS Shelter:
 - (a) Shelter shall be rated prefabricated metal or pre-cast concrete enclosures for wind, rain, or UV protection.
 - (b) Shelter may include HVAC equipment or other means as required to maintain inverter operating environment within inverter manufacturer's specifications. HVAC equipment with a minimum SEER rating of 16 shall be utilized.
 - (c) Shelter layout shall include provision for inverter(s) with adequate spacing to accommodate inverter maintenance activities and safe operating distances. Minimum equipment clearances shall be in accordance with the NESC and inverter manufacturer's installation and maintenance requirements.
 - (d) Shelter shall have provisions for equipment removal and replacement.
 - (e) Shelter shall have adequate task lighting to perform all maintenance activities.
 - (f) Shelter shall not be designed or classified for occupancy.
 - (g) Shelter shall be configured to have no roof penetrations of any kind, except for HVAC equipment needs, if any.
 - (h) Shelter manufacturer shall provide detailed engineering design drawings and calculations complying with the requirements of the applicable building code(s) and local and state laws that have jurisdiction where the building will be delivered and erected. Drawings shall be stamped by a Professional Engineer registered in the Project state and are subject to Owner review and approval.

- (i) Shelter shall have air terminal lightning protection in accordance with NFPA 780 standards.
- (j) Shelter shall have a means of prohibiting access when energized.

5.2 Submittals

5.2.1 Contractor shall prepare the Collection System Circuit design documents per the submittal schedule in Exhibit G.1 (Submittal Schedule) and containing the following information, at a minimum: (a) design basis; (b) plan view of the overall system, including power and fiber; (c) one-line electrical diagram, including all transformer tap positions that are to be selected during the installation of that transformer; (d) fiber optic loop diagram, including communication loop and connection / termination details for all inverters, meteorological stations, and the O&M Building; (e) cable installation details, including cable specifications, trench details, splice details, and cable marker details; (f) cable crossing details, including road crossings, utility crossings, pipeline crossings, and directional boring; (g) grounding details, including trench grounds; (h) termination details, including junction boxes; (i) junction box details; (j) meteorological station power details; (k) conduit and cable schedules; (l) civil works requirements (e.g., backfill, compaction, grading, drainage, etc.); (m) drawing index; (n) bill of materials; and (o) inspection, testing, and quality control requirements.

5.2.2 Contractor shall prepare a set of studies and analyses for the Project (collectively, the “**Collection System Electrical Studies**”) to demonstrate the adequacy of the proposed electrical system design, including any studies and analyses that may be necessary to ensure compliance with the Requirements, including the Applicable Standards or utility requirements. The Collection System Electrical Studies shall be submitted to Owner for review and approval *prior* to the procurement of the applicable major Equipment. The following shall be included in the Collection System Electrical Studies, at a minimum:

- (1) Load Flow Study: load flow study with power flow analysis for the Collection System Circuits. Final report shall include a table showing cable ampacity and percent loading per cable section corresponding to the Project one-line diagram. Cable ampacity shall not exceed 95 percent of the rated value, based on Project Site-specific thermal resistivity testing results, as further described in Section 3.0 herein, including specifically IEEE 442. All external heat sources shall be considered, including parallel circuits. Thermal design shall account for actual field soil samples and backfill requirements (native or engineered).
 - (a) The Load Flow Study shall be performed utilizing CYME CYMCAP software and shall consider, at a minimum, the following factors as part of the study:
 - 1. Historical Ambient Soil temperature data
 - 2. Historical Soil Moisture content data
 - 3. Air temperature data
 - 4. Maximum rated conductor temperature
 - 5. Critical soil interface temperature
 - 6. Measured maximum soil temperature

7. Measured native in-situ thermal resistivity
 8. Native soil dried-out thermal resistivity
 9. Laboratory determined compacted soil thermal resistivity
 10. Compacted soil dried out thermal resistivity
 11. Load factor
 12. Conductor installation arrangement (Trefoil, etc.)
 13. Conductor burial / bore depth
 14. Concentric Neutral conductor ampacity
 15. Number and spacing of adjacent cables
 16. Heating effect from adjacent cables
- (b) Soil moisture content assumptions in CYMCAP shall be based upon:
1. Available historical soil water content data.
 2. Soil water content measurements per the final geotechnical report.
 3. Soil water content data used in CYMCAP shall account for seasonal variation in soil moisture and drought conditions.
- (c) Conductor and concentric neutral is to be sized based upon the calculated current requirements and thermal damage limits that the cable can withstand under full load and short circuit conditions.
- (d) No improvement in soil thermal resistivity / heat transfer characteristics of the soil is allowed when using the native soil as backfill around buried cables. Only engineered thermal backfill material is allowed for use in improving the heat transfer from buried cables.
- (2) Short Circuit Study: short circuit analysis of Collection System Circuits, Project Substation, and Interconnection Line. The short circuit analysis and study shall be utilized in Contractor's electrical designs to support relay coordination study and equipment specification. The study shall be performed using Easypower or Owner-approved equivalent.
- (a) Conductor shall be sized based on the assumption that 100 percent (100%) of the fault current is carried by the conductor.
- (b) Concentric neutral shall be sized based on the assumption that 70 percent (70%) of the fault current is carried by the concentric neutral and 30 percent (30%) of the fault current is through earth (collection system grounding conductor) or other phase cable concentric neutral.

- (c) Collection system grounding conductor routed with the collection system phase conductors shall be sized to carry 30 percent (30%) of the fault current and shall not be less than 1/0 AWG. The grounding conductor may be copper, or an equivalently sized copper-clad conductor with a suitable estimated life.
 - (d) Short circuit thermal damage limit calculations shall assume a minimum of a 5-cycle delay on relay trip signal, and an additional 1 cycle of margin being added to the breaker interrupt time.
- (3) Annual Energy Loss Report: electrical losses evaluation, including estimate of annual energy losses for Project design. Such analysis shall be sufficient to demonstrate that the Electrical Loss Limit, as defined herein, is not being exceeded, and shall be based upon Project-specific cabling and transformer specifications, Project Site-specific soil conditions, and other similar considerations. A pre-construction annual energy loss report and an as-built energy loss report, respectively, shall be submitted.
 - (4) Reactive Compensation Study: reactive power flow report, including power factor study at the Point of Interconnection. The study shall identify reactive compensation required to meet the Requirements, including the requirements of interconnection for power factor and voltage regulation, and including any capacitor bank and/or reactor requirements and/or STATCOM requirements. The study shall include varying combinations of active power (from no load (0 percent real power) to full load (100 percent real power) and voltage (minimum 0.95 to 1.05 pu) at the Point of Interconnection unless the voltage letter is available in which case the study shall cover the voltage range defined in the voltage letter.
 - (5) Harmonic Analysis Report: power quality analysis at the Point of Interconnection to determine the harmonic resonance and flicker conditions within the Project and demonstrate that the Project design meets the harmonics distortion requirements in the Requirements (including IEEE 519, and the Interconnection Agreement), including any necessary filtering or mitigation to be provided by Contractor.
 - (6) Harmonic Measurement Report: the purpose of this report is to confirm the Project will meet the Interconnect Agreement harmonic requirements under all configurations of the Project and Project Substation. Upon completion of the Project, harmonic measurements shall be made at both the Point of Interconnection, and the 34.5 kV Project Substation bus to confirm the Interconnection Agreement power quality requirements and industry standard requirements, such as IEEE 519, are met. Harmonic measurements made, and the harmonic report that are prepared are to be per Exhibit E.2.11 (*Guideline for Inverter Based Renewable Generation (IBRG) Power Quality Measurements and Reports - Rev. A*).
 - (7) Shield Wire Induced Voltage Report: analysis to determine the maximum voltage difference between ground and the cable shield. The collection system cables shall have their shields (concentric neutral) grounded on each end of the cable and the maximum shield voltage shall not exceed 25 volts when referenced to ground. An equipment ground conductor (bare copper or copper clad steel with suitable estimated life) shall be routed with each collection system cable.
 - (8) Insulation Coordination Report: study to ensure the insulation coordination requirements of IEEE C62.22-2009 have been satisfied within the Project electrical design, including proper application of surge arresters to safeguard electric power equipment within the Collection System Circuits, Substation, and Interconnection Line against hazards of abnormally-high voltage surges of various origins.

- (9) System Transient Temporary Overvoltage Report: the collection system transient temporary overvoltage study is developed with a digital simulation program that models transient voltages and currents on the collection system. The study shall be developed using EMTP (Electromagnetic and Electromechanical Transients Program by EMTP Alliance) or Owner-approved equal.
- (a) This study shall also be used to select the MCOV (Maximum Continuous Operating Voltage) rating for the surge arresters installed on the collection system. When selecting the arrester MCOV (Maximum Continuous Operating Voltage) rating, both the highest transient overvoltage and the highest temporary overvoltages shall be considered. The system model shall determine the highest voltage that occur on the un-faulted phases for a single line to ground fault along the collection system.
 - (b) The highest transient overvoltage typically occurs within 3 cycles of either the fault occurring or the substation feeder breaker opening to clear the fault. Minimum MCOV rating = Peak Transient Overvoltage / (1.53 x 1.4142). See IEEE standard C62.22-2009 Figure 12: 0.02 second overvoltage duration requirement for metal oxide surge arresters on AC systems).
 - (c) The arrester shall also be capable of withstanding the temporary overvoltage (voltage following the transient overvoltage while the inverters continue to provide power). Minimum MCOV rating = Peak Temporary Overvoltage / (1.30 x 1.4142) (see IEEE standard C62.22-2009 Figure 12: 10 second overvoltage duration requirement for metal oxide surge arresters on AC systems).
- (10) Ground Grid Report: analysis of major Equipment grounding design to verify the adequacy of the proposed design and the safety of personnel working in or around the major Equipment. The study shall confirm that the grounding system maintains touch and step voltages within tolerable limits, and shall be prepared in accordance with the procedures, data, and recommendations given in IEEE 80. The study shall determine the ground potential rise with respect to remote earth, and Foundations shall be modeled as they are actually constructed (i.e., if not solidly bonded (e.g., using wire ties), they should be modeled accordingly).
- (11) Reactive Power Control Report: the purpose of the reactive power control analysis is to develop the logic for use in signaling when each reactive power source (switched capacitor, switched reactor, static var compensation, or similar device) should be turned on or off in coordination with the reactive power supplied by the inverters. Information used in determining the logic shall include, but not be limited to, (i) the voltage schedule letter; (ii) the voltage flicker limitations identified in the Reactive Power study; (iii) the Interconnect Agreement and FERC 827 power factor requirements; (iv) reactive power capability curves for applicable equipment; and (v) the dynamic model of the system to model the impact of reactive power switching.

- (a) The end results of the study are the parameters / inputs required for the Wind Turbine / PCS Inverters and it's controller to coordinate with the other available reactive power sources. Parameters supplied from the study typically include (i) voltage droop profiles (percent droop, percent deadband, QMax, and Qmin); (ii) reactive power switching parameters (switch in percent and switch out percent); (iii) reactive power switching time delay (switch in delay and switch out delay); (iv) Point of Interconnection power factor limits (leading power factor limit and lagging power factor limit); and (v) Graphs of dynamic response switching events effect on voltages at the point of interconnect and at the substation.
 - (b) When designing the logic, the full reactive power capability of the system shall be made available to respond to grid disturbances. No artificial limiters shall be designed into the logic to limit the amount of reactive power provided to support the electric grid during grid disturbance events.
- (12) Arc Flash Study: arc flash hazard analysis of the major Equipment, including all energized equipment in the solar PV Array (including inverters) / BESS / Wind Turbines Collection System Circuits, Project Substation, Interconnection Line, and O&M Building. This analysis shall be performed in accordance with the latest version of current versions of IEEE C2, National Electric Safety Code, NFPA-70E, IEEE 1584, and OSHA standard 1910.269.
- (a) The arc flash study shall be performed using EasyPower software for voltages up to 15 kV and ArcPro software for voltages over 15 kV, or Owner-approved equals. For calculations above 15 kV, the ArcPro calculation results shall be adjusted to account for three phase arcs in open air or in an enclosure, as required in OSHA 1910.269 Appendix E, Table 3 Notes.
 - (b) The input data, one-line model, and study results shall be provided with the report (both draft and final) and shall be provided in *.pdf format. Contractor shall also provide the native software files utilized for the study for Owner's review and record.
 - (c) Contractor shall supply and install arc flash labels on all applicable equipment enclosures from the Project Substation to the Wind Turbines / PV panels / BESS. Labels shall be in accordance with Section 2.6.
 - (d) Contractor shall utilize the minimum working distances indicated in Table 13 in the arc flash study.

Table 5-2: Arc Flash Study Minimum Working Distances

Equipment Class	Working Distance
480-volt motor control center and panels	18 inches
480-volt switchgear	24 inches
5-kV switchgear	36 inches
15-kV switchgear	36 inches
15-kV equipment (outdoor)	36 inches
16- to 36-kV equipment (enclosed)	48 inches
16- to 46 kV equipment (outdoor)	48 inches
47- to 72.5-kV equipment (outdoor)	72 inches
73- to 169-kV equipment (outdoor)	84 inches
170- to 362-kV equipment (outdoor)	120 inches

5.2.3 Contractor shall prepare energization plans and procedures for each Collection System Circuit. Energization plans shall be submitted to Owner for approval *prior* to use. Energization plans shall include both electrical and communications infrastructure as well as backfeed plans, soaking plans, testing plans, and lock out tag out procedures, at a minimum.

5.2.4 Contractor shall provide a complete recommended spare parts list for the Project's electrical works, including the Collection System Circuits. Such list shall include recommended quantities, part / model numbers, and nominal pricing.

5.2.5 Contractor shall submit all manufacturer's product sheets (material cut sheets), warranties, and operations and maintenance manuals (as applicable) for all permanently-installed equipment and materials.

5.3 Collection Circuits

5.3.1 Contractor shall design, furnish, construct, and install the Collection System Circuits in conformance with the minimum requirements set forth herein.

(1) Contractor shall furnish all labor, equipment, and materials that are necessary for a complete, fully-functional, and safe Collection System Circuit configuration, excluding only the Owner-Supplied Equipment in Exhibit B (*Owner Scope of Work*).

5.3.2 Contractor shall furnish a sufficient quantity of medium-voltage transformers, as applicable, including one (1) spare unit(s). All spare units shall be specifically marked and packed for storage.

5.3.3 Contractor shall furnish a sufficient quantity of PCS units, as applicable, including one (1) spare unit(s). All spare units shall be specifically marked and packed for storage.

5.3.4 Notwithstanding the following sentence and as more particularly described in Section 14.4.3 herein, Contractor shall complete all fiber optic terminations, including, but not limited to, those at the O&M Building, Project Substation, and permanent meteorological towers. Turbine Supplier shall complete all fiber optic terminations in the base of each Turbine.

5.3.5 Contractor shall perform directional boring at all Collection System Circuit crossings with a stream, wetland, county road, railroad, pipeline, or other buried facility. Augers or pneumatic or hydraulic jacks shall be used to install a conduit through an area that may not be trenched (such as a paved road or paved area). The diameter of the hole shall not exceed the diameter of the conduit if by more than one (1) inch. Where a gap between the conduit and hole exceeds one (1) inch a thermally conductive, flow-able material shall be added to fill the void around the conduit. Boring a hole utilizing water pressure and washing is not acceptable. HDPE type conduit shall be installed for all tunneling/boring. Proposed material for flow-able fill shall be submitted for Owner review and approval prior to use.

5.3.6 Contractor shall install four (4) bollards around every junction box and MV pad-mounted transformer (if any), respectively.

5.4 Testing and Quality Control

5.4.1 Contractor shall test, commission, start-up, and place into successful operation each Collection System Circuit, including the electrical infrastructure and communications infrastructure. At a minimum, testing shall include the minimum requirements set forth below. All testing shall be performed by an independent, experienced third party.

- (1) All Collection System Circuits shall be tested to demonstrate they meet stated design criteria and are fit for purpose.
- (2) All testing specified in the Applicable Standards, including NETA standard for Acceptance Testing Specifications.
- (3) All testing reasonably recommended or required by the applicable equipment suppliers.
- (4) All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.
- (5) Solar and BESS: Resistance testing on grounding grid at each junction box, electrode ring and central inverter or inverter transformer.
- (6) Megger test of all 34.5-kV cables.
- (7) Final continuity tests after completion of all system connections. After installation of the cable and prior to the high potential test specified below, a simple continuity test shall be conducted on the system. This can be accomplished by grounding the conductor at the source and checking for continuity from the end of each tap with an ohmmeter.
- (8) Cable jacket integrity testing shall be performed on all collection cables. Defects or damage to cable jackets shall be repaired using a cable OEM approved method, or the damaged cable section shall be replaced.
- (9) High potential very low frequency (“VLF”) test shall be performed on all 34.5-kV power cabling. After successful completion of cable continuity testing and cable jacket integrity testing.

- (10) Collection system phase verification testing. Once VLF testing has been completed, and prior to energization, a test voltage shall be applied to the collection feeder riser conductors at the substation. Every inverter location in that feeder should then be checked with a meter to verify that the collection system phase sequence is correct. This test can only be conducted once all collection cables have been terminated and installed on each feeder in the systems entirety (all equipment is connected in the collection system and substation).
- (11) Collection system voltage and phase rotation testing. After energization, phase and line voltage and phase rotation shall be tested at the low-voltage side of the medium voltage step-up transformer.
- (12) Partial discharge testing: If more than two (2) failures of any particular collection system component occur within one (1) year of commercial operation, then partial discharge testing shall be performed on all similar components.
- (13) Compaction testing shall be verified at a minimum of every 1,500 feet and at every splice pit location.
- (14) Communications system testing per Section 9.4 herein.
- (15) Pad-mount transformer (if any) minimum testing:
 - (a) Transformer turns ratio (“TTR”) on all tap positions.
 - (b) Insulation resistance test (i.e., Megger), including winding-to-winding and winding-to-ground measurements.
 - (c) Winding resistance test.
 - (d) Insulation power factor test.
 - (e) Oil testing including color, moisture content, and dissolved gas analysis prior to energization and at least 30 days following energization, respectively.
 - (f) No-load and load loss test factory certified test reports.
 - (g) Not used.
- (16) In the commissioning report, Contractor shall provide the following with respect to the collection system transformer tap position settings:
 - (a) Confirmation that all transformer tap settings (generator step up, etc.), relay settings, and control system parameters match the engineer of record construction documents (issued for construction drawings, PRC-019, PRC-023, PRC-024, PRC-025, PRC-027, VAR-002 studies, Substation Electrical Studies, etc.).
 - (b) Confirms transformer voltages are per NEMA / ANSI utilization voltage standard C84.1 (Electric Power Systems and Equipment – Voltage Ratings – 60 Hz) for transformers that provide power to utilization equipment.

- (c) Confirms transformer voltages are correct per the manufacturer ratings, (issued for construction drawings, PRC-019, PRC-023, PRC-024, PRC-025, PRC-027, VAR-002 studies, reactive power flow study, reactive power Control Analysis study, arc-flash studies, etc.).

5.4.2 Contractor testing plan shall be submitted to Owner for review and approval. Contractor shall notify Owner of all testing schedules at least 30 days in advance of testing activities and copies of testing reports (including a summary of testing procedures and acceptance criteria) shall be submitted to Owner within 10 days of completing such test.

6.0 PROJECT SUBSTATION

6.1 General Provisions

6.1.1 The Project Substation shall be constructed on owned land and not acquired through an easement, and designed and constructed per AHJ required guidelines and withstand no less than a 100-year, 24-hour storm event. Final constructed grade shall be at least 12 inches above such flood depth, as determined in the Contractor-provided hydrology study.

6.1.2 The design working life of the Project Substation shall be a minimum of 35 years.

6.1.3 The Project Substation shall be designed and constructed to a high level of reliability and shall meet the requirements set forth by the interconnection utility, Transmission Provider, FERC, and the ISO.

- (1) Design shall consider the interconnecting utility's future fault values for the worst-case value over a 35-year life.
- (2) The Project Substation shall be constructed with steel structures. The use of wood structures is not allowed.

6.1.4 The Project Substation shall be designed, constructed and tested at a minimum in accordance with applicable ANSI (including safety signage in accordance with ANSI Z535), IEEE and NEMA standards and in accordance with the latest version of the NESC; and shall also be designed, constructed, and tested to a high level of reliability and shall meet or exceed the requirements set forth by the interconnection utility. Contractor testing plan shall be submitted to Owner for review and approval.

6.1.5 Contractor shall design and construct the Project Substation in accordance with the Project Substation Electrical Studies and the Electrical Loss Limit, each as defined herein.

6.1.6 No splices shall be made within the Project Substation for 34.5-kV or higher system energized conductor (except for tubular bus as determined by bus support calculations). Additionally, power, instrument, and control conductors shall not be spliced. Shields may be spliced where necessary to permit connection to the Project Substation ground system.

6.1.7 Project Substation basic impulse level shall be at least 200 kV for the 34.5-kV system and in accordance with Table 6-1 below for the high-voltage system (to be determined based on the Project voltage level). Design of the high-voltage and 34.5-kV systems shall be for a short circuit rating calculated based on the results of a Contractor-furnished short circuit study.

Table 6-1: Minimum Basic Impulse Ratings and Clearances

A		B			C		D		E	F		G	H	
Nominal Voltage	Max. design application altitude	Equipment External Impulse Withstand	Insulation Coordination		Bus & Switch Insulator	Ph-Gnd Clearance		Ph-Ph Clearance		Ph-Ph Spacing without Switches & Vertical Runs	Ph-Ph Spacing		Vertical Clearance - Energized part to permanent supporting surface	Vertical Height Rigid Bus
		Nominal (sea-level) BIL	Min. Allowable Effective BIL & Surge Arrester MCOV		Nominal (sea-level) BIL	IEEE C37.30.1, 1427 STD. Min.	XEL Design Min.	IEEE C37.30.1, 1427 STD. Min.	XEL Design Min.	XEL Design Minimum	Historical Design Min.	IEEE C37.30.1 XEL Design Min.	STD. Min. NESC Table 124-1	XEL Design Minimum
		kV	kV	kV	kV	FT-IN (Metal-Metal)	FT-IN (Metal-Metal)	FT-IN (CL-CL)	FT-IN (CL-CL)	FT-IN (CL-CL)	FT	FT	FT-IN (Surface-Metal)	Low High
(Ph-Ph)	(ASL)	(BIL)	(BIL)	(MCOV)	(BIL)	(Metal-Metal)	(Metal-Metal)	(CL-CL)	(CL-CL)	(CL-CL)	(CL-CL)	(CL-CL)	(Surface-Metal)	(Baseplate-CL)
2.4	14	60	36	2.55	200 ⁽⁴⁾	0-4.5	1-6	0-5	2-0	3-0	3	4	8-9	12-0 19-0
4.16	14	75	44	2.55	200 ⁽⁴⁾	0-5.6	1-6	0-6.2	2-0	3-0	3	4	8-10	12-0 19-0
7.2	14	95	56	8.4	200 ⁽⁴⁾	0-6	1-6	0-7	2-0	3-0	3	4	8-10	12-0 19-0
15	14	110 ⁽²⁾	65	8.4 ⁽³⁾	200 ⁽⁴⁾	0-7	1-6	1-0	2-0	3-0	3	4	9-0	12-0 19-0
25	14	150	89	15.3	200 ⁽⁴⁾	0-10	1-6	1-3	2-0	3-0	3	4	9-3	12-0 19-0
35	14	200	118	22 ⁽³⁾	200	1-1	1-6	1-6	2-0	3-0	3	5	9-6	12-0 19-0
46	14	250	148	31.5	250	1-5	1-10	1-9	2-0	4-0	4	6	9-10	12-0 19-6
69	14	350	207	48	350	2-1	2-6	2-7	3-0	5-0	5	7	10-5	13-0 20-0
115	14	550	326	76	550	3-6	3-9	4-5	5-0	7-0 ⁽¹⁾	10	10	11-7	14-0 21-0
138	14	650	385	88	650	4-2	4-6	5-3	5-9	8-0	11	12	12-2	15-0 23-0
161	14	750	444	106	750	4-10	5-2	6-0	6-8	9-0	13	14	12-10	16-0 25-0
230	9.55	900	630	152	900	5-11	6-8	7-5	8-2	11-0	15	16	13-9	17-0 28-0
230	13.6	1050	630	152	1050	6-11	7-8	8-9	9-8	13-0	16	18	14-10	18-0 31-0
345	7.7	1300	975	230	1300	8-8	8-10	9-11	10-11	14-6	16	20	17-2	19-0 33-6
345	12.4	1550	975	230	1550	10-4	10-8	10-10	11-11	20-0	25	25	18-10	21-0 41-0
500	7.1	1800	1380	335	1800	12	12-8	12-6	13-9	22-0	27	27	20-6	31-2 53-2

6.1.8 Contractor shall receive explicit approval from Owner or Owner’s representative(s) of the design of the Project Substation prior to construction. Owner shall have unlimited access to such designs throughout the design process, and construction of all such facilities shall be completed by one of Owner’s approved subcontractors, as more particularly detailed in Exhibit A.3 (Approved Suppliers).

6.1.9 Project Substation equipment paint shall be designed for the Project environment including items such as temperature swings, ultraviolet exposure, salt exposure, chemical exposure, pesticide exposure and warranted for no less than 10 years. The coating shall consist of rust-inhibiting epoxy primer, standard intermediate coating, and two (2) finish coats of paint. The total coating shall be a minimum of five (5) mils dry. The paint color of all equipment shall match and comply with Project architectural requirements. If no architectural requirements are provided, equipment paint color shall be ANSI 70 gray, unless otherwise specified by the Requirements.

6.1.10 Station auxiliary power at the Project Substation shall be provided from two (2) sources. The Interconnection Line and local distribution system may each be utilized as a source. A standby generator shall be installed if a local distribution system connection is not available.

6.1.11 The Project Substation shall be designed and constructed to meet guidelines set forth by the Avian Power Line Interaction Committee (“APLIC”). Refer to Exhibit E.4 (APLIC Guidance) for additional information.

6.1.12 Requirements for Project Substation civil and structural works:

- (1) All civil and structural works including, but not limited to, grading, structures, foundations, assemblies, and components for the Project Substation shall be designed and constructed in accordance with the applicable specifications in Section 4.0 (Civil / Structural Works).

- (2) Excavation by blasting for the Project Substation is prohibited.
- (3) Trench widths shall be kept to a minimum to allow sufficient space for equipment installation. The trench bottom shall be firm for the entire length and width. Trenches shall be kept free from water. Conduit and cable shall not be placed on frozen ground.
- (4) Project Substation equipment shall have wind and seismic withstand capability in accordance with the Applicable Standards, including IEEE 693 and AISC's "*Manual of Steel Construction*".
- (5) Areas at the Project Substation to be surfaced with finish rock, including areas outside the permanent fence, shall be treated with a weed eradicant and soil fumigant. Care shall be taken with the application of the soil sterilant to prevent contamination of adjacent areas and to comply with environmental permitting constraints.
- (6) The Project Substation Site Access Road shall have a minimum inside radius of 50 feet and shall be long enough for a delivery vehicle to fully pull in and straighten prior to entering through the gate.
- (7) Substation driving paths shall be designed to avoid crossing of pre-cast cable trenches if possible.

6.1.13 Requirements for substation cabling:

- (1) All cable furnished shall conform, at a minimum, to the requirements included in Table 6-2 (Summary of Cable Requirements):

Table 6-2: Summary of Cable Requirements

Cable Type	Description
Low-voltage power	600 volts, single-conductor, Class B stranded copper; EPR or XLP insulated; CSP or CPE jacketed.
Low-voltage power	600 volts, three-conductor; concentric lay, stranded copper with a ground wire in the interstices; FRXLPE or FREPR insulation; CSP, or CPE jacketed overall.
Control	Control cable, 600 volt, multiple-conductor, as required, stranded copper, 10 AWG, 12 AWG, 14 AWG; multiple-conductor, XLP insulation; CSP, or CPE jacketed overall. Shielded control cable is required when 230kV or greater is present in the Project Substation.
Instrumentation	Instrumentation cable, 600 V, flame retardant single-and multiple-twisted pairs and triads, shielded instrument cable with individually shielded pairs, overall shield, and overall jacket; FRXLPE or FREPR insulation; CSP, or CPE jacketed overall. (Single pair or triad 16 AWG, multi-pair or triad 18 AWG).
Lighting and receptacles	Lighting circuit runs totally enclosed in conduit, NEC Type RHW-USE with XLPE insulation for use in outdoor or unheated areas.
Shielded control	Control cable, shielded, 600-volt, multiple conductor, as required, stranded copper, 10 AWG, 12 AWG, 14 AWG; multiple conductor, XLP insulation; CSP, FRPVC or CPE jacketed overall.

- (2) Power conductor size and ampacity shall be coordinated with circuit protection devices. Conductor size shall be determined for 125% of connected load at the design basis maximum outdoor ambient temperature. Below-grade power cable conductor size shall be determined in accordance with the methods in IEEE 835.
- (3) Control, shielded control, and instrumentation multi-conductor cable assemblies shall include a minimum of 25 percent spare conductors. Multi-conductor cable assemblies shall utilize the ICEA color coding scheme E-1.
- (4) Installation of conductors shall be understood to include placement, splicing (in accordance with 6.1.6), and terminating conductors; coiling and taping of spare conductors; identification, testing, and verification of each circuit, cable, and conductor.
- (5) Insulated cable, conductors, and conductor accessories shall be furnished and installed in accordance with the requirements of these specifications and the recommendations given in IEEE 525. Insulated cable, conductors, and conductor accessories shall be furnished in quantities sufficient for a complete installation as indicated in these Specifications.
- (6) Terminations of conductors shall be as follows:
 - (a) Connectors, sizes 12 - 2 AWG, shall be non-insulated ring-tongue type.
 - (b) Connectors, sizes 1 AWG – 750 kcmil, shall be uninsulated two-hole rectangular tongue.
 - 1. Solderless-type terminal lugs and connectors shall be used for connecting #9 AWG wire and smaller stranded cable to studs.
 - 2. Terminations for wire sizes larger than #8 AWG shall have at least two (2) indentations.
 - (c) Terminations shall be made with pressure-type terminal lugs using a compression tool provided with a ratchet or toggle mechanism that ensures a complete and positive crimp before the tool can be removed. Compression tools shall be approved by the lug manufacturer.
 - (d) Cables and wires used for all instrumentation and control connections shall be terminated with seamless, non-insulated, ring-type Burndy YAV hylug-type compression connectors.
 - (e) Wire strands shall not be removed from the end of a cable in order to reduce the conductor diameter. Appropriately sized terminal lugs must be used to maintain the same ampacity rating as the cable.
 - (f) Sufficient length shall be left at all ends of wires and cables to conveniently make connections to equipment and devices. Spare conductors at the end of a multiconductor cable shall be coiled neatly and retained in a length equal to that of the longest single conductor at each end of the multiple-conductor cable or terminated as shown in the design drawings. All cables entering a terminal cabinet, switchgear compartment, distribution board, or other such device from a conduit, cable slot, or cable trench shall be clamped securely at the opening. All exposed cable or wire runs shall be bundled together and tied so as to prevent movement.

- (g) Cables and wires shall not be bundled in a cable tray or floor trench but shall be bundled and laced immediately after passing through an opening in the tray or trench cover at each instrument panel rack.
- (h) A threaded stud shall be used if more than two wires are landed on the same point on a terminal block.
- (7) The cable furnished shall be flame retardant construction in accordance with the applicable ICEA standards and suitable for wet or dry locations.
- (8) All cable shall have surface printing showing manufacture's name, insulation type, jacket type, conductor size, conductor type, voltage rating, and numbered footage markers.
- (9) Control and instrument cables, and 600-volt class cables shall be terminated with ring-tongue connectors.
- (10) Cable pulling shall be as follows:
 - (a) A careful determination of the length of all wire and cable runs shall be made by Contractor prior to any cable installation in order to minimize pulling stresses. Cable pulling tensions shall not exceed those recommended by the cable vendor or supplier. Wire and cable shall be handled with care to avoid damage. Contractor shall carefully inspect all wire or cable for visible defects. Instances of damaged wire or cable shall be promptly brought to the attention of Owner or its representative, who shall determine the action to be taken to correct such defects.
 - (b) A clean, dry, tight-fitting rag shall be drawn through the conduit immediately before installing the wire or cable. No wire or cable shall be installed in conduit unless it is free of all foreign material.
 - (c) An Owner approved water-based lubricating material non-injurious to the insulation or jacket shall be used when necessary to prevent mechanical damage.
 - (d) No cable shall be installed prior to the completion of the raceway system in which the cable is routed in.
- (11) Shielded wire and cable shall have the shield grounded strictly in accordance with the Requirements.

6.1.14 Requirements for substation bollards:

- (1) See Section 4.1.22 herein.
- (2) Non-metallic bollards shall be placed as appropriate around the perimeter of above-grade equipment, including the 34.5-kV Collection System feeder conduit and cable trench as needed, in particular in areas within or adjacent to driving lanes.

6.1.15 Requirements for main power transformer:

- (1) The main step-up transformer(s) has/have the technical specifications as noted in Exhibit D.6 (Main Power Transformer Specification).

- (2) No more than 150 MW of capacity shall be directed through any single main step-up transformer. For Project's with a nameplate capacity exceeding this threshold, the Project shall incorporate parallel main step-up transformers in either 100 MW, 125 MW or 150 MW increments, where each such transformer is identical and interchangeable (mechanically and electrically). Load from each Collection System Circuit shall be split evenly across each transformer. Example: a 270-MW project shall incorporate two (2) identical 150 MW main step-up transformers with approximately 135 MW on each unit.
- (3) The standard transformer MVA rating for a transformer carrying 100 MW of generation is 75/100/125 MVA with an impedance at 75 MVA of 9%. The standard transformer MVA rating for a transformer carrying 125 MW of generation shall be 94/125/156 MVA with an impedance at 125 MVA of 10 percent. The standard transformer MVA rating for a transformer carrying 150 MW of generation is 113/150/187 MVA with an impedance at 113 MVA of 10 percent.
- (4) The main power transformer high side voltage rating shall coordinate with the transmission line voltage. The transformer nominal high side voltage rating shall match ANSI standard C84.1 voltage ratings. The nominal high voltage rating shall typically be either 115,000; 161,000; 230,000; or 345,000 volts.
- (5) The main power transformer low side voltage rating shall be 34,500 volts.
- (6) The main step-up transformer foundation and containment shall be provided with secondary oil containment equal to at least 110% of the volume of oil present in the transformer in addition to the volume of rainwater for a 100-year, 24-hour storm event over the area of the containment; a calculation shall be provided by Contractor to demonstrate compliance with this requirement. Oil containment shall be a concrete containment with a manual brass ball valve drain and shall have grating over the oil containment to facilitate access to instrumentation and control cabinets for operations.
- (7) The main step-up transformer shall include a +/-10% on-load tap changer on the high side winding.

6.1.16 Requirements for circuit breakers:

- (1) Circuit breaker electrical ratings shall be verified by Contractor against electrical studies including but not limited to TOV study, short circuit study, reactive switching study, and site ampacity study. Contractor is responsible for circuit breakers meeting project application.
- (2) High-side bus circuit breakers shall be outdoor, air insulated, three-pole, single-throw, 60 Hertz, dead-tank design with dual trip coils, alarms, interlocks and contacts necessary to meet the Project design. Such circuit breakers shall utilize SF6 gas as the interrupting medium. Such breakers shall consist of three sections: high-voltage compartment, mounting provisions, and low-voltage compartment.
- (3) 34.5-kV circuit breakers shall be installed for protection of the Collection System Circuits, capacitor banks, and reactors, respectively. Such circuit breakers shall be outdoor, distribution, 60 Hertz, vacuum circuit breakers consisting of three sections: high-voltage compartment, mounting provisions, and low-voltage compartment.

- (a) The number of medium voltage 1200 Amp collection system feeder breakers shall be determined by the collection system.
- (b) Up to two (2) medium-voltage collection feeders may be connected to a single vacuum breaker, provided that the equipment is capable of that arrangement based on the Substation Electrical Studies and other Requirements.
 - 1. On projects that are geographically disperse up to three (3) feeders on a single breaker may be used only with Owner's explicit approval.
- (c) Medium voltage main breakers shall be provided for each main power transformer. Main Power transformers with 100 MW of generation connected to it shall be rated for 2000 Amps. Main Power transformers with 125 MW or 150 MW of generation connected to it shall be rated for 3000 Amps unless the Engineer of record determines that a higher rating is required to meet the interconnect agreement reactive power requirements at the point of interconnect.
- (d) Substations with two main power transformers shall include a medium voltage bus tie circuit breaker. Bus tie breakers shall be rated for the same ampacity as the medium voltage main breakers.
- (e) Grounding breakers are not allowed as a form of grounding a feeder following disconnection of the feeder from the substation (feeder breaker opening) and shall not be used. Grounding transformers must be included (when required) to ground a feeder following the feeder breaker opening.
- (f) Feeder breaker naming convention shall be as follows:
 - 1. 34.5 kV Bus 1: 311 to 319
 - 2. 34.5 kV Bus 2: 321 to 329
 - 3. 34.5 kV Bus 3: 331 to 339
- (4) Circuit breakers shall contain bushing current transformers for metering and/or protective relaying applications. Current transformers utilized for metering shall be provided with accuracy levels as required by the applicable metering standards of entities which will be installing metering within the station. Current transformers shall be selected for appropriate burden support during fault conditions for Project's application as well as for thermal ratings that do not limit the Project capacity output.
 - (a) When the highest level of metering accuracy is required, "High Accuracy, Extended Range Class 0.15" current transformers may be utilized. This means that from 1 percent of nominal current through the rating factor, accuracy is guaranteed to be ± 0.15 percent. Use of the current transformer rating factor and meters that accept current inputs from 10 Amps to 20 Amps may also be used to achieve the Project requirements.
- (5) Circuit breaker mounting provisions shall be formed-steel supports that mount the breaker to a foundation and provide height adjustment.

- (6) The low-voltage compartment of the circuit breakers shall contain the control components and operating mechanism including anti-condensation heaters.
- (7) The stored energy mechanism shall drive a common shaft which operates all three phases and the auxiliary switches for breaker position contacts.
- (8) The control enclosure shall contain the relays, meters, and switches for the breakers.
- (9) The minimum continuous current rating used for transmission circuit breakers shall be 1200A for 230 KV and below and 2000A for 345 KV. The minimum continuous current rating for 34.5 KV feeder circuit breakers shall be 1200 Amps.
- (10) All circuit breakers shall be sourced from one of the approved suppliers in Exhibit A.3 (Approved suppliers).

6.1.17 Requirements for voltage transformers:

- (1) All voltage transformers shall be connected through an indoor, panel mounted, voltage injection test facility (test switch). Each voltage transformer neutral shall be brought through into the control building for termination and single point grounding within the associated protection relay panel.
- (2) All voltage transformers shall be a 2 or 3 winding, 0.3 class unit minimum, suitable for outdoor installation. Turn ratios shall be determined by Contractor. The units shall be suitable for revenue metering and relaying accuracy as required.
- (3) Capacitive Coupled Voltage Transformers (“CCVT”) shall have the facility for grounding through an external grounding switch.
- (4) Outdoor potential transformers connected to the collection system bus must be suitable for use on renewable applications including the ability to withstand frequent reactive power switching events (turning capacitor or reactor banks on and off) causing transient overvoltage conditions.
 - (a) Potential transformers shall meet the following standards, at a minimum:
 - 1. IEEE C57.13-2016 – IEEE Standard Requirements for Instrument Transformers.
 - 2. IEC 61869-3, Clause 7.2.3 – IEC standard – Instrument transformers – Part 3: Additional requirement for inductive voltage transformers.
 - 3. CAN/CSA 411.1, Clause 6.6 – CSA standard for AC suspension insulators, clause 6.6 - requirements for basic impulse and fast impulse transient withstand.
- (5) All voltage and outdoor potential transformers shall be sourced from one of the approved suppliers in Exhibit A.3 (Approved suppliers).

6.1.18 Requirements for current transformers:

- (1) All current transformers shall be connected through an indoor, panel mounted, current injection test facility (test switch). Each current transformer neutral shall be brought through into the control building for termination and single point grounding within the associated protection relay panel.
- (2) The facility for short circuiting the secondary tails of all current transformers, with removable links, must be provided. All current transformers are to be connected through an indoor, panel mounted current injection test facility (test switch).
- (3) All current transformers shall be sourced from one of the approved suppliers in Exhibit A.3 (Approved suppliers).

6.1.19 Requirements for disconnect switches:

- (1) High-side line disconnect switches: motor operated.
- (2) High-side breaker disconnect switches: 3-phase gang, manually operated (hand crank).
- (3) Low-side bus disconnect switches: 3-phase gang, manually operated (hand crank).
- (4) Low-side breaker disconnect switches (includes all feeder breakers, reactors, capacitor banks, and/or grounding transformers as applicable): 3-phase gang, manually operated (hand crank).
- (5) Low-side feeder disconnect switches: hook stick, maximum height of 12 ft to hook.
- (6) Bus-tie disconnect switches (if used): 3-phase gang, manually operated (hand crank).
- (7) All switches shall be suitable for outdoor use and shall be non-load break type.
- (8) All motor-operated switches shall include contacts and interlocks wired for protection and control with provisions for padlocking for personnel safety and maintenance. All switches shall have hard-wired interlocks and shall be designed and implemented to prevent operation in an undesired state.
- (9) The minimum continuous current rating used for transmission disconnect switches shall be 1200A for 230 KV and below and 2000A for 345 KV. The minimum continuous current rating for 34.5 KV feeder disconnect switches shall be 1200 Amps. The minimum continuous current rating for 34.5 KV main and tie switches shall be the 34.5 KV main bus continuous current rating.
- (10) All disconnect switches shall be sourced from one of the approved suppliers in Exhibit A.3 (Approved Suppliers).

6.1.20 Requirements for grounding transformers:

- (1) Grounding transformers (if required) shall be sized per the System Transient Temporary Overvoltage Report to effectively ground the portion of the Collection System Circuit that is disconnected from the main Project Substation 34.5-kV bus when the Project Substation feeder or collector breaker is open.

- (2) The duration of time that the grounding transformer shall provide effective grounding shall be determined assuming that the Collection System Circuit was at full rated generation at the time when a fault condition occurs on the Collection System Circuit, the time required for the collector breaker to trip due to the fault condition, and the additional time that the generation on the Collection System Circuit continue to contribute energy to the fault after the collector breaker opens.
- (3) Effective grounding shall be as defined in IEEE Standard 142 and meet the following two conditions, at a minimum:
 - (a) The positive sequence reactance is greater than the zero sequence resistance ($X1 > R0$)
 - (b) The zero sequence reactance is less than or equal to three (3) times the positive sequence reactance ($X0 \leq 3X1$).
- (4) All grounding transformers shall have the same KVA rating and shall be interchangeable.
- (5) All grounding transformers shall be sourced from one of the approved suppliers in Exhibit A.3 (Approved Suppliers).

6.1.21 Requirements for reactive compensation devices:

- (1) Solar and BESS: The PV Array inverters shall provide all required reactive power to comply with the Requirements, including the Interconnection Agreement. Switched capacitor banks or switched reactor banks are not allowed in the substation.
- (2) Reactive compensation devices, including the inverters, capacitor banks and/or reactors, shall be sized and incorporated into the Project electrical design to comply with the Requirements, including the Interconnection Agreement.
- (3) Wind Projects: Capacitor banks shall be sized so that the change in voltage at the point of interconnect does not cause a voltage increase or decrease that is objectionable (e.g., causes voltage oscillation). Capacitor bank switching shall utilize capacitor switchers with pre-insertion resistors. Interrupting breakers shall be installed between the bus and capacitor switchers.
- (4) Wind Projects: Reactors shall be sized so that the change in voltage at the POI does not cause a voltage increase or decrease with switching that is objectionable (e.g., causes voltage oscillation). Care shall be taken to minimize induced magnetic coupling currents into structures and adjacent equipment.
- (5) Wind Projects: Any reactive power compensation devices required for the Project shall be provided on the low side of the main power transformer, unless otherwise explicitly required by the Transmission Provider Requirements and approved by Owner.

6.1.22 Requirements for space heaters:

- (1) Breakers and other outdoor equipment shall be furnished with space heaters (if not already provided by manufacturer of the equipment) that are thermostatically controlled and shall be rated single phase 240V for operation on 120V and shall include personnel protection screens.

6.1.23 Requirements for surge arresters:

- (1) High-side voltage surge arresters shall meet the requirements of ANSI C62.11 for Station Class installation in a 60-Hertz outdoor installation. Surge arresters shall be provided on the high-voltage bushings of the main step-up transformer and on the interconnection side of the motor-operated disconnect switch in the Project Substation.
- (2) 34.5-kV surge arresters shall meet the requirements of ANSI C62.11 for Station Class installation in a 60-Hertz outdoor installation. Surge arresters shall be provided at the 34.5 kV capacitor switchers and at each feeder disconnect switch.
- (3) Equipment surge arresters shall be station class, metal-oxide type surge arresters for outdoor use and polymer housing. Surge arresters shall be shatterproof.
- (4) Surge arresters shall not be used as rigid bus supports.

6.1.24 Requirements for rigid bus:

- (1) Design of the bus systems shall be in accordance with IEEE 605, at a minimum.
- (2) Loading and seismic performance shall be in accordance with the Project design and Project Site location. Such information is subject to verification by Contractor.
- (3) Rigid bus, at a minimum, shall be seamless, Schedule 40 tube made of 6063-T6 aluminum alloy fabricated per ASTM B241. All channel bus shall be aluminum integral web channel bus (IWCB) conductor, No. 2EC-T61 Alloy.
- (4) A damping conductor shall be furnished in all horizontal bus.
- (5) Bus shall have 0.25-inch drain holes in all bus/fittings that could possibly trap water.
- (6) Station post insulators shall be of sufficient strength to support the rigid bus and shall be ANSI 70 gray color.
- (7) Filler Metal: Type ER4043 filler metal shall be used for all aluminum welding, except for those isolated cases where the base metal is a type other than 356, 6061, or 6063.
- (8) Phasing shall be sequential with phase B in the center.

6.1.25 Requirements for connectors and fittings:

- (1) Connectors and fittings shall be of the proper size and design to assure permanent, secure, and low-resistance connections.
- (2) Rigid bus connections to transformers, breakers, CCVTs, or freestanding current transformers are prohibited.
- (3) For electrical pad connections, stainless steel hex-bolts, hex-nuts, flat washers, and Belleville washers shall be provided. Belleville washers shall have a minimum compression rating of 4,000 pounds. Bolt lengths shall be sized to provide minimal projection beyond hex nut to prevent excessive noise due to corona, but entire hex nut must be engaged.

- (4) For copper to aluminum connections, stainless steel bolts shall be used for copper to aluminum bar or rod connections and faced or sleeved aluminum connectors shall be used for cable connections.
- (5) All connections between stranded aluminum or ACSR-type conductors and equipment stud terminals shall be made with a stud-to-pad type stud connector and a compression-type cable-to-pad type conductor termination.
- (6) All dead-end fittings, terminals, splices, and other similar items for ACSR and other types of stranded aluminum conductor shall be tubular compression type fittings. In no case shall any type of stranded aluminum conductors be used with bolted or clamp-type fittings, except for through-type connections to surge arresters on transformers. At least five percent (5%) extra dead-end body filler plugs for each type used shall be provided.
- (7) Stranded and tubular copper bus work, where used, shall have connectors and fittings with a minimum of four (4) bolts or two (2) “U”-bolts on each side of each joint.
- (8) Fittings shall develop the full strength of the conductor and shall be capable of carrying the full current capacity of the conductor.
- (9) Fittings for shield wire dead ends, splices, and taps shall conform to the following:
 - (a) Shield wire dead-end fittings shall be compression type with bolted jumper connection. Shield wire insulators shall be located as indicated.
 - (b) Compression sleeves for shield wire tension splices shall be used which will develop at least ninety percent (90%) of shield wire strength.
- (10) Bus support clamps for rigid bus shall be fixed or slip type as required to firmly support the bus but allow for temperature expansion and contraction.
- (11) Bolted ground connectors and flexible type grounding jumpers shall be provided for operating handles of disconnect switches.
- (12) All transformer and oil circuit breaker stud connectors shall be tinned bronze material.
- (13) All grounding connectors in contact with galvanized structures shall be tinned bronze material.
- (14) All compression tees are to be open type compression run and 4-hole NEMA pad tap.
- (15) Bundled jumpers from power circuit breakers to disconnect switches shall be furnished.
- (16) For disconnect switch connections, NEMA-type terminal pad connectors shall be provided with at least four (4) bolts.
- (17) All materials furnished shall have mechanical and electrical ratings, types, sizes, and other similar items coordinated with adjacent hardware and fittings.
- (18) All hardware furnished shall be static-free type.

- (19) Ground jumpers shall be provided direct from switch-operator ground pad to ground connector on operating handle or mechanism of switch. No other ground connection is to be made to pad. Ground mat(s) shall be furnished at each switch-operator.
- (20) Bus grounding stud, welded or swaged, shall be furnished as indicated and at a minimum be provided on both sides of serviceable equipment.
- (21) Wire guides and bundle conductor spacers shall be provided as required and indicated to maintain adequate clearance and support on cable jumpers, connections, and overhead lines.
- (22) All current carrying aluminum connections shall be thoroughly cleaned, coated and sealed with an oxide inhibiting agent. Aluminum oxide, which is a poor electrical conductor, forms rapidly on the surface of drawn or rolled aluminum. It must be removed and prevented from reforming after the connection is completed. This applies to all connections, whether bolted, clamp or compression type. Caution - Aluminum expands approximately 30 percent (1.33 times) more than copper. Every connection involving a combination of aluminum and copper must be planned to avoid gradual loosening caused by large temperature changes. Unequal expansion of aluminum, copper and steel can cause extremely high pressure during hot conditions which stretches one or more of the metals leaving a loose connection when cold conditions occur.
 - (a) Bolted electrical connections shall be made on flat contact surfaces, completely cleaned with an oxidation inhibitor. This must be done by thoroughly scratching-brushing the contact surfaces through the inhibitor, leaving enough of it on the surface to control reformation of oxides. After the connection is completed, additional compound shall be applied and forced into every irregularity and opening in order to completely seal the joint against moisture and corrosion.
 - (b) Aluminum to aluminum connections shall be fastened with aluminum bolts, 2024-T4 alloy with No. 205 aluminite finish and preferably NO-OX-ID coated. Nuts shall be of the same alloy and finish. Heavy series bolts and nuts (7/8-inch across flats) are preferred.
 - (c) Aluminum to copper connections shall be made only with flat contact surfaces. Dressing and sealing the connection with inhibitor is especially important where unlike metals are in contact. Care must be taken to place the aluminum above copper when in a horizontal plane so that corrosive copper salts do not flow onto the aluminum. The type of bolt used is also important because extreme temperature changes can cause a loose joint due to the expansion differential between copper and aluminum. Aluminum or bronze bolts will be used as specified below: (a) Use aluminum bolts if thickness of the aluminum conductor is the same or greater than the copper conductor. (b) Use bronze bolts if the copper conductor is thicker than the aluminum.
- (23) Cable terminations can be made with clamp, compression, and welded type fittings; preferably welded or compression types.
- (24) All connections shall be torqued, as applicable, and in accordance with manufacturer's recommendations and the design drawings.

6.1.26 Requirements for grounding system:

- (1) The grounding system/grid shall be installed throughout the Project Substation, including at least three (3) feet outside the perimeter fence of the Project Substation and shall be bonded to the fence as required to meet acceptable levels of both touch and step potential and ground potential rise.
- (2) The Project Substation grounding grid shall be designed in accordance with the methods and recommendations of IEEE 80 and using SES-CDEGS software or Owner-approved equal. The grounding system shall have adequate capacity to dissipate heat from ground current under the most severe conditions in areas of high ground fault current concentrations, with grid spacing such that safe voltage gradients are maintained. The short-circuit design rating for the Project Substation shall be based on the calculated maximum available fault current available at that location and take into account the future growth of the substation and power system.
- (3) The Project Substation grounding system shall be an interconnected network of bare copper conductor and copper-clad ground rods. Ground wells and other grounding enhancements may be utilized if required. The system shall be designed such that Project Substation personnel are protected from the hazards that can occur as the Project Substation grounding system provides the earth return electrode during power system phase to ground faults.
 - (a) The ground grid shall not be interconnected with other facilities' grounding (e.g. O&M Building fencing). However, to the extent that other facilities may contribute to the electrical properties of the ground grid, such facilities shall be studied appropriately to quantify and understand their impact on overall grounding.
- (4) Ground resistivity testing shall be performed *prior* to final design to determine ground analysis parameters. The ground resistivity shall be measured with the methods given in IEEE 81.
- (5) Contractor shall provide ground potential rise (“GPR”) calculations to support the local telephone provider design needs, if required.
- (6) Ground conductor size shall be sized accordingly to specific ground conditions and equipment requirements but shall be a minimum of 4/0. Bare conductors to be installed below grade shall be spaced in a regular pattern that is consistent with the grounding analyses. Each junction of the grid shall be bonded together by an exothermic welding process. Above ground shall be NEMA two-hole connectors.
- (7) Grounding connections shall be made to all fences and equipment (including support structures).
 - (a) The fence and the fence counterpoise (a conductor buried 3' beyond the substation fence) are both connected to the ground grid.
 - (b) All equipment must have provisions for grounding in accordance with OSHA codes. The ground grid shall be attached to equipment at two different points such as opposite corners of a transformer or each leg of a switch stand. The grid shall be bolted or welded to all steel structures and fence posts.
 - (c) At least two (2) grounding connections shall be included to the control building.
- (8) Cable trench conductor grounding shall conform to the following:

- (a) One 4/0 bare copper conductor shall be laid in all precast or direct burial cable trench. The ground conductor is required to protect control cables from stray ground currents or signals usually present in high voltage installations by equalizing the potential along the length of the cables.
 - (b) The trench ground conductor must be connected to the station grounding system at every intersection and at the ends of each trench. In the case of direct buried trenches, the ground conductor shall be incorporated into the system grounding design.
- (9) Switch handle grounding on steel structures shall have the operating pipe be bonded to the steel using a flexible grounding jumper.
 - (10) Substation aggregate shall conform to ASTM C33, gradation 1.5 to No. 8 particles, and shall have minimum resistivity as modeled in the Project Substation step and touch potential study but no less than 3000 Ohm-m. A minimum depth of 4 inches of aggregate shall be installed and at least 2 feet beyond the Project Substation grounding grid.
 - (11) All grounding materials required shall be furnished new and undamaged.
 - (12) All clamps, connectors, bolts, washers, nuts, and other hardware used with the grounding system shall be made of copper. Compression fittings below grade are prohibited. Above-ground fittings shall be DMC360 swage hydraulic compression type.

6.1.27 Requirements for wildlife protection:

- (1) Outdoor bushings operating at 35 kV and below shall have protection installed on them to reduce the potential for phase to ground or phase to phase faults caused by wildlife getting near the area of the bushings. The protection shall be applied on equipment such as transformer bushings, surge arresters, circuit breakers, circuit switchers, auxiliary transformers, potential transformers, etc. The bushing protection shall include covers for conductors extending from the bushings.
- (2) Each bushing protector shall have a minimum of two cable ties around it to ensure it stays in place.

6.1.28 Requirements for lightning protection:

- (1) Lightning protection shall be designed in accordance with IEEE 998.
- (2) All Project Substation electric equipment, electric bus, and support structures shall be shielded from direct lightning strikes. Shield masts and shield wires are the preferred methods of lightning shielding within substations. When economical, it is preferred to not have shield wires directly over bus. Overhead shield wires installed on the take-off towers and lightning masts may be provided for protection from direct lightning strikes. The lightning protection system shall be adequately tied into the Project Substation ground grid.
- (3) Steel masts for direct stroke protection shall be round tapered seamless extruded or spun aluminum tubes.

- (a) The overall height of the masts above grade shall be determined from the direct stroke protection study, as more particularly described under the Project Substation Electrical Studies herein.
- (b) Masts shall have a single uniform taper from top to bottom.
- (c) Each mast shall be capped with a suitable finial.
- (d) Each mast shall be equipped with an internal chain vibration dampening device.
- (e) Each lightning rod mounted onto the top of masts shall be a minimum of 3 inches in diameter and a maximum of 20 feet long.
- (f) The design of masts shall have a safety factor of two (2) based on the allowable yield stress for the mast material in accordance with the latest ASCE specifications governing design of structures.
- (g) The horizontal deflection at the top of each free-standing mast shall be limited to L/20 of its height above foundation.
- (h) Each mast shall be installed on a concrete foundation with galvanized steel anchor bolts. Foundations, bolts, and welding shall be in accordance with the Requirements, including Section 4.0 (Civil / Structural Works) herein.
- (i) Each mast shall be provided with two grounding pads located 12 inches above the foundation.

6.1.29 Requirements for lighting:

- (1) A lighting system shall be furnished for the Project Substation. The lighting system shall provide personnel with illumination for Project Substation operation and maintenance under normal conditions and means of egress under emergency conditions. Dark sky lighting is recommended.
- (2) The lighting system shall be designed in accordance with IES standards to provide acceptable illumination levels, including at all switching stations. Lighting levels shall meet, at a minimum, the requirements of the NESC, including Table 111-1 therein.
- (3) Outdoor lighting shall be LED type. Lighting sources and fixture selections shall be based on the applicability of the luminaries for the area under consideration.
- (4) Exterior lights at doors shall be connected to photocells.
- (5) All lighting shall be operable via switches or contactors in the control building, including all exterior lighting.

6.1.30 Requirements for equipment labeling:

- (1) All equipment labeling shall be done in accordance with Section 2.6.

6.1.31 Requirements for electrical equipment enclosures:

- (1) All control cabinets, pull boxes, and electrical junction boxes shall be in accordance with NEMA standards and type number and shall be suitable for the Project location conditions, including corrosivity. Minimum design shall be:
 - (a) Indoor: NEMA 1
 - (b) Outdoor: NEMA 4
- (2) All enclosures shall be provided with pad-locking provisions.

6.1.32 Requirements for battery system:

- (1) Batteries shall be provided with racks, connection devices, tools, instruction books, protection shield covers, rail protection system, and other standard items. They shall also include redundant fans for the required ventilation. Such fans shall be installed directly above the location where batteries are to be installed.
- (2) Battery charger requirements:
 - (a) One (1) fully-rated, self-cooled battery charger shall be installed and one (1) spare charger. The charger will be served from the Project Substation AC system.
 - (b) Project Substation battery chargers shall be 125V_{DC} output, sized as required for eight (8)-hour recharge (following a complete discharge) while serving continuous load.
 - (c) Chargers shall include an AC circuit breaker in the charger input circuit to provide a disconnect point and overcurrent protection. Chargers also shall include DC ammeters, DC voltmeters, AC power failure alarm relays, high/low DC voltage alarm relays, ground detection alarm relays, and battery temperature compensation systems which reduce the charge rate if necessary.
 - (d) Chargers shall maintain output voltage within plus or minus one-half percent (0.5%) from no load to full load, with an input power supply deviation in voltage level of plus or minus ten percent (10%) and an input power supply deviation in frequency of plus or minus five percent (5%).
 - (e) Chargers shall automatically vary the charging rate in accordance with the requirements of the Project Substation battery.
 - (f) Each battery charger-eliminator furnished shall be self-regulating, natural cooled, solid-state silicon controlled full wave rectifier type designed for single and parallel operation with the batteries specified under the Specifications. Charger shall be able to provide the DC load requirements in the event that battery is disconnected.
 - (g) Solid-state electronic circuits shall have AC and DC transient voltage protection and shall be designed to recharge a totally discharged battery without overloading and without causing an interrupting operation of AC or DC circuit breakers.

- (h) Charger shall be a full capacity charger and shall have the capacity to recharge the battery in eight (8) hours following complete discharge. Charger shall also have an equalizing charge mode. Battery charger will be self-regulating after charging levels are manually selected. Battery charger shall be manufactured in NEMA 1 enclosures suitable for placement in an indoor, environmentally controlled atmosphere. Charger shall require only front access and will allow either top or bottom conduit/cable entry.
- (3) Each battery cell shall be wet cell, lead-acid pasted plate-type with lead-calcium alloy plate grids or sealed type. Cell containers shall be sealed, clear, shock absorbing, heat resistant plastic, with electrolyte high and low-level markers and spray-proof vents. Batteries shall be manufactured for full float service with a high discharge rate, low deterioration rate, and low maintenance. Batteries shall be supplied complete with all accessories (e.g., battery rack, inter-cell connectors). Racks shall be a two (2)-step configuration.
- (4) The DC panel and bolted breakers shall have a main bus current rating as required to supply the connected load. The continuous current ratings and interrupting ratings of the feeder breakers shall be based on the available fault current and the characteristics of the connected loads or the battery chargers.
 - (a) A 15-Amp, 125 V_{DC} feeder shall be installed from the DC panel board to the Owner-supplied network equipment. Contractor to coordinate the installation of this equipment with Owner.
- (5) The capacity of each battery shall be determined in accordance with IEEE 485 and the specifications herein. With the battery initially fully charged at the floating voltage specified, and with the battery chargers disconnected, the battery shall be capable of supplying the duty cycle specified. The ambient temperature during the duty cycle shall be 25°C.
- (6) The duty cycle for battery sizing shall include (a) one (1) minute at the level of current required to operate all Project Substation circuit breakers plus the continuous load; (b) 478 minutes of continuous load (actual but not less than 15A); and (c) one (1) minute at the level of current required to operate all Project Substation circuit breakers plus the continuous load.

6.1.33 Requirements for raceway:

- (1) Raceway shall conform, at a minimum, to the recommendations included in IEEE 525.
- (2) Raceway that contains multiple cable circuits shall have all cables with identical insulation ratings.
- (3) Individual raceway systems shall be established for the following services: (a) 600-volt control cable; (b) special electrical noise-sensitive circuits; and (c) fiber optic cable.
- (4) Hot-dipped, rigid galvanized conduit (after fabrication) shall be used for above-ground power and control cables.
- (5) Flexible conduits shall be used only at locations where vibration is required; the maximum contiguous length of flexible conduit shall be three (3) feet.

- (6) All raceway and conduit locations shall be coordinated with other equipment and structures. All raceway and conduit shall be installed perpendicular or parallel to the major equipment and bus structures.
- (7) All raceway and conduit shall be installed in a neat, rectangular form. Special attention shall be given to securing a neat appearance.
- (8) All raceway materials required shall be furnished new and undamaged in accordance with the following requirements, at a minimum:
 - (a) Duct: polyvinyl chloride, Schedule 40 PVC in accordance with NEMA TC-2.
 - (b) Couplings: plastic, for use with duct previously specified and “duct-to-steel” adapters as required, including joint cement.
 - (c) Spacers: plastic high impact, interlocking, base and intermediate type
 - (d) Factory bends and sweeps: Schedule 40 PVC, three (3)-foot minimum radius.
 - (e) End bells: plastic.
 - (f) Plugs: plastic, high impact, tapered to fit end bell provided.
 - (g) Riser termination: rigid hot-dip galvanized mild-steel coupling.
 - (h) Riser bends: rigid steel conduit elbows, factory or field made, three (3)-foot minimum radius, 90 degree, entirely concrete encased below grade; hot-dip galvanized rigid mild steel in accordance with ANSI C80.1 and UL 6; the conduit interior and exterior surfaces having a continuous zinc coating with an overcoat of transparent enamel or transparent lacquer.
 - (i) Cables within the substation shall be routed through a cable trench system extending from the control enclosure to equipment located within the substation. The final route from the cable trench to the device shall be in schedule 40 PVC conduit for below grade portions of the conduit, and RGS conduit for bends / sweeps and above grade locations.

6.1.34 Requirements for metering:

- (1) A facility check meter (SEL-735 Power Quality and Revenue Meter) shall be provided. Inputs to the meter shall include metering grade current transformers on the high side of each main transformer and voltage input from the high side coupling capacitor voltage transformer (CCVT).
- (2) Contractor shall provide provisions for the interconnecting utilities metering (if required). Contractor shall coordinate with the interconnecting utility and owner as required to complete the installation of the metering system per the interconnecting utility requirements.

6.1.35 Requirements for protective relaying:

- (1) Protective relaying shall provide secure and selective isolation of equipment when necessary during faults, abnormal or hazardous operating conditions.

- (2) All relays shall be microprocessor-based and wired to a central communication processor with IRIG-B time stamping. The communication processor shall integrate all relaying.
- (3) Relay panels shall be located in the Project Substation control building and shall include all hard-wired and soft-wired protection and control interlocks. Relay panels shall be installed in the control building.
- (4) Collection system feeder protection relay settings shall be configured to display the distance from the relay to the location of the fault. The distance information must be displayed in a format that is easily understood.
- (5) SEL-351S relays on the main and tie breakers are to include a closed transition fast bus transfer scheme. See SEL quickset design template guide LDG00003-01 (SEL-351S three relay main-tie-main automatic transfer scheme control application). The transfer scheme is intended to allow for the isolation of a main power transformer through an operator-initiated action with no loss of power to the 34.5 kV bus that is normally powered from the main power transformer being isolated.
- (6) Protective relaying design and equipment selection shall be provided in accordance with the Requirements, including, but not limited to, the Applicable Standards and prudent electrical industry practices.
- (7) All protection device settings shall be provided for Owner's review no later than 60 days prior to the system energization date.
- (8) Programming of devices shall be provided in electronic format straight from the device.
- (9) Owner will review and approve the final design prior to procurement of equipment.
- (10) The local utility shall require review and confirm line protection, metering (if required), and signal exchange requirements. Owner shall facilitate such reviews.
- (11) Protection shall be provided for all breakers, bus, transformers, 34.5-kV lines, high-side lines, capacitors, and inductors.
- (12) The relaying schemes shall monitor and respond to over-currents, phase faults, ground faults, and other system abnormalities. Protection schemes to be utilized shall include, but not be limited to, line impedance/differential, bus differential, transformer differential, breaker failure, backup relaying, switch into fault, and sync check.
- (13) Annunciation and alarms shall be communicated to the Operator through an RTU that will signal loss of protection integrity including, but not limited to, coil monitoring, loss of tripping power, gas pressure, relay failure, and other similar items.
- (14) High-side lines shall include primary and backup relaying.
- (15) Main step-up transformer protection shall include primary and backup relaying and monitor for oil and winding temperature.
- (16) Observe IEEE 1050 for protective instrument grounding.
- (17) All relays shall have digital read-out on the front. The following relays should be used unless the interconnecting utility requirements differ:

- (a) [TBD]-kV Interconnection Line
 - 1. Line Differential: SEL-411L
- (b) [TBD]/34.5 kV Transformer
 - 1. Transformer Differential Primary: SEL-487E Transformer
 - 2. Differential Secondary: SEL-387A
- (c) 34.5kV Transformer Breaker Failure: SEL-351S
- (d) 34.5kV Main, Tie, and Feeder Breakers
 - 1. Main , Tie, & Feeder Protection: SEL-351S
- (e) 34.5kV Bus
 - 1. Bus Differential: SEL-487B or SEL-587Z (when SEL-487B is insufficient).
- (f) 34.5kV Capacitor Bank or Reactor Bank (if required)
 - 1. Overcurrent and voltage: SEL 487V
 - 2. Voltage: 34,500V

6.1.36 Requirements for control building:

- (1) The control building shall be a new, prefabricated, weatherproof, climate-controlled building containing protective relaying and control, communications systems equipment and cable management systems (i.e. cable trays). All electrical equipment shall be installed and pre-wired in the building prior to shipment.
- (2) The control building shall be a minimum of 14 feet by 40 feet.
- (3) The control building shall be located within the fenced area of the Project Substation with sufficient clearance on all sides and shall be located near the entrance gate.
- (4) The control building shall be grounded in accordance with Section 6.1.26.
- (5) The control building shall contain a data concentrator and communications processor to collect Project Substation data signals for facility use.
- (6) The control building shall include adequate space and clearance for the following equipment, at a minimum:
 - (a) Any Equipment supplier-furnished Communications System equipment
 - (b) Owner-supplied equipment
 - (c) Relay and control panels (panels shall be configured to optimize panel space, with up to three relays on a single panel)

- (d) Fiber patch panels & other communication equipment
 - (e) Field termination cabinets
 - (f) Station service equipment, including AC panel boards and automatic transfer switches
 - (g) DC panel boards, batteries, and battery chargers
 - (h) Eye wash station located immediately adjacent to the battery chargers
 - (i) Lighting contactor for control of substation lighting
 - (j) HVAC equipment
 - (k) Interior and exterior lights and receptacles, including exterior receptacles for servicing HVAC units and emergency lighting.
 - (l) Small desk for operators
 - (m) Hot-stick
 - (n) Fire extinguisher at each exit door
- (7) Local user controls shall be included that are capable of overriding the controller if required for any reason. Local controls, including monitoring screens and keyboards, shall be placed in the control building.
- (8) A ground bus shall be provided in the control building to provide grounding for all control, SCADA, and AC and DC panels.
- (9) Building alarms such as fire alarms, intrusion alarms, and temperature alarms shall be submitted for Owner's review and approval.
- (10) The control building shall include two (2) doors, each with panic hardware, on opposite sides of the building for ingress and egress. One door shall have a minimum width of 72 inches to facilitate the movement of equipment.
- (11) The control building shall include a small desk for Owner's operator use. A standard electrical outlet shall be provided near the location of the desk for device charging as well as a 2-gang electrical box with a single gang cover with 3/4-inch conduit routed to the cable tray to allow for Owner's future internet installation.
- (12) Cell phone boosters shall be included in the control building.
- (13) Control building roof:
- (a) The roof system shall include a 20-year warranty on material and weather tightness, and shall carry a UL Class 90 listing in accordance with UL 580.

- (b) The roof covering shall include exposed metal roof panels of 12 gauge (minimum) commercially pure aluminum coated steel, “Galvalume”, or coated steel (Galvanneal) with a color finish. As a minimum, base metal panels shall conform to the physical requirements of ASTM A446, Grade B. Panels shall be of such configuration to provide the load carrying capability and meet the deflection requirements specified herein. The coating shall have a 20-year warranty against rust perforation, a 20-year warranty against fading and chalking, and a 25-year warranty against flaking and peeling. Exterior color finish of roof, walls, doors shall be tan in color. Paint samples to be submitted for Owner approval.
 - (c) Roof panels shall be “standing-seam interlocking” design and shall be secured to the roof purlins with a concealed structural fastening system. The concealed system shall provide minimal through penetration of the roof surface and allow the roof covering to move independently of any differential thermal movement by the structural framing system. Except at the concealed fastener, there shall be no thermal contact between the roof panels and supporting purlin. The standing seams shall have a factory-applied, non-hardening sealant.
 - (d) Roof covering shall be properly designed with a sealing system provided at all roof and wall seams to provide a watertight building. The ridge, eaves, and openings together with necessary fascia and trim shall be caulked and sealed to provide a weather tight system.
 - (e) Properly sized attic space ventilation shall be provided. All attic openings shall be screened to prevent entrance of bees, large insects, or birds.
- (14) Control building exterior walls:
- (a) The exterior walls shall be comprised of galvanized steel panels with a PVDF resin-based finish. Exterior siding panels shall be overlapped and installed with appropriate self-tapping fasteners with integral gaskets and shall be removable without any disturbance to internal panels. The wall covering shall include a minimum 15-year warranty on paint. As a minimum, the panels shall be galvanized according to ASTM A525, coating designation G90.
 - (b) Manufacturer’s standard exterior base flashing shall be provided with the building. Material shall be zinc-coated steel conforming to ASTM A446, Grade B and ASTM A525, coating designation G90. Flashing shall be manufacturer’s standard white in color, and have a baked silicon polyester (or equivalent) enamel coating.
 - (c) Butted seams are not allowed.
 - (d) All openings in the walls are to be structurally framed, sleeved, trimmed, and provided with external drip caps.
 - (e) Repair or replacement of external panels must be able to be done entirely from the exterior of the control building structure.
- (15) Control building interior walls:

- (a) The control building interior walls shall be lined with flush-fit with a minimum of 16 gauge, roll-formed liner panels. Liners shall be zinc-coated steel conforming to ASTM A446, Grade B and ASTM A525, coating designation G90. Liners shall be provided with base and ceiling trim. Panels shall be manufacturer's standard white in color, and have a baked silicon polyester (or equivalent) enamel coating.
 - (b) Liner panels shall be fully reinforced with concealed fasteners.
 - (c) The control building interior shall feature a complete trim system, including base, jamb, header, and ceiling trim.
- (16) Control building floor:
- (a) The control building floor shall have a hot-rolled welded steel framework, comprised of hot-rolled steel or steel tube supports with a maximum deflection of L/240 under required loads. Cold formed joists shall be sized and spaced to meet design loads. The steel framework shall be supported on concrete piers, spacing, anchorage requirements, and layout to be indicated by the building designer. Steel floor members shall be hot-rolled steel that meets a minimum standard ASTM-A36. All galvanized steel shall meet ASTM-A653.
 - (b) Steel floor shall be a welded steel top surface of at least 1/4" thickness to handle floor design loads with a maximum deflection of L/240. The floor shall have a painted, slip-resistant finish. The bottom of the floor shall have a rodent and moisture barrier of recessed 26-gauge sheet galvanized steel. Floor welding standards shall meet all AWS recommended practices.
 - (c) The floor framework and floor deck plates shall be fully cleaned, primed, and painted with a self-priming coating system designed to provide a durable finish, suitable for heavy resistance to fading. Paint is to have a minimum Dry Film Thickness per coat of 3-5 mils. Color is to be ANSI 61. A non-slip texture shall be added to the paint.
- (17) Control building insulation:
- (a) Floor shall be insulated with fiberglass batt insulation between the joists and rigid polystyrene insulation between joists and fully hot-dipped steel rodent and insect barrier. The insulation shall be at least R-13 for the floors and walls and R-19 for the roof, or a higher specific insulation value called out in applicable state and local codes. The entire Electrical Equipment Enclosure shall be insulated to thermal transmittance value of no more than 0.05 for walls and 0.03 for roofs when tested in accordance with ASTM C236.
- (18) Control building exterior doors:
- (a) There shall be two doors in the control building, at least one of which is a 72-inch wide double door to facilitate the installation of equipment. Both doors shall have the same access key. Enclosure doors shall comply with Steel Door Institute directive SDI-100 and SDI-107. Doors shall have an insulated core and be constructed of no less than 18-gage steel-faced leafs with stiffeners and 16-gauge door frames. Doors and frames are to be hot-dipped galvanized to ASTM-A294 and ASTM-A653, then factory primed and painted with epoxy enamel to match the enclosure or trim.

- (b) There shall be three stainless steel ball bearing hinges per door.
 - (c) A drip cap shall be provided on the exterior top and bottom of each door.
 - (d) Each door shall have Sergeant 2828F low-profile rim device type panic interior openers, with cylinder lock keyed entry and thumb latch exterior.
 - (e) A door closer with hold open arm shall be installed on each door.
 - (f) Shock absorbing restraints shall be provided on the doors to prevent damage from high wind conditions.
- (19) Control building HVAC:
- (a) At least one (1) unit shall be installed on each end of the control building. HVAC equipment size shall be based on maintaining an interior temperature range of 60-80 degrees F, taking into consideration the heat load of present and future equipment and the site conditions. HVAC equipment shall consist of self-contained wall mount units, complete with supply and return grilles, lockable circuit breaker or disconnect switch, manual thermostat, barometric fresh air damper, and a disposable air filter. The following controls shall be supplied: high-pressure controls, low pressure controls, low ambient control, compressor anti-cycle relay, and alarm relay.
- (20) Control building lighting:
- (a) Exterior lights shall be provided above each personnel door and shall be connected to photocells for automatic dusk to dawn control. Exterior lights shall be suitable for use in wet locations.
 - (b) A lighting contactor located in control enclosure shall be utilized for control of the substation lighting.
 - (c) Control enclosure interior lighting shall be in accordance with accepted industry standards and practices. The National Electric Safety Code (ANSI C2) shall be followed in all cases. Sufficient lighting is required for safe operation and testing in front and back of all control panels.
 - (d) Emergency lighting shall be a self-contained battery powered unit with two directionally adjustable illuminating heads. The units shall switch on automatically upon loss of AC power and provide 1.5 hours of continuous illumination, and then turn off automatically and recharge when AC power is restored.
 - (e) Lighting shall be LED (Light Emitting Diode) type.

6.1.37 Requirements for fire protection:

- (1) Substation fire protection designs shall be in accordance with accepted industry standards and practices. IEEE 979 Guide for Substation Fire Protection shall be consulted for new facilities.
- (2) Protective firewalls or barriers should be considered whenever clearances from IEEE 979 cannot be achieved.

6.1.38 Requirements for Project Substation meteorological tower:

- (1) The meteorological tower shall be a 30-foot self-supporting base hinged unit designed for an 80-mph minimum wind load and installed according to the manufacturers specification. Tower shall be Great Plains Towers model number DT/MHP30'6 or engineer approved equal. Tower shall be installed onto a concrete pier foundation.
- (2) Meteorological tower designs, including foundation design, shall be approved by Owner prior to procurement of such equipment or materials.
- (3) Sufficient grounding and lightning protection per IEC 61400-12 shall be installed on all meteorological towers, including lightning finials.
- (4) Each Project Substation meteorological tower shall include the following instruments as specified below, or Owner-approved equal:
 - (a) One (1) cup anemometer near tower height.
 - (b) One (1) wind direction sensor near tower height. Sensor shall be MetOne 020C or NRG #200P, respectively.
 - (c) One (1) temperature / relative humidity sensor with radiation shields near tower base. Sensor shall be MetOne 597 or Vaisala HMP60A.
 - (d) One (1) barometric pressure sensor near tower base. Sensor shall be MetOne 092 or Vaisala PTB 110.
 - (e) One (1) precipitation sensor. Sensor shall be Campbell Scientific 237-L above control enclosure height.
- (5) Each Project Substation meteorological tower shall include the following auxiliary equipment as specified below, or Owner-approved equal:
 - (a) One (1) NEMA 4X fiberglass enclosure for data logger.
 - (b) One (1) data logger. Each shall be Campbell Scientific, model CR3000.
 - (c) Signal surge protection terminals. Each shall be Phoenix Contact, type Termitrab 24V.
- (6) Each permanent meteorological tower shall include the following other equipment:
 - (a) Grounding and lightning protection, including lightning finial.
 - (b) Cabling.
- (7) All anemometers shall be type “first class”, heated sensors. All anemometers shall be calibrated in accordance with MEASNET’s Anemometer Calibration Procedure and performed by a MEASNET-certified organization.
- (8) Requirements for communications:

- (a) Meteorological towers shall be connected to, and communicate with, the Communications System and allow data recording and storage through the data archival features of the Communications System.
- (9) Requirements for power:
 - (a) Permanent power supply for the meteorological tower shall be taken from the substation control building (but not from the backup battery bank in the control building).
 - (b) Project Substation meteorological tower shall be capable of operation (and data storage) through a power outage for a minimum of seven (7) days through a battery backup or UPS separate from the backup battery bank in the control building.

6.2 Submittals

6.2.1 Contractor shall prepare the Project Substation design documents per the submittal schedule in Exhibit G.1 (Submittal Schedule) and containing the following information, at a minimum: (a) design basis; (b) general arrangement plan and physical layout diagrams; (c) civil works drawings, including subgrade preparation, grading, drainage, and erosion control; (d) protection and control system designs and philosophies; (e) one-line diagrams, three-line diagrams, and wiring diagrams, including A/C and D/C schematics. One-line and three-line diagrams shall include all transformer tap position settings required to comply with the NERC studies for the site; (f) communications block diagram, including all Communications System equipment, Owner-Supplied Equipment, and utility equipment; (g) Communications System details, including logic descriptions, points lists, rack layout diagrams, HMI screen development, and fiber termination diagrams; (h) cable specifications and arrangements; (i) conduit and cable schedules; (j) panel schedules; (k) loop drawings; (l) elevation drawings; (m) connector and fitting details; (n) structural design documents, including foundation plans and details (with structural calculations to be provided with each set of foundation drawings); shop drawings showing fabrication of structural-steel components; details of cuts, connections, splices, camber, holes, and other pertinent data; indication of welds by standard AWS symbols, distinguishing between shop and field welds, and showing size, length, and type of each weld; indication of type, size, and length of bolts, distinguishing between shop and field bolts; mill test reports and structural steel properties, including chemical and physical; and fastener properties (mechanical/chemical), including bolts, nuts, and washers, and indicating coatings used to satisfy anchor bolt protection plan; (o) ground grid plans; (p) metering and relaying diagrams. Metering and relaying diagrams shall include all transformer tap position settings required to comply with the NERC studies for the site; (q) conduit and trough plans; (r) fencing and gate details; (s) control building drawings; (t) drawing index; (u) bill of materials; and (v) inspection, testing, and quality control requirements.

6.2.2 Contractor shall prepare a set of studies and analyses for the Project (collectively, the “**Project Substation Electrical Studies**”) to demonstrate the adequacy of the proposed electrical system design, including any studies and analyses that may be necessary to ensure compliance with the Requirements, including the Applicable Standards or utility requirements. The Project Substation Electrical Studies shall be submitted to Owner for review *prior* to the procurement of the applicable major Equipment. The following shall be included in the Project Substation Electrical Studies, at a minimum:

- (1) Substation Grounding Report: grounding system study of ground grid conductors and interconnection (if any) with the ground grid. The study shall confirm that the grounding system maintains touch and step voltages within tolerable limits, and shall be prepared in accordance with the procedures, data, and recommendations given in IEEE 80. The study shall determine the ground potential rise with respect to remote earth.
- (2) Substation Short Circuit Report: Calculation of the fault currents in the substation including a study of the main power transformer neutral grounding reactor (“NGR”) sizing to reduce the single line to ground fault current.
- (3) Substation AC System Study: calculation of the capacity of the low-voltage AC systems in the Project Substation to determine the size of station service load.
- (4) Substation DC System Study: calculation of the capacity of the batteries and chargers within the Project Substation with the DC service required for the equipment at the substation, as determined from a load profile developed for all DC loads. The study shall determine if the minimum voltages are maintained as specified and required by equipment vendors. The DC system shall be sized to accommodate future loads for ultimate switchyard configuration.
- (5) Substation Bus Ampacity Study: calculation of bus ampacity in the Project Substation based upon continuous current rating as given on the one-line diagram and Project Site-specific conditions.
- (6) Substation Bus Structural Analysis Study: analysis of bus structural design in the Project Substation including bus, insulators, bus structures, and foundations, and based upon the most stringent combination of wind, fault current, and ice load factors, as defined in the Applicable Standards and other applicable Requirements.
- (7) Substation Bus Design Study: analysis of the performance of the buses, disconnect switches, and separately-mounted current transformers within the Project Substation to confirm that the ampacity, structural integrity, vibration, and required mechanical and electrical ratings are in accordance with the methods and recommendations of IEEE 605. Bus design, including gust factor, exposure height factor, importance factor, and corona considerations, shall be in accordance with the procedures and data given in IEEE 605.
- (8) Substation Lighting Study: lighting illumination calculations for the Substation to determine the illumination levels within the new substation that will be achieved with added luminaires.
- (9) Substation Lightning Study: direct stroke protection analysis for lightning at the Project Substation based upon Project Site-specific determinations for thunderstorm days, thunderstorm duration, isokeraunic levels, exposure, and other similar factors. The direct stroke protection system design shall include analysis using the rolling sphere method of the electrogeometric model given in IEEE 998. The direct stroke protection system design shall be in accordance with the procedures, data, and methods given in IEEE 998.
- (10) Arc Flash Study: see requirements in Section 5.2.2(12).

- (11) Protection Coordination Study: relay and protection equipment coordination study, including detailed calculations, one-line and three-line diagrams, fuse curves, coordination curves, protected equipment data, and relay set points. This study shall include the major Equipment (including switchgear), Collection System Circuits, Project Substation, and Interconnection Line. A narrative philosophy statement shall be submitted for comment before completing the coordination study, and the proposed settings for the Solar / BESS / Wind Turbine protection equipment shall be delivered to supplier for implementation *prior* to energization.

6.2.3 Contractor shall prepare a set of studies and forms for the Project (collectively, the “**NERC Compliance Studies**”) to meet NERC Regulatory Standard Requirements. The NERC Compliance Studies shall contain all studies summarized in Table 6-3, at a minimum.

For each project, Contractor is to develop the NERC compliance studies defined in Exhibit A.2.4 (*NERC Requirements*). The required NERC compliance studies are to be reviewed with Owner using Xcel policy XES 7.405 and XCEL NERC compliance standard XES 2.800A01 NERC standards compliance matrix.

Table 6-3: Summary of Requirements for NERC Compliance Studies

Requirement	Timing
COM-001-3, R11	Before energization
COM-002-4, R3, R6	Before energization
CIP-002-5.1a	Before energization
CIP-003-8, R1.2.1, R1.2.2, R1.2.4, R1.2.5, R2	Before energization
CIP-004-6, R2	Before energization
EOP-004-4 R1, R2,	Before energization
FAC-008-3 R1	At Engineer of Record 90% Design Submittal
FAC-008-3 R2	At Engineer of Record 90% Design Submittal
FAC-008-3 R6	At Engineer of Record 90% Design Submittal
FAC-008-3 R7,R8	At Engineer of Record 90% Design Submittal
PRC-027-1	At Engineer of Record 60% Design Submittal
PRC-005-6 R1, R3, R5	Two weeks prior to Commercial Operation
TOP-001-4, R3-R6	Before energization
PRC-004-5(i)R1-R6	Within 30 days after energization
PRC-004-WECC-2, R1-R3	Within 30 days after energization
PRC-019-2 R1, R2	At Engineer of Record 60% Design Submittal
PRC-024-2 R1 – R4	At Engineer of Record 60% Design Submittal
PRC-025-2 R1	At Engineer of Record 60% Design Submittal
VAR-002-4.1 R2.1-R2.3, R3-R6	Within 30 days after energization
VAR-501—WECC-3.1, R1-R5	Within 30 days after energization
EOP-005-3 R11-R16	4-12 months after energization
FAC-001-3 R2, R4	4-12 months after energization
FAC-002-2 R2	4-12 months after energization
FAC-003-4	4-12 months after energization
IRO-010-2	4-12 months after energization

Requirement	Timing
MOD-025-2 R1-R2	2 months after substantial completion
MOD-026-1 R2-R5	2 months after substantial completion
MOD-027-1 R2-R4	2 months after substantial completion
MOD-032-1 R2, R3	4-12 months after energization
PRC-002-2	4-12 months after energization
PER-006-1 R1	4-12 months after energization
PRC-023-4 R1	4-12 months after energization
PRC-026-1 R1	4-12 months after energization
TOP-003-3 R5	4-12 months after energization
TPL-007-3 R6, R10	4-12 months after energization

6.2.4 Contractor shall prepare energization plans and procedures for the Project Substation. Energization plans shall be submitted to Owner for approval *prior* to use. Energization plans shall include both electrical and communications infrastructure as well as backfeed plans, soaking plans, testing plans, and lock out tag out procedures, at a minimum.

6.2.5 Contractor shall provide a complete recommended spare parts list for the Project's electrical works, including the Project Substation. Such list shall include recommended quantities, part / model numbers, and nominal pricing.

6.2.6 Contractor shall submit all manufacturer's product sheets (material cut sheets), warranties, and operations and maintenance manuals (as applicable) for all permanently-installed equipment and materials.

6.3 Project Substation

6.3.1 Contractor shall design, furnish, construct, and install one (1) 34.5/ [TBD]-kV Project Substation in conformance with the minimum requirements set forth herein.

- (1) Contractor shall furnish all labor, equipment, and materials that are necessary for a complete, fully-functional, and safe Project Substation configuration.
- (2) Contractor shall install a disconnect switch between the high side of the main power transformer and the Point of Interconnection such that the Project can be isolated from the interconnecting utility's grid.

6.3.2 Contractor shall furnish all capacitor banks, reactors, and/or other reactive compensation equipment necessary for the Project.

6.3.3 Contractor shall furnish and install fencing and gates at the Project Substation.

- (1) The Project Substation perimeter shall be fenced. The fence shall be tied into the Project Substation grounding grid.
- (2) At least one (1) vehicle gate shall be installed at the Project Substation.
- (3) At least one (1) pedestrian gate shall be installed at the Project Substation.

- (4) Except as noted in the following paragraph, all fencing and gates shall comply with the minimum specifications in Section 4.1.10 herein.
 - (a) Project Substation fencing and gates should be a minimum of 10 feet high with 1-inch diamond mesh and no barbed wire.
 - (5) Contractor shall furnish and install a contact sign at the entrance to the Project Substation, as described in Section 2.6 herein.
 - (6) A minimum of six (6) inches of *washed* crushed aggregate shall cover the entire Project Substation footprint, including those areas reserved for future build-out, *plus* a minimum of three (3) feet outside the perimeter fence, to help reduce touch and step potentials. A greater level of washed crushed aggregate shall be installed if necessary to meet the Requirements and satisfy the recommendations set forth in the geotechnical engineering report. Any areas at the Project Substation to be utilized for traffic must be suitably compacted to support traffic loads.
- 6.3.4 Contractor shall furnish and install closed-circuit cameras at the Project Substation and BESS site areas. Cameras shall be positioned to allow for monitoring of entry points and major Equipment.
- 6.3.5 Contractor shall be responsible for supplying the main step-up transformer(s) as specified in Exhibit D.6 (*Renewable Generation Main Power Transformer Specification*), offloading, assembling, and testing the transformer(s) and for completing all terminations, including, but not limited to, high-voltage terminations, medium-voltage terminations, low-voltage control and power terminations, and grounding connections.
- 6.3.6 Contractor shall furnish and install the revenue [check] meter(s).
- 6.3.7 Contractor shall furnish and install arc flash labels in accordance with Section 2.6.
- 6.3.8 For wind projects, Contractor shall furnish, and install one (1) meteorological tower in the Project Substation.
- (1) Contractor shall furnish all labor, equipment, and materials that are necessary for a complete, fully-functional, and safe meteorological tower configuration.
 - (2) Project Substation meteorological tower shall be installed adjacent to the substation control building.

6.4 Testing and Quality Control

- 6.4.1 Contractor shall test, commission, start-up, and place into successful operation the Project Substation, including the electrical infrastructure and communications infrastructure. At a minimum, testing shall include the minimum requirements set forth below. All testing shall be performed by an independent, experienced third party.
- (1) All Project Substation equipment shall be tested to demonstrate it meets stated design criteria and is fit for purpose.
 - (2) All testing specified in the Applicable Standards, including NETA Acceptance Testing Standard (NETA ATS) tests with the exception of NETA ATS Optional tests unless they are specifically called out in this specification.

- (3) All testing reasonably recommended or required by the applicable equipment suppliers.
- (4) All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.
- (5) Insulation testing of all installed cables.
- (6) Point-to-point wiring checks of all installed wiring.
- (7) After completion of wiring installation work, all circuits shall be tested for continuity, grounds, shorts. Documentation shall include highlighting or otherwise identifying each conductor verified on the AC three-line diagrams and schematics including the date verified and the authorized testing personnel's signature that verified the installed wiring matches the drawing.
- (8) Breaker function testing.
- (9) PT/CT turns ratio and polarity testing.
- (10) Breaker contact resistance testing.
- (11) Ground resistance and continuity testing.
- (12) Surge arrester testing.
- (13) Instrument transformer testing.
- (14) Ground grid testing.
- (15) Relay functional testing.
- (16) Disconnect switch testing.
 - (a) Commissioning of high voltage and medium voltage disconnect switches shall include the switch manufacturer's representative being at the Project Site to review the mechanical installation of the switch to confirm it is installed and adjusted properly. The switch manufacturer's representative is also required to review the electrical switch test records and confirm in writing that the switch is ready for energization prior to it being placed into service.
 - (b) Switch suitable for energization records to be supplied to the owner prior to switches being energized.
- (17) Reactor / capacitor bank testing (if applicable).
- (18) Control building testing.
- (19) Minimum main step-up transformer testing:
 - (a) Commissioning testing of all connections (high voltage, medium voltage, low voltage power; current transformer; relay; control; instrumentation; and communication).

- (b) On-load tap changer.
 - (c) AC power transfer switch.
- (20) In the commissioning report, Contractor shall provide the following with respect to the transformer tap position settings:
- (a) Confirmation that all transformer tap settings (generator or inverter step up, main power transformer, etc.), relay settings, and control system parameters match the engineer of record construction documents (issued for construction drawings, PRC-019, PRC-023, PRC-024, PRC-025, PRC-027, VAR-002 studies, Substation Electrical Studies, etc.).
 - (b) Confirms that transformer automatic tap changing systems are functioning properly including the On-Load Tap Changer for each main power transformer.
 - (c) Confirms transformer voltages are per NEMA / ANSI utilization voltage standard C84.1 (Electric Power Systems and Equipment – Voltage Ratings – 60 Hz) for transformers that provide power to utilization equipment.
 - (d) Confirms transformer voltages are correct per the manufacturer ratings, (issued for construction drawings, PRC-019, PRC-023, PRC-024, PRC-025, PRC-027, VAR-002 studies, reactive power flow study, reactive power Control Analysis study, arc-flash studies, etc.).
- (21) Contractor to mark-up construction drawings and studies to document final, as-left transformer settings. All setting deviations from the issued for construction drawings or studies must be approved by the engineer of record and the owner prior to adjusting transformer tap positions.
- (22) All Project Substation foundations shall be tested for concrete and grout properties (strength, slump, air content, temperature).
- (23) Compaction.
- 6.4.2 Contractor testing plan shall be submitted to Owner for review and approval. Contractor shall notify Owner of all testing schedules at least 30 days in advance of testing activities and copies of testing reports (including a summary of testing procedures and acceptance criteria) shall be submitted to Owner within 10 days of completing such test.

7.0 INTERCONNECTION LINE (IF APPLICABLE)

7.1 General Provisions

7.1.1 Contractor shall actively coordinate with Owner and any Owner representatives, contractors, or Transmission Providers for the completion of the Project, including at any interfaces of the Interconnection Line including, but not limited to, sharing design drawings and studies, coordinating testing procedures, and attending meetings to discuss design implications and schedule of the work.

7.1.2 Contractor shall actively coordinate with Transmission Provider regarding any outages that may be required for the performance of the Work.

7.1.3 Contractor shall relocate, drop, or cross power lines as needed and as appropriate to complete the Work, with prior approval of the appropriate authority(ies). Contractor shall be responsible for obtaining and maintaining any necessary permits and / or easements for such work.

7.1.4 The Interconnection Line shall have a design working life of at least 35 years.

7.1.5 The Interconnection Line shall be designed and constructed to a high level of reliability and shall meet or exceed the requirements set forth by the interconnection utility.

7.1.6 Contractor shall design and construct the Interconnection Line in accordance with the Project Substation Electrical Studies and the Electrical Loss Limit, each as defined herein. In addition, contractor shall work with Owner at the design stage to evaluate options to reduce the transmission line losses by increasing the conductor size.

7.1.7 PLS-CADD software shall be utilized to spot and perform detailed analysis and design of the Interconnection Line. Copies of all PLS-CADD electronic design files shall be provided to Owner in final form at the conclusion of the Project. Copies of preliminary PLS-CADD electronic design files shall be provided to Owner with each preliminary design.

7.1.8 The Interconnection Line shall be designed to minimize or eliminate corona and not cause radio or television interference, nor excessive noise in excess of requirements set forth in the Applicable Standards, Applicable Permits, or other applicable Requirements including state noise Requirements for utility companies.

7.1.9 See Section 4.14.6 for the weather cases and loading criteria that shall be applied to the design of the Interconnection Line.

7.1.10 The Interconnection Line shall be designed and constructed to meet guidelines set forth by the Avian Power Line Interaction Committee.

7.1.11 Contractor shall receive explicit approval from Owner or Owner's representative(s) of the design of the Interconnection Line prior to construction. Owner shall have unlimited access to such designs throughout the design process.

7.1.12 Requirements for Interconnection Line civil and structural works:

- (1) All civil and structural works including, but not limited to, grading, structures, foundations, assemblies, and components for the Interconnection Line shall be designed and constructed in accordance with the applicable specifications in Section 4.0 (*Civil / Structural Works*).

7.1.13 Requirements for Interconnection Line structures:

- (1) All Interconnection Line structures shall be steel. Steel structures shall be galvanized or self-weathering and comply with the Interconnection Line requirements for steel in Section 4.1.19.
- (2) Interconnection Line pole shaft and arm components shall have a minimum wall thickness of 3/16 inch, except davit arm and cross arm minimum plate thickness shall be 0.25 inch.
- (3) Structure shaft sections shall be regular polygonal with a minimum of 8 sides.
- (4) Structure arm sections shall be regular or elliptical polygonal with a minimum of 6 sides except for the following.
 - (a) For temporary stringing arms and distribution arms, the use of 4-sided square tube arms with yield strengths of 50-ksi for weathering steel and 46-ksi for galvanized steel is allowed.
 - (b) For short static arms, the use of minimum 6-sided tubular arms is required. However, the use of 4-sided square tube arms may be approved by the Company prior to use on any project.
- (5) Wind pressures shown in the loading criteria shall be multiplied by the appropriate shape factor applied to the poles. Pressures, in psf, shall be computed as follows:

$$p = W \times C_d$$

where:

p is the pressure on projected area of the pole normal to wind

W is the wind pressure

C_d is the shape or drag factor (per Table 7-1 below)

Table 7-1: Shape Factors (C_p) for Interconnection Line Design

Shape	Shape Factor
Square/Rectangular	1.6
6 or 8 Sided Polygonal	1.4
12 or more Sided Polygonal or Round	1.0

- (0) Structure Joint Requirements:
 - (a) Structure shafts shall be designed with a minimal number of joints.
 - (b) Field welding will not be allowed as part of the design of a new structure.
 - (c) Shaft joints to be joined in the field shall be slip joints or bolted flange joints.
 - (d) H-Frame structure joints and cross-braced multi-pole structure joints shall be slip joints or bolted flange joints.

1. Slip joints shall have a minimum of two locking devices permanently installed at the joint to counteract resist 100% of the maximum axial load. The locking devices shall be equally spaced around the joint.
 2. After installation, the structure cross-arm shall be level.
- (e) All switch poles shall have bolted flange joints. All other pole shaft joints shall be slip joints unless approved by Owner.
 - (f) Manufacturer shall verify slip joint fit before shipment. Joints shall not interfere with ground pads, ladder clips or jacking nuts.
 - (g) Sufficient jacking nuts and permanent orientation marks shall be provided at all slip joints to ensure proper alignment and complete overlap of the joint.
 - (h) The maximum slip joint tolerance shall be accounted for to maintain the design dimension between the phases and the design dimension to the ground.
 - (i) Provide helicopter installation joint guides for slip and flanged joints when required.
- (1) Structure taper requirements:
 - (a) Poles shall have nearly a uniform taper throughout their entire length. All sides of the shaft shall have the same taper. Where a variable taper is economical, Contractor may submit this as an alternate design for Owner review and approval. Change in taper shall be limited to 0.2 inches per foot difference.
 - (b) Shaft taper shall be limited to a range of 0.15 inches per foot minimum and 0.6 inches per foot maximum for custom slip jointed structures.
 - (2) Structure deflection at the top of the structure shall not exceed 2% of the structure height under the deflection load case unless otherwise approved by Owner.
 - (3) Structure Arms requirements:
 - (a) Arms shall be designed so the end of the arm is at the specified height under a loading of initial conductor tension, deflection load case. This everyday load case will be shown on the supplied configuration and load Drawings, denoted as the “Deflection” loading condition.
 - (b) Arm lengths as shown on the Contractor supplied Drawings are the horizontal distance measured from the face of the shaft to the wire attachment point on the arm.
 - (c) Deflection of arms shall not exceed the following criteria under the deflection loading condition:
 1. Vertical deflection of davit arms:
 - a. Vertical deflection of davit arms:
 - b. Deflection shall be limited to $L/200$ where L is the length of the arm.

2. Vertical deflection of cross arms:
 - a. Deflection shall be limited to $L/50$ where L is the un-braced length of the cross arm.
 3. Horizontal deflection:
 - a. (a) Deflection shall be limited to $L/100$ where L is the length of the arm.
 - (d) Arms shall not deflect vertically more than 12 inches at the end of the arm under any loading condition.
 - (e) Davit arms:
 1. Davit arms less than 3 feet in length shall be straight (no upsweep) under deflection loading with normal gravity loads while also considering pole shaft deflection.
 2. All distribution arms shall be straight.
 3. Davit arms longer than 3 feet in length shall be upswept.
 4. All davit arms shall be tapered, tubular steel members
 5. Upsweep shall be 1-inch per foot rise unless approved by Owner.
 - (f) Three piece and single piece arms for H-Frame structures shall be straight under deflection loading with normal gravity loads.
 - (g) Arm connections to the shaft may be pinned or bolted. Pinned connections are preferred. Manufacturer shall specify connection type. Pinned connections shall utilize individual through (keeper) bolts at ends to prevent pin removal. Pins shall have chamfered ends to ease installation. Cotter pins and cotter keys are not acceptable as keeper bolts.
 - (h) Arms shall have a complete joint penetration weld (CJP) or partial penetration weld with fillet overlay between tube and connection plate to be attached to structure.
 - (i) Weathering steel arms shall be hermetically sealed.
 - (j) Arms and arm attachments shall be designed to avoid the trapping or holding of moisture.
 - (k) Unloaded arms shall be marked on Contractor supplied Drawings. For these arms the manufacturer shall provide temporary, removable weight bolted to end of arm to resist Aeolian vibration. Manufacturer to determine minimum weight required and provide the basis for the weight determined.
- (4) Structure vang requirements.

- (a) In the design of connections for vangs, brackets, or stiffeners, care shall be taken to distribute the loads sufficiently to protect the wall of the section from local buckling.
 - (b) Vertical vangs shall be designed so that the tension load is applied at an angle out of plane with the vang equal to a minimum of one half the design line angle range of the structure family plus the structure shaft twist tolerance. If the structure family has the tangent position within its range, the vangs shall be oriented in line with the longitudinal axis.
 - (c) All vertical dead-end vangs, through the shaft, shall have identical holes on both sides of the shaft. The holes on the back side of the shaft shall be used for temporary guying of the structure during the stringing process to control longitudinal deflections.
- (5) Interconnection Line structure shall be cambered if deflection of the top of the pole shaft under the camber load case is greater than one-half of the pole top diameter. The camber shall be the calculated deflection plus the following tolerances when the pole is fully assembled.
- (a) Straightness or camber in 10 feet: + 1/8 inch, -1/8 inch
 - (b) Total straightness or camber: +3 inches, -0 inch
- (6) Design to eliminate water and refuse trap requirements:
- (a) All weathering steel sections shall be hermetically sealed except for pole shaft sections that use slip joints. For slip jointed structures, the top of each section shall be sealed and the bottom of each upper section may be left open. The bottom of the base section shall be sealed.
 - (b) All factory drilled holes in weathering steel sections shall be sleeved to prevent moisture intrusion.
 - (c) Structure assembly shall not include any field drilled holes.
 - (d) Structures, when assembled, shall be effectively sealed to prevent moisture intrusion.
 - (e) Connections shall be designed to reduce the effect of pack-out by preventing moisture from entering the joint or by designing the connection to allow moisture to easily drain off.
 - (f) Threaded plastic plugs shall be provided for jacking nuts and threaded holes of ground pads. Hole plugs shall be slotted head, square head, or 12-point socket head type.
 - (g) Cap plates located on top of pole sections shall be designed and installed flush with the top of the shaft to prevent water intrusion and wind 'whistling'.
- (7) Galvanized structure requirements:

- (a) Tubular members of galvanized structures shall be designed to minimize environmental degradation.
 - (b) Galvanized poles shall have a drain hole at the bottom.
 - (c) Galvanized arms shall have drain holes where appropriate.
 - (d) Galvanized poles shall have a sturdy metal cap plate covering the entire pole shaft opening to minimize wind noise, wind movement and rain entry.
 - (e) Galvanized poles shall be designed to eliminate bird and insect entry. Openings in structure components greater than one inch wide shall be screened with 0.20-inch maximum opening galvanized steel screen material or covered with galvanized steel plate to eliminate bird or pest entry
- (8) Direct embed structure requirements:
- (a) Structures shall have a bearing plate. Bearing plate shall have a diameter no more than 2 inches greater than the maximum pole diameter.
 - (b) Structures shall have a ground sleeve. Ground sleeves shall have a minimum length of 4 feet. Ground sleeves shall have a minimum thickness of 3/16 inch. A seal weld shall be provided around the ground sleeve. The ground sleeve shall not be considered in strength calculations.
 - (c) Galvanized poles shall have a drain hole at the bottom. Weathering steel poles shall be hermetically sealed.
 - (d) Embedded pole sections shall extend at least 12 feet above grade.
- (9) Climbing devices requirements:
- (a) Pole shafts shall have ladder attachment clips where required.
 - (b) Arms shall have hand holds/climbing loops where required.
 - (c) Clips of proper type and spacing to support “McGregor” type ladders or equivalent shall be provided.
 - (d) When required, climbing clips shall be placed on one face (one flat) of the pole from the top of the pole to approximately the ground line or base plate. Working clips shall be placed on three additional faces from the top of the pole to approximately 10 feet below the bottom conductor attachment. Working clips shall be evenly spaced around the diameter of the pole. Each section of a flanged joint shall have working clips, two ladders above and below the joint, on the three additional faces if located below the lowest arm.
 - (e) Each ladder clip shall be designed to support a minimum 1,000 lb. vertical load and a minimum 200 lb. horizontal working load.
 - (f) Ladder clips shall be welded to the pole surface.

- (g) Ladder clips shall be located to avoid interference between ladders and other attachments.
 - (h) Ladder clips shall provide maximum safety, minimal projection beyond the shaft surface, minimal opportunity for corrosion, and shall not permit air to enter the shaft.
 - (i) Removable step bolts shall not be used.
- (10) Grounding device requirements:
- (a) The grounding pads shall be a 1-1/2 x 3-1/2 inch flat, stainless steel plate, 0.75 inch thick meeting ASTM A666-10 shall be welded to the structure, as shown on Company supplied Drawings. The grounding pads shall be drilled and tapped for a standard NEMA 2-hole pad as shown in ANSI/NEMA CC 1-2018.
 - (b) Do not paint or cover grounding devices with any coating.
 - (c) Personal grounding loops shall be provided as shown on drawings. Personal ground loop shall be a 0.75-inch diameter, stainless-steel rod.
- (11) Lifting devices requirements:
- (a) Lifting lugs shall be installed in appropriate locations on all structure shaft and arm sections.
 - (b) Instructions for the handling and erection of structures shall be provided.
- (12) Base plate and flange plate requirements:
- (a) Base plates shall be designed so that the design moment may be applied in any direction, regardless of the base plate orientation.
 - (b) If designs produce a base-plate or flange plate to pole shaft thickness ratio of more than 6:1, then special finishing requirements shall be applied for galvanized structures.
 - (c) Carbon Equivalence (CE) shall be taken into account when determining weldability of steel plate. Proper preheat and interpass temperatures shall be maintained. The formula for carbon equivalence shall be that used by the American Welding Society.
 - (d) Flange and base plate joint design shall meet the minimum requirement for transverse weld dimension of at least 2X the shaft plate thickness.
 - (e) The use of roll-forged/ Thermo-Mechanical Controlled Process (TMCP) ring material is allowed. The Vendor supplied Drawings shall indicate where TMCP material is substituted for use. A specific welding procedure specification (WPS) must be prepared by each fabrication plant proposing to use forged ring material. The WPS and all associated documentation must be approved by the Company prior to use on any project.

- (f) Place one alignment mark on the base plate of structure so proper alignment can be made with the anchor bolt v-notch line.
 - (g) The diameter or point-to-point dimension across the base plates shall be limited to a maximum of 12 inches larger than the anchor bolt circle of the base plate to prevent the base plate from extending outside of the circular pier foundation.
 - (h) Interior opening of base and flange plates shall be sized and configured appropriately to allow adequate access for proper welding procedures and inspection of the backing strip(s) or backing weld between the shaft and base/flange plates.
- (13) Interchangeable Structure requirements:
- (a) Structures within the same manufacturer defined part number shall be interchangeable when specified.

7.1.14 Requirements for Interconnection Line conductor design clearances:

- (1) The phase-to-phase and phase-to-ground line clearance requirements shall exceed the NESC requirement by at least the following additional design margins:
 - (a) Additional vertical (V) design clearance margin = 5 feet.
 - (b) Additional horizontal (H) design clearance margin = 3 feet.
- (2) The phase-to-phase and phase-to-ground clearance requirements per Owner standards are minimum dimensions. Contractor shall account for the cumulative fabrication and installation tolerances from the foundation, pole shaft, joint slip, connections, and arms to maintain these design dimensions. Clearance requirements shall also consider the structure deflection under the specified loading cases.
- (3) Vertical and Horizontal Wire Clearance Requirements – Elevation adders per NESC 232-C1(b) shall be added for elevations above 3,300 feet above mean sea level.
- (4) Galloping Design Requirements. An elliptical analysis shall be performed to estimate the extent of conductor galloping ellipses possible using PLS-CADD. The Cigre Report 322 calculation method shall be utilized to model galloping of a conductor
 - (a) The ellipse amplitude safety factors for use in PLS-CADD are listed in Table 7-2 below.

Table 7-2: Ellipse Amplitude Factors for Use in PLS-CADD

Conductor Type	Twisted Pair	Round			
Galloping Risk Region	All	Low	Medium	High	
Span Type	All			Deadend	Other
Amplitude Factor	0.5		0.7		1.0

7.1.15 Requirements for conductors, shield wire, and OPGW:

- (1) Conductors supplied shall be as listed below unless explicitly approved by Owner.

- (a) ACSR: Hawk, Drake, Cardinal, Bittern.
 - (b) ACSS: Hawk, Drake, Cardinal, Bittern.
 - (c) ACSR/TP (Twisted Pair): Penguin, Ibis, Hawk, Grosbeak.
- (2) All conductor cables, shield wire, and OPGW shall be installed by controlled tension methods.
 - (3) Pre-stressing of any type of wire shall not be permitted without the prior written approval of Owner.
 - (4) If conductors are bundled, all conductors in any one bundle shall be sagged simultaneously and all shall be clipped in on the same day.
 - (5) Spacers shall be installed on all spans of vertical 2-bundle configurations where needed. Spacers shall be placed in intervals recommended by the spacer manufacturer. Horizontal bundles are not allowed.
 - (6) Each sag span and control span shall be measured with surveyor's transits to verify exact span lengths, prior to sagging.
 - (7) All conductor cables, shield wire and OPGW sag spans and control spans shall be measured before sagging.
 - (8) Conductor cables, shield wire, and OPGW, and all Interconnection Line accessories shall be installed in accordance with IEEE's "*IEEE Guide to the Installation of Overhead Transmission Line Conductors*", Standard No. 524, and sagged to within a tolerance of 6-inch sag increase and no sag decrease. Transits shall be used for sagging and shall be maintained in good operating condition and checked for accuracy and adjusted, if necessary, a minimum of once per week during sagging operation.
 - (9) Conductor cables, shield wire, and OPGW shall not be dead-ended and clipped sooner than two (2) hours and should be fully tensioned within 24 hours of initial stringing. In no case shall more than 72 hours elapse between the stringing of conductor/ground wires and their final tensioning.
 - (10) No single conductor cable within a bundle shall be more than 3 inches from its sag position relative to the other conductor cables.
 - (11) No more than one (1) splice or repair on any single phase conductor in any single span shall be made. Splices shall be a minimum of 100 feet from any structure. Splices are not allowed within a dead-end span.
 - (a) Conductor tension splices will be one-piece compression sleeves with two core grips.

- (b) Sleeves shall be installed with a hydraulic compression tool per manufacturers requirements. The aluminum compression sleeve shall be installed after the aluminum stranding is thoroughly scrubbed with a wire or nylon brush. The compression sleeves shall be pre-filled or filled with inhibitor and compressed in accordance with manufacturer recommendations and die. All burrs and sharp edges of the splice shall be removed by filing and sanding. Excess inhibitor, which has been forced out of the sleeve during compression, shall be thoroughly cleaned from the conductor. Overhead ground wire splices shall use a one-piece sleeve.
 - (c) Sleeves shall not be straightened. Tension sleeves or compression dead-end's bowed more than ½ (one half) conductor diameter shall be replaced.
 - (d) Sleeves shall be measured and conductors marked before compressing to ensure that the core grips are placed properly on the core wire and the conductor is inserted into the sleeves the proper distance.
 - (e) Splices are not allowed in any spans crossing railroads, main highways, major phone lines or electric lines of over 13.8kV. Sleeves shall not be pulled through any traveler unless allowed by the sleeve manufacturer.
- (12) Wire tension limits shall be in accordance with the more restrictive of either Interconnection Table 5 (Cable Tension Limits), or the project site condition requirements. Note that Table 7-3 lists the base conditions per the NESC as well as the Xcel Energy design standards chosen to be more conservative than those requirements. Special loading areas exist throughout the United States and the Xcel Energy service area, examples such as the higher wind speed areas in south-west Minnesota and along the Colorado foothills may require design limits more conservative than those listed in the table. For phase conductor types not listed in Table 7-4, the lowest value listed shall be assumed.
- (a) Tension limits apply to phase conductors, overhead ground shield wires (OHGW) and optical ground shield wires (OPGW).
 - (b) Construction limitations shall be accounted for in determining the design tension such as: substation dead-end structure loading limits, which typically require a “slack” span, limits due to available stringing equipment or available stringing locations in the field, and mechanical damage to conductors due to the type of pulling grips available

Table 7-3: Cable Tension Limits

Load Case	Weather Case	Final / Initial	Tension Limits (RBS)		
			NESC	Xcel	
			All	ACSS	ACSR
Rule 261H1a	Rule 250B	Initial	60%	50%	40%
	Rule 250C	Initial	80%		
	Rule 250D	Initial			
Rule 261H1c	Rule 261H1c	Initial	35%		
		Final	25%		

- (c) The catenary constant shall be calculated using the H/w limits from CIGRE 273 and auto sag in PLS-CADD using the uplift load case from Criteria for Design of Transmission Line Structures – Loads and initial RS conductor condition. If the actual H/w for the uplift load case is greater than 3600·feet, then the design engineer should use dampers. If a different load case governs, and H/w for the uplift load case is less than 3600·feet then dampers should not be installed.

Table 7-4: Maximum Catenary Constant (H/w in feet.) for Aeolian Vibration Mitigation

Code Word	Max allowed H/w (ft) for the given ruling span (ft)									
	300	400	500	600	700	800	900	1,000	1,100	1,200
Bittern	8,700	8,400	8,100	8,000	7,800	7,700	7,600	7,500	7,400	7,300
Bunting	8,600	8,300	8,100	7,900	7,800	7,700	7,600	7,500	7,400	7,300
Cardinal	8,600	8,300	8,100	7,900	7,800	7,700	7,600	7,500	7,400	7,300
Drake	8,600	8,300	8,100	7,900	7,700	7,600	7,500	7,400	7,300	7,300
Grosbeak	8,500	8,200	8,000	7,800	7,600	7,500	7,400	7,300	7,200	7,200
Hawk	8,300	8,000	7,800	7,700	7,500	7,400	7,300	7,200	7,100	7,000
Ibis	8,200	7,900	7,700	7,600	7,400	7,300	7,200	7,100	7,000	7,000
Linnet	8,100	7,900	7,700	7,500	7,400	7,200	7,100	7,000	7,000	6,900
Partridge	8,000	7,800	7,600	7,400	7,300	7,100	7,000	6,900	6,900	6,800
Penguin	7,900	7,700	7,500	7,300	7,200	7,100	7,000	6,900	6,800	6,700
Rook	8,400	8,100	7,900	7,700	7,600	7,500	7,400	7,300	7,200	7,100
Thrasher	9,000	8,600	8,400	8,200	8,100	8,000	7,800	7,700	7,700	7,600

- (13) If dampers are needed for a specific wire type, they shall be installed on the entire project for that wire type. Where dampers are required, they shall be the size, quantity, and placement dictated by the damper manufacturer. The exact location where each reel of conductor was installed shall be recorded.
- (14) Final sag measurements, including but not limited to each sag span’s record date, span number, span length, ruling span, wire temperature, ambient temperature, initial sag for the span, time in blocks, time of day and sag measurements, shall be recorded.
- (15) OPGW (including a primary and secondary (redundant) OPGW) shall be installed the entire length of the overhead route and coordinated with the Communications System/communication/protection specification.
- (16) OPGW shall be 48-count fiber, single mode manufactured by either AFL Global (AFL) or Suzhou Furukawa Power Optic Cable (SFPOC). Owner-approved conductors include:

Table 7-5: Owner Standard OPGW

Manufacturer	“Low Lightning”	“Medium Lightning”	“High Lightning”
AFL	OGW074	OGW075	OGW076
SFPOC	OGW093	OGW094	OGW091

- (17) OPGW design tension limits shall be specified in the Project-specific sections.
- (18) Stringing tensions for the OPGW shall not exceed twenty percent (20%) of the ultimate cable strength.
- (19) Splice locations shall be selected and provided with weatherproof splice boxes suitable for the selected OPGW.
- (20) At each splice location, a 50-foot coil of spare wire shall be maintained.
- (21) Spare wire may be coiled on the pole, placed in an underground vault, or coiled in an aerial slack storage device.
- (22) The OPGW shall be solidly bonded to the structure with a braided soft drawn copper jumper and steel structures shall incorporate a welded grounding nut for that purpose.
- (23) Shield wire shall be minimum 3/8-inch, 7-strand EHS steel wire.
- (24) Shield wires and OPGW shall be bonded to the pole grounding system using a suitable ground wire.

7.1.16 Requirements for wind-induced oscillation dampers.

- (1) A vibration analysis shall be performed to determine the need for oscillation dampers and the preferred placement of the dampers along the interconnection line. The analysis shall consider the environmental conditions along the interconnection line and assume the following:
 - (a) Terrain Category: Category 1 – Open Terrain
 - (b) Direction of line shall be the direction between dead-ends for each section of line.
 - (c) The average annual minimum temperature shall be assumed to be -20 Deg. F for the Xcel – NSP and Xcel – PSCO regions and 0 Deg. F for the Xcel-SPS region.
- (2) Spiral vibration dampers shall be installed on phase conductors and OPGW shield wires that are smaller than 0.75” in diameter.
- (3) Stockbridge type dampers shall be installed on phase conductors and OPGW shield wires that are 0.75” diameter and larger.
- (4) Placement of dampers along the line and installation of the dampers shall be consistent with the manufacturer’s recommendations including but not limited to: bolts tightened to the proper torque; prevent contamination from entering the damper clamping area, etc. Dampers shall be installed following clipping of the line.
- (5) Design drawings shall include damper locations and installation requirements. The weight of the dampers shall be included in the conductor sag-tension calculations.

7.1.17 Requirements for bird diverters.

- (1) Bird diverters shall be installed to increase the visibility of conductors where required by permit or recommended due to bird traffic. Bird diverters shall be spiral type unless the permit requires a different type.
- (2) Design drawings shall include bird diverter locations and installation requirements. The weight of the bird diverters shall be included in the conductor sag-tension calculations.

7.1.18 Requirements for insulators and hardware:

- (1) All surfaces of metal parts shall be relatively smooth with no projecting points, damage, or irregularities, which may cause corona. Damage to insulators includes, but is not limited to, breaks, scratches, chips or cracks in the glass, bent or deformed pins, nicks, cuts or undue roughness in either caps or pins.
- (2) Nuts shall be hexagonal and of corona-free design.
 - (a) Nuts on all suspension and dead-end clamps shall be tightened in accordance with the clamp manufacturer specified torque requirements. Ten (10) minutes or greater following the initial tightening of the U bolts on the dead-end clamps, the U-bolts shall be torqued a second time. Note that dead-end clamps are not allowed on phase conductor dead-ends. Phase conductor dead end terminations shall be compression type.
- (3) All ferrous material except stainless steel shall be hot dip galvanized to conform to ASTM A153.
- (4) Cotter keys shall be austenitic stainless steel and each piece shall be marked for identification with the manufacturer's part or catalog number.
- (5) Dead end structures shall utilize toughened glass bell insulators. Tangent poles shall use polymer insulators. The type and manufacturer of the insulators shall be consistent by application.
 - (a) Toughened glass insulators shall be ANSI standard profile shape, Type K ball and socket coupling.
 - (b) Suspension insulators shall be Hubbell Power Systems or Maclean Power Systems as indicated in Table 7-6:

Table 7-6: Suspension Insulator Requirements

Elevation Range	Insulator Type	Voltage (kV)	Hubbell Power Systems					Maclean Power Systems				
			XP#	CID	Manufacturer's Part #	Section/ Overall Length (in)	Dry Arc Length (in)	XP#	CID	Manufacturer's Part #	Section/ Overall Length (in)	Dry Arc Length (in)
0'-5300'	Suspension	69/115	SUS371	1008425	S030049S2010P1	61.3	49.6	SUS372	1008611	S54080044VXSS018	55.6	47.9
	Suspension	230	SUS295	222443	S030077S201AP1	89.4	77.0	SUS376	1008615	S54080077VASS040	88.6	77.3
	Suspension	345	SUS381	1008429	S030123S201BP1	134.8	121.6	SUS382	1008618	S54080121VBSS058	132.6	121.2
5300'-7300'	Suspension	69/115	SUS371	1008425	S030049S2010P1	61.3	49.6	SUS373	1008613	S54080046VXSS018	57.6	49.9
	Suspension	230	SUS377	1008427	S030084S201AP1	95.9	83.5	SUS378	1008616	S54080082VASS038	93.6	82.3
	Suspension	345	SUS389	1008440	S030129S201BP1	141.3	128.1	SUS390	1008619	S54080128VBSS057	139.6	128.2
7300'-14000'	Suspension	69/115	SUS374	1008426	S030053S2010P1	65.7	53.9	SUS375	1008614	S54080050VXSS017	61.6	53.9
	Suspension	230	SUS379	1008428	S030090S201AP1	102.4	89.9	SUS380	1008617	S54080090VASS036	101.6	90.3
	Suspension	345	SUS391	1008441	S030146S201BP1	158.5	145.4	SUS392	1008630	S54080144VBSS054	155.6	144.2

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- (c) Braced line post insulators shall be Hubbell Power Systems or Maclean Power Systems as indicated in Table 7-7:

Table 7-7: Braced Line Post Insulator Requirements

Elevation Range	Insulator Type	Voltage (kV)	Hubbell Power Systems					Maclean Power Systems				
			XP#	CID	Manufacturer's Part #	Section/ Overall Length (in)	Dry Arc Length (in)	XP#	CID	Manufacturer's Part #	Section/ Overall Length (in)	Dry Arc Length (in)
0'-5300'	Braced Line Post	69/115	BLP090	1008813	BLP055G12041P1	67.7	49.6	BLP091	1008724	B2901060T52066MX REV 1	60.1	47.9
	Braced Line Post	230	BLP095	1008815	BLP082F00008P1	92.0	77.0	BLP096	1008728	B2511095T52087AA	94.7	77.3
	Braced Line Post	345	BLP101	1008818	BLP531F00005P1	142.2	121.6	BLP102	1008731	B3511144T52198AB	146.5	121.2
5300'-7300'	Braced Line Post	69/115	BLP090	1008813	BLP055G12041P1	67.7	49.6	BLP092	1008725	B2901065T52066BX	65.3	49.9
	Braced Line Post	230	BLP097	1008816	BLP089F00001P1	99.2	83.5	BLP098	1008729	B2511100T52087AA	99.7	82.3
	Braced Line Post	345	BLP103	1008819	BLP538F00001P1	149.5	128.1	BLP104	1008732	B3511153T52207AB	152.5	128.2
7300'-14000'	Braced Line Post	69/115	BLP093	1008814	BLP060G12008P1	72.4	53.9	BLP094	1008727	B2901070T52069AX	70.2	53.9
	Braced Line Post	230	BLP099	1008817	BLP494F00001P1	105.7	89.9	BLP100	1008730	B3511108T52093CA	107.5	90.3
	Braced Line Post	345	BLP105	1008841	BLP749F00003P1	163.9	145.4	BLP106	1008733	B4711165T52231CB	164.9	144.2

- (d) Horizontal line post insulators shall be Hubbell Power Systems or Maclean Power Systems as indicated in Table 7-8:

Table 7-8: Horizontal Line Post Insulator Requirements

Elevation Range	Insulator Type	Voltage (kV)	Hubbell Power Systems					Maclean Power Systems				
			XP#	CID	Manufacturer's Part #	Section/ Overall Length (in)	Dry Arc Length (in)	XP#	CID	Manufacturer's Part #	Section/ Overall Length (in)	Dry Arc Length (in)
0'-5300'	Horizontal Post	69	HLP252	1008178	P250043S0020P1	55.9	44.0	HLP253	1008667	H29010043MXSS022	53.3	45.1
	Horizontal Post	115	HLP254	1008179	P250055S0020P1	67.7	56.0	HLP255	1008669	H29010050MXSS026	60.1	52.9
	Horizontal Post	230	HLP257	1008560	P250084S002AP1	96.1	83.0	HLP258	1008711	H29010081AASS032	90.7	82
	Horizontal Post	345	HLP261	1008562	P300129S002AP1	139.8	129.6	HLP262	1008683	H39010128ABSS050	138.3	128.4
5300'-7300'	Horizontal Post	69	HLP252	1008178	P250043S0020P1	55.9	44.0	HLP253	1008667	H29010043MXSS022	53.3	45.1
	Horizontal Post	115	HLP254	1008179	P250055S0020P1	67.7	56.0	HLP256	1008710	H29010055BXSS014	65.3	57.7
	Horizontal Post	230	HLP257	1008560	P250084S002AP1	96.1	83.0	HLP258	1008711	H29010081AASS032	90.7	82
	Horizontal Post	345	HLP261	1008562	P300129S002AP1	139.8	129.6	HLP262	1008683	H39010128ABSS050	138.3	128.4
7300'-14000'	Horizontal Post	69	HLP252	1008178	P250043S0020P1	55.9	44.0	HLP253	1008667	H29010043MXSS022	53.3	45.1
	Horizontal Post	115	HLP267	1008564	P250060S0020P1	72.4	61.0	HLP268	1008685	H29010060AXSS012	70.2	62.7
	Horizontal Post	230	HLP259	1008561	P250092S002AP1	104.0	90.0	HLP260	1008682	H29010089CASS028	98.5	90
	Horizontal Post	345	HLP263	1008563	P300144S002AP1	154.0	144.2	HLP264	1008684	H39010144CBSS044	153.6	144.4

- (6) Insulator length, strength, and required number shall be determined based on loading requirements, switching surge and lightning requirements, and by contamination levels.
- (7) Contractor shall use construction methods to assure all polymer insulators are not subjected to torsion, such methods shall include working swivels when pulling conductor, clipping, adjusting turn buckles and dead ending.
- (8) Contractor shall inspect all insulators prior to installation to assure there is no damage to the insulator, including but not limited to polymer coating exposing the fiberglass rod
- (9) Materials shall be packaged in weather-resistant cartons or crates suitable for outdoor storage.
- (10) The insulators shall be protected with suitable material to prevent damage to the sheds, bell, connections, and/or end fittings during shipping and at the structure sites prior to installation.

- (11) Insulators shall be inspected prior to installation, cleaned as required, protected during installation and replaced if damaged. Installation shall follow IEEE 524 “IEEE Guide to the Installation of Overhead Transmission Line Conductors”
- (12) Line guards and armor rods shall be installed in conjunction with suspension clamp assemblies.
- (13) Elastomeric suspension units (AGS or CGS) are the preferred conductor support. Clamps with armor rod may only be used where elastomeric suspension units are not available. (At the time of publishing this document, they were available from several manufacturers down to size 336 kcmil.) Clamps without armor rod shall not be used. Hardware shall be appropriately rated for the operating temperature of the line. See Interconnection Line Table 7: Preferred fitting types for various wire types.
- (14) The termination of the armor rods shall be within one-half (0.5) inch of each other.
- (15) In the assembly of insulators and insulator hardware, every cotter key shall be inspected to ascertain that it is in place and properly seated and spread.
- (16) All in line bolts/pins shall face the same direction on all structures on the project. The nuts/pins on all side-to-side bolts/pins shall face the pole (except in a V-String where the outside nut/pin shall face out/down).
- (17) Corona rings shall be installed per the manufacturer’s requirements. The smooth side of the ring shall face the sheds on the insulator.

7.1.19 Requirements for grounding:

- (1) All overhead poles shall be grounded locally at each pole. The ground should consist of a copper ground wire connected to a 5/8-inch, copper-clad steel ground rod.
- (2) Grounding systems shall be designed in accordance with all Applicable Standards and best engineering practices.
- (3) Maximum resistance shall be no greater than 25 ohms. If ground resistance is greater than 25 ohms, special grounding designs shall be prepared. A ground resistance test shall be done at every structure.

7.1.20 Requirements for lightning protection:

- (1) The Interconnection Line shall be protected against lightning by the use of shield wire(s). The shield wires shall be located so as to intercept lightning strikes and prevent direct strikes to the conductors. Position of shield wires, ground resistance, and electrical parameters of the line insulation shall be coordinated to produce a calculated performance equal or superior to the standard value.
- (2) The isokeraunic level of the area of the line shall be determined by Contractor and shall be used in the design of the shielding/grounding system.
- (3) The method of grounding and the required ground resistance to minimize the outage rate shall be calculated.

- (4) The shield wire shall be positioned using the rolling sphere model described in IEEE 1243. Design engineer shall achieve the lightning protection using the structure geometry, including adjustments for terrain, and the structure grounding, including allowances for the soil electrical resistivity.

7.1.21 Requirements for marking and lighting:

- (1) All Interconnection Line structures shall be marked with identification numbers and permanent, weatherproof labels. Marking and identification scheme requirements include:
 - (a) The base piece of each structure shall be permanently marked on the pole shaft 60 inches above ground line and on the bottom of the base plate or bearing plate with the following identifying information:
 - 1. Company
 - 2. Load & Design Drawing Number
 - 3. Overall Structure height
 - 4. Month – Year structure was manufactured
 - 5. Vendors Job Number with Fabrication Plant Code
 - 6. Vendors Part Number including Sequence Number
 - (b) Each separate part of the steel pole structure shall be permanently and distinctly marked on outside face of piece with unique Manufacturer Job Number with Fabrication Plant Code and Manufacturers Part number including Sequence Number to identify the type, structure and position of the piece on the structure and for the purpose of tracking material deliveries, inspections and material properties.
 - (c) Each pole shaft shall be permanently and distinctly marked on plate welded to inside of pole at small diameter end of the shaft of slip-jointed and flange connections to assist in identifying shafts from their end when in storage when face markings are not visible. Top pole shafts shall be marked similarly. Mark shafts with unique Manufacturer Job Number and Manufacturers Part number including Sequence Number to identify the type, structure and position of the piece on the structure and for the purpose of tracking material deliveries and inspections.
 - (d) Marking shall be made by ½-inch stamping on a metal plate welded to the base piece and ½-inch stamping on a metal plate welded to all other loose shipped pieces, less hardware.
 - (e) All markings shall be clearly legible after finishing and galvanizing.
 - (f) The method of identification shall be approved by the Company.
 - (g) Unnecessary marks, such as chalking or scribes, are not allowed on the outer surfaces of weathering steel sections.

- (h) All structure shaft pieces, davit arms and cross arms shall have a weld bead, across the same flat as the nameplate, to identify the balance point of the piece along with the letters BP.
 - (i) The structure manufacturer shall provide ½-inch Stainless Steel welded nuts for permanent Contractor supplied and installed structure signs. The marking and identification scheme for the structure signs shall be approved by Owner prior to use.
- (2) Spherical markers shall be installed as specified by permit on at least the top conductor of the transmission line to increase visibility of the wire at all navigable river crossings or where aircraft operate. The weight of the spherical markers shall be included in the conductor sag-tension calculations.
- (3) The Interconnection Line lighting system shall comply with the requirements as defined in US DOT-FAA Advisory Circular No. AC 70/7460-1K: *Obstruction Marking and Lighting*.

7.2 Submittals

7.2.1 Contractor shall prepare the Interconnection Line design documents per the submittal schedule in Exhibit G.1 (Submittal Schedule) and containing the following information, at a minimum: (a) design basis; (b) plan and profile drawings, including electrical phasing matching the phasing at the Project Substation terminations with minimal rolls and phase swapping; (c) structure details and drawings, including elevations, spacing, and hardware; (d) civil works drawings, including subgrade preparation, grading, drainage, and erosion control; (e) foundation design and embedment drawings; (f) anchoring and guying details; (g) structural calculations; (h) PLS-CADD design files; (i) grounding details; (j) drawing index; (k) bill of materials; and (l) inspection testing, and quality control requirements.

7.2.2 Contractor shall prepare energization plans and procedures for the Interconnection Line. Energization plans shall be submitted to Owner for approval *prior* to use. Energization plans shall include both electrical and communications infrastructure as well as backfeed plans, soaking plans, testing plans, and lock out tag out procedures, at a minimum.

7.2.3 Contractor shall prepare an in-field insulator installation plan for Owner's review and approval.

7.2.4 Contractor shall provide a complete recommended spare parts list for the Project's electrical works, including the Interconnection Line. Such list shall include recommended quantities, part / model numbers, and nominal pricing.

7.2.5 Contractor shall submit all manufacturer's product sheets (material cut sheets), warranties, and operations and maintenance manuals (as applicable) for all permanently-installed equipment and materials.

7.2.6 Contractor shall enter the as-built LiDAR survey data into the existing IFC PLS-CADD model and update the model as necessary based on that data. As built PLS-CADD model to be provided to owner. Contractor shall confirm with LiDAR survey that clearances and line sag values conform to the applicable requirements.

7.3 Interconnection Line

7.3.1 Contractor shall design, furnish, construct, and install the [TBD-kV] Interconnection Line in conformance with the minimum requirements set forth herein.

- (1) Contractor shall furnish all labor, equipment, and materials that are necessary for a complete, fully-functional, and safe Interconnection Line configuration.
- (2) The Interconnection Line shall not cross through (under / over) the O&M Building yard. Placement of structures within the yard is prohibited.
- (3) Contractor shall allow a sufficient amount of conductor and OPGW coiled at the last structure outside the Interconnection Switchyard for termination by the Interconnecting Transmission Provider.
- (4) Contractor shall actively coordinate with Owner and any Owner representatives or contractors for the completion of the Project, including the Interconnection Line interface at the Interconnection Switchyard. Such coordination may include, but not limited to, sharing design drawings and studies, coordinating testing procedures, and attending meetings to discuss design implications and Progress of the work.

7.4 Testing and Quality Control

7.4.1 Contractor shall test, commission, start-up, and place into successful operation the Interconnection Line, including the electrical infrastructure and communications infrastructure. At a minimum, testing shall include the minimum requirements set forth below. All testing shall be performed by an independent, experienced third party.

- (1) All Interconnection Line equipment shall be tested to demonstrate it meets stated design criteria and is fit for purpose.
- (2) All testing specified in the Applicable Standards, including NETA.
- (3) All testing reasonably recommended or required by the applicable equipment suppliers.
- (4) All exposed conductor and OPGW sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation. Upon receipt, Contractor shall perform reel acceptance testing on all OPGW using optical time-domain reflectometer (“**OTDR**”) and compare those trace results with the data from the manufacturer.
- (5) After installation and completion of all required splicing and terminations, all OPGW shall be verified using OTDR. All such testing shall be done with an OTDR in both directions of the strands. For single-mode fiber, test each fiber in both directions at 1310 nm and 1550 nm. A successful test result shall have (a) attenuation less than (i) 0.50 dB per connector and (ii) 0.30 dB per fusion splice and (b) optical return loss of each connector less than (i) -35 dB if UPC and (ii) -65 dB if APC. Contractor shall compare results with reel tests performed by the manufacturer.
- (6) Following OTDR testing, an optical attenuation test shall be performed on all fibers. This test shall be performed at 1310 and 1550 nanometers, using a calibrated light source and optical power meter.

- (7) Resistance testing on grounding grid at each structure location.
- (8) All Interconnection Line foundations shall be tested for concrete and grout properties (strength, slump, air content, temperature), with the first concrete truck of the design mixture, and every three (3) concrete trucks thereafter.
- (9) Compaction.
- (10) Other testing set forth in the design documents.

7.4.2 Contractor shall notify Owner of all testing schedules at least 30 days in advance of testing activities and copies of testing reports (including a summary of testing procedures and acceptance criteria) shall be submitted to Owner within 10 days of completing such test.

8.0 INTERCONNECTION [SUBSTATION / SWITCHYARD]

Not used.

8.1 General Provisions

Not Used

8.2 Submittals

Not Used

8.3 Interconnection Switchyard

Not Used

8.4 Testing and Quality Control

Not Used

9.0 COMMUNICATIONS SYSTEM

9.1 General Provisions

9.1.1 Contractor shall coordinate with Owner regarding the equipment size, location, conduit entry, power, grounding and other requirements for the SCADA and meteorological equipment.

9.1.2 Contractor shall provide a Communications System that permits at least two (2) remote concurrent users. The Communications System shall operate on server operating system and shall be compatible with Owner's existing control system. Contractor shall assume 2 users and shall provide incremental pricing for the addition of more users.

9.1.3 Contractor shall provide list of networking and server equipment for Owner approval, including the equipment provided in Exhibit A.3 (Approved Suppliers), as applicable. Owner shall have the option to program the Contractor-provided networking equipment (e.g. switches and firewalls).

9.1.4 The Communications System, field SCADA enclosures, MET Stations, etc. shall be provided with backup power for a minimum of 8 hours. The control house battery bank shall be used to provide backup power to all Communication System related devices in the Project Substation including devices such as the power plant controller (PPC), automation controllers, protective relays, network equipment and computing equipment. A UPS (uninterruptible power supply) may be used for backup power when a device is not able to be powered from the control house battery.

- (a) Chargers shall include AC power failure alarm output contacts, high/low DC voltage alarm output contacts, and ground detection alarm output contacts.

9.1.5 The Communications System shall be designed with data continuity, reliability, and security as priority.

9.1.6 Communications equipment shall be furnished with anti-condensation heaters supervised by a thermostat as required for the conditions (if not already provided by the manufacturer of the equipment).

9.1.7 All monitoring and control devices and systems shall be suitably zone protected against lightning electromagnetic impulses in accordance with IEEE C37.90.1.

9.1.8 The Communications System shall be compliant with all Applicable Standards, including NERC Functional Model Registered Entity function, NERC Reliability Standards, Regional Entity Standards, approved regional variances, and/or FERC Orders. Further, the Communications System shall comply and be designed to work in accordance with applicable Owner's system operator approved protocols, operating guides, standards, business practice manuals, and/or approved rules. In so far as either a state utility commission or provincial authority has instituted additional regulations, the communications system should be designed to accommodate where no conflict exists with NERC or FERC. Design should include parameters for operating under conditions specified by rules stated hereto as well as capability to function on an evidentiary basis.

9.1.9 All Communications System design and construction shall conform to the supplier's requirements.

9.1.10 Requirements for system functionality:

- (1) The Communications System shall be capable of centrally and remotely monitoring, controlling, and recording the performance of the Project Substation equipment, permanent MET Stations, solar PV modules, inverters / BESS / permanent meteorological towers, Wind Turbines], and other critical sensors.
- (2) The Communications System design shall include configuration files and a comprehensive data points list and protocol specification for communications between all Project components requiring communications, data transfer, and control monitoring using the fiber network integrated into the Communications System. Such configuration files shall have the ability to be configured by Owner, and Contractor shall furnish development application software for each configurable device.
- (3) The Communications System shall include the necessary equipment (hardware and software) for the exchange of signals with Project Substation equipment to support grid monitoring.
- (4) The Communications System shall include the necessary equipment (hardware and software) for the exchange of signals with the permanent MET Stations / Met Towers to support data monitoring.
- (5) The Communications System shall include the necessary equipment (hardware and software) for the exchange of signals and integration of any required reactive compensation devices (e.g., capacitor banks, reactors, solar or BESS inverters).
- (6) Upon loss of utility power interconnection or failure of utility power, restart of the instrumentation and control system to a fully-functioning condition should require no local manual operations. Synchronization shall be performed automatically.

9.1.11 Requirements for fiber network:

- (1) Fiber optic cable shall be installed in the same trench as the Collection System Circuit power cabling. Fiber optic cable shall be installed with detectable tape or other means of detection (excluding detectable tape or wire within the Project Collector Substation or other facility in which the detectable tape or wire would interfere with the safe operations of such facility.)
 - (a) When fiber cables are installed in a trench, the fiber cable shall be placed in non-conducting conduit or continuous innerduct; the fiber cable shall be rated for underground use; and there shall be a suitable locating cable installed in the innerduct/conduit. Innerduct shall have a minimum diameter of 1.25 inches. C
 - (b) Fiber located in burrowing rodent prone areas shall consider mitigation measures such as increased burial depths and innerduct / conduit with enhanced rodent protection.
 - (c) Fiber optic shall be separated from any power cables when co-located in a trench.
- (2) All fiber cables shall consist of a minimum of 12-strand multi/single mode fiber. All fiber runs greater than one (1) mile in length shall be single-mode fiber, or as otherwise required to maintain a minimum of at least one (1) gigabyte bandwidth throughout the backbone of the system.

- (3) The fiber optic cables shall be terminated at the Project Substation control enclosure in a patch panel provided and installed by Contractor. All spare fibers shall be terminated at each location and connected at each splice location. Launch and landing boxes shall be installed as necessary to facilitate testing.
- (4) All fiber optic connectors and ports shall be LC type (patch panels, ethernet switches, etc.).
- (5) All fiber cables shall be designed with a minimum of fifty percent (50%) spare fiber.
- (6) Excess slack shall be provided to allow re-termination in the event of failure. Sufficient cable length shall be provided such that the cables may be re-terminated at least two (2) times after installation. Terminations shall be completed with either an approved fiber optic pigtail kit or with approved mechanical connectors and an approved fanout kit.
- (7) All communications cables, including fiber cables, shall be appropriately labeled in accordance with Section 2.6.
- (8) The fiber system shall be designed for a minimum of five (5) dB system margin.
- (9) The fiber system design shall be a fiber ring topology or a “daisy-chained” system.
- (10) Fiber cables may be routed through Project Substation control cable trenches with other control wiring provided that a high-visibility color innerduct is used for identification and protection of the fiber cables.
- (11) All splices shall be fusion splices and shall be housed in splice trays. Other types of splices are subject to Owner approval. Where used, all fiber optic splice enclosures shall be NEMA 3 and locking.
- (12) Maximum attenuation:
 - (a) 0.36 dB/km at 1310 nm.
 - (b) 0.22 dB/km at 1550 nm.
- (13) Data collection loops shall be designed so that a loss of a power circuit does not cause a loss of data collection from the PV Array / Wind Turbines during the power outage.

9.1.12 Requirements for monitoring and control:

- (1) Design and installation of the Communications System shall be provided with all hardware, telemetry, communication and other requirements as required by the interconnection utility.
- (2) The Communications System shall be provided with the following supervisory screens, at a minimum.
 - (a) Project Substation one-line diagram, including all breakers, switches and transformers and the real-time status of each (current, power, voltage, power factor, and reactive power, as applicable).
 - (b) Project Substation alarms and notifications: (1) status of all relays and (2) status of all alarms and notifications.

- (c) Main power transformer status, including the following for each main power transformer: (1) operation and fault status, including alarms; (2) relay statuses; (3) temperatures (winding, oil); (4) tap changer position; and (5) dissolved gas monitor data and alarms.
- (d) Breaker status, including the following for each medium- and high-voltage breaker: (1) operation and fault status, including alarms; (2) relay statuses; and (3) breaker readings (current, power, voltage), including per Collection System Circuit.
- (e) Control building status, including the following: (1) operation and fault status, including alarms; (2) enclosure alarms (fire/smoke alarm status, enclosure temperature, intrusion, etc.); (3) battery charger voltage and status; (4) intrusion detection; and (5) HVAC status.
- (f) Solar status, including the following:
 - 1. Meteorological parameters: GHI irradiance, plane of array (“POA”) irradiance, ambient temperature, wind speed and direction, and rainfall
 - 2. Tracker points: Status and alarms (per tracker for linked-row trackers and per row for independent row trackers), setpoint position, actual position (per tracker for linked-row trackers and per row for independent row trackers), and wind speed
 - 3. Inverter shelter points (if applicable): Shelter environmental conditions (if applicable), shelter HVAC/climate control status (if applicable), and shelter door position switch (if applicable)
 - 4. Inverter points: inverter status, alarm states, and faults; instantaneous input and output power; energy production (daily and total); DC and AC voltages (line-to-line and per phase for AC); DC and AC currents (per phase for AC); DC current zone-level monitoring; internal component and cooling system temperatures (IGBTs, heat sinks, air temperature, fluid temperature, as applicable)
 - 5. Back of Module temperature points
 - 6. Soiling station data points
 - 7. PVCS Points (if applicable): AC disconnect switch points with position feedback (except manually operated air break switches), indicating protection relays’ power information, and protection relaying auxiliary contacts for alarming
 - 8. MV Transformer Alarms (binary): Overtemperature 1 and 2, low oil level, pressure, vacuum
- (3) Other supervisory screen requirements:
 - (a) All major components (e.g., breakers, transformers, MET Station) shall be listed separately.

- (b) Alarms and faults shall be color-coded where applicable (e.g., green, yellow, red).
- (4) The Communications System shall include control functionality for the following, at a minimum: (a) active power; (b) reactive power; (c) frequency; (d) voltage; (e) power factor; and (f) noise-related operations.
- (5) Fault notification shall be provided through real-time text messaging or e-mail alerts, as determined by Owner. Fault notification messages and recipients shall be specified by Owner.

9.1.13 Requirements for reporting and storage:

- (1) Contractor shall provide a SCADA points list for Owner approval.
- (2) All reporting shall be in Generation Availability Data System (“GADS”), in an appropriate format.
- (3) Communications System reporting shall include, at a minimum, the following for the Project Substation, permanent MET Station, solar PV modules, and BESS: (a) performance parameters, availability, operation counters, faults, and alarms; (b) browsing and filtering of historical data; and (c) creation of pre-defined and custom reports.
- (4) All data monitored by the Communications System shall be recorded and stored. Local controllers shall have sufficient buffer for at least 30 days of data storage in the event of power loss.
- (5) Historical data shall be stored in an SQL database or Owner-approved equivalent for the life of the Project. Data shall be stored in the database as no higher than 1-minute averages, with accompanying statistical values including, but not limited to, minima, maxima, and standard deviation. All data shall be retrievable.
- (6) All stored data and generated reports shall be exportable as ASCII and Microsoft Excel formats.
- (7) The system shall not permit unwarranted tampering with or changing of raw data or functionality.

9.1.14 Requirements for data integration:

- (1) Contractor shall perform data integration.

9.2 Submittals

9.2.1 Contractor shall prepare configuration files and a comprehensive data points list and protocol specification for communications, as more particularly described in Section 9.1.10 herein.

9.2.2 Contractor shall prepare a Communications System control narrative to describe the following:

- (1) How data will be collected from the inverters, trackers (if applicable), substation, meters, and meteorological stations and sent to the Owner, balancing authority, and Transmission Provider in accordance with the interconnection agreement.

- (2) How the substation communication systems, major Equipment SCADA, power plant controller and facility SCADA (site computer) will communicate and function together to enable Owner to monitor and control the Project locally and remotely.
- (3) How the power plant controller will perform the following functions:
 - (a) Active power curtailment
 - (b) VAR control
 - (c) Power factor control
 - (d) Automatic Voltage Regulation (AVR)
 - (e) Active and reactive power ramp-rate control
 - (f) Frequency droop control (Hz vs. kW)
 - (g) BESS: Battery charging and discharging

9.2.3 Contractor shall provide the following documentation:

- (1) IP address list.
- (2) I/O list and dataset mapping.
- (3) Factory acceptance test procedure and results.
- (4) Recommended spare parts list with equipment make/model and pricing
- (5) All credentials use and configured during setup. All system should be changed from default passwords during setup
- (6) License keys and warranty\support information. All licenses, warranty and support contacts should be purchased with the owner being the end user or owning party.

9.2.4 Refer to Section 5.2.1 and Section 6.2.1 for additional Communications System submittals.

9.2.5 Contractor shall submit all manufacturer's product sheets (material cut sheets), warranties, and operations and maintenance manuals (as applicable) for all permanently-installed equipment and materials.

9.2.6 Contractor shall submit a list of all the software installed on Contractor-provided equipment

9.3 Communications System

9.3.1 Contractor shall design, furnish, construct, and install the Communications System in conformance with the minimum requirements set forth herein.

- (1) Contractor shall furnish all labor, equipment, and materials that are necessary for a complete, fully-functional, and safe Communications System configuration.

- (2) Contractor shall furnish and install all network and communication devices, including programming and configuration, necessary for the Communications System.
- (3) Communications System shall be support Open Platform Communications Unified Architecture (OPC UA) (IEC 62541) protocol interface.
- (4) Contractor shall furnish and install / terminate all fiber optic cabling between the major Equipment, Project Substation, permanent MET Station, and O&M Building, including patch cables between fiber patch panels and devices.
- (5) Contractor shall develop and furnish HMI supervisory screens for the Project Substation RTAC as described in Section 9.1 herein.
- (6) Contractor shall furnish and configure the RTAC, including incorporation of the major Equipment Communications System and dissemination of points to the interconnection utility and offtaker, as requested.

9.3.2 Contractor shall install the major Equipment in the Communications System, including all power and fiber optic terminations, within the Project Substation.

9.3.3 Contractor shall coordinate with Owner's resources to integrate all Contractor-supplied equipment with Owner-supplied network equipment.

9.4 Testing and Quality Control

9.4.1 Contractor shall test, commission, start-up, and place into successful operation the Communications System, including the electrical infrastructure and communications infrastructure. At a minimum, testing shall include the minimum requirements set forth below. All testing shall be performed by an independent, experienced third party.

- (1) All Communications System Line equipment shall be tested to demonstrate it meets stated design criteria and is fit for purpose.
- (2) All testing specified in the Applicable Standards, including NETA.
- (3) All testing reasonably recommended or required by the applicable equipment suppliers.
- (4) All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation. Upon receipt, Contractor shall perform reel acceptance testing on all fiber cable using OTDR and compare those trace results with the data from the manufacturer.
- (5) Verify all alarms, indications and analog quantities are communicated and received properly by the RTU and displayed correctly on the HMI.
- (6) Verify all communication channels (intra- and inter-Project Substation), including Project Substation LAN, operate as expected.
- (7) After installation and completion of all required splicing and terminations, verify fiber optic system performance (power losses, splice or connector losses, etc.) using OTDR.
 - (a) OTDR testing shall be in accordance with TIA 568-C Tier 2.

- (b) Prior to testing each fiber span, the OTDR shall be calibrated for length and pulse width.
 - (c) All such testing shall be done in both directions of the strands.
 - (d) For single-mode fiber, test each fiber in both directions at 1310 nm and 1550 nm. A successful test result shall have (a) attenuation less than (i) 0.50 dB per connector and (ii) 0.30 dB per fusion splice and (b) optical return loss of each connector less than (i) -35 dB if UPC and (ii) -65 dB if APC.
 - (e) Contractor shall compare test results with reel tests performed by the manufacturer to confirm consistency.
- (8) Following OTDR testing, an optical attenuation test shall be performed on all fibers. This test shall be performed at 1310 and 1550 nanometers, using a calibrated light source and optical power meter.
 - (9) All fiber optic cable shall be visually inspected and OTDR-tested and power meter tested prior to installation / termination.
 - (10) Provide system functionality and compatibility at the control room / O&M Building.
 - (11) Test each cable and strand on every fiber run from termination to termination.
 - (12) Provide entire Project Site testing to ensure proper operation of all data points into the component gateways and testing of all data points provided to third parties with that party.

9.4.2 Contractor shall notify Owner of all testing schedules at least 30 days in advance of testing activities and copies of testing reports (including a summary of testing procedures and acceptance criteria) shall be submitted to Owner within 10 days of completing such test.

10.0 O&M BUILDING

10.1 General Provisions

10.1.1 Requirements for O&M Building configuration:

- (1) Contractor shall furnish all labor, equipment, materials, and permitting that are necessary for a complete fully-functional and code compliant building, excluding only the Owner-Supplied Equipment in Exhibit B (*Owner-Supplied Equipment / Owner-Supplied Work*).
- (2) The O&M Building shall be constructed on at least 4.5 acres and positioned as shown in Figure 10-7. The land shall be owned and not acquired through an easement. The O&M building shall have the general dimensions as indicated in Table 10-1 below for the size of the Project, and indicative layouts shown in Figure 10-1 through Figure 10-8 herein, at a minimum. For hybrid projects (projects with more than one type (Wind, Solar, BESS) of renewable generation) selected building size and type shall be approved by Owner. Minor adjustments to the size may be permitted to accommodate standard materials. Such adjustments shall be reviewed and approved by Owner.

Table 10-1: O&M Building Size Table

Project Rating (MWac): Solar, BESS	Approximate Building Size and Type
< 50	40-foot converted shipping container
50-199	1,020 square feet
200-699	4,140 square feet
700+	5,780 square feet
Turbine Quantity: Wind	Approximate Building Size
50-150	7,520 square feet
151-250	8,320 square feet
>250	9,440 square feet

- (3) The building orientation shall be fixed as shown in the site layout in Figure 10-1 through Figure 10-8 herein and the entrance road shall be from the south. The parking area may require adjustment based on final building layout.
- (4) The O&M Building shall be designed and constructed such that it is ADA compliant, including parking, doorways, bathrooms, and other building features.
- (5) All manufacturer installation instructions for the installation of all O&M Building equipment and components shall be obtained and followed.
- (6) The O&M Building shall be constructed using metal studs.
- (7) Contractor shall provide professional cleaning service for the O&M Building at the conclusion of the Work, including, but not limited to, cleaning light fixtures, mirrors, sinks, toilets, cabinets, and lockers; washing floors; washing windows; and waxing hard flooring.

10.1.2 Requirements for O&M Building civil works:

- (1) All civil works for the O&M Building shall comply with the applicable specifications in Section 4.0 (Civil / Structural Works).
- (2) Excavated material shall be backfilled and compacted on the outside of the foundation walls adjacent to green areas and graded around building to provide proper drainage. The outside foundation walls adjacent to hard surfaces and future additions shall be filled with compacted granular fill.
- (3) Fill shall be compacted to at least 95 percent (95%) of the maximum density within the moisture content of two percent (2%) below optimum to two percent (2%) above optimum, as determined by ASTM Standard D698, unless a higher level of compaction is required by the Geotechnical Report. Contractor shall furnish compaction-testing results to Owner.
 - (a) Any fill necessary for O&M site development shall be clean granular fill supplied by Contractor.
- (4) The graveled fenced area for the O&M Building shall be covered throughout with at least six (6) inches of aggregate over fabric or geogrid and a compacted subgrade, with aggregate extending at least one (1) foot beyond the fence in all directions. The maximum aggregate size shall not exceed two (2) inches.
- (5) Septic leach fields shall be cordoned off and protected from all construction traffic and equipment to mitigate unnecessary soil compaction in the area.
- (6) All finished grades shall be 1/8-inch per foot and provide proper drainage away from buildings and structures.

10.1.3 Requirements for O&M Building structural works:

- (1) All O&M Building structures, foundations, assemblies, and components shall be designed and constructed in accordance with the applicable structural works specifications in Section 4.0 (Civil / Structural Works).
- (2) The O&M Building shall have a reinforced-concrete foundation covering the building footprint. The O&M Building floor shall be at least six (6) inches thick. Where necessary, the floor shall be thickened to accommodate large equipment (e.g., generator) and heavy loads to be stored in that area. Concrete reinforcement shall be shop fabricated per design drawings. Field bending of reinforcement shall be in accordance with applicable sections of ACI 318. Shop drawings shall be submitted for review prior to construction.
- (3) Contractor shall require that the concrete subcontractor has a minimum of 3 years of experience with commercial concrete construction and concrete floor finishing.
- (4) Minimum concrete strength shall be 3,000 psi for footings and walls, respectively, and 3,500 psi for floors in place in 28 days.
- (5) Welded wire fabric shall conform to ASTM A185. Plain wire shall conform to ASTM A82. Placement shall be in accordance with Chapters 7 and 12 of ACI 318 and the CRSI's "Manual of Standard Practice".
- (6) All foundations shall extend a minimum of six (6) inches above the adjacent finished grade.

- (7) Foundation wall and under slab insulation, when required by location, shall be extruded polystyrene board insulation, ASTM C578, Type IV, 1.6 pcf density minimum, “k” factor of 0.20 at 75 deg. F (R-5), 25 psi minimum compressive strength, 0.3 percent maximum water absorption by volume, square edges, manufacturer’s standard board size, such as Styrofoam SM manufactured by Dow Chemical Co., Foamular 250 manufactured by Owens Corning, or approved equal. Thickness noted on Design Documents. Install on the perimeter of the foundation and wrap around under the concrete slab floor 4’-0”.
- (8) Concrete for equipment pads and containment areas shall be sealed with 2 coats of petroleum resistant sealant. All exposed concrete slabs, interior or exterior, shall have a combination sealer/curing compound, ASTM C309 or equivalent applied. Sealer to be Sonneborn, Tremco, or approved equal.
- (9) Footing, wall, and floor heights shall be set with a laser transit to improve accuracy of determining heights for construction.
- (10) Design of structural and miscellaneous steel shall be in accordance with the AISC’s “*Manual of Steel Construction*”. Design of structural and miscellaneous steel shall also be in accordance with NEMA Standard SG6, NEMA Standard TT1, and the International Code Council’s “*International Building Code*”, respectively.
- (11) High strength bolts, nuts, and washers shall be galvanized in accordance with ASTM F2329. Bolts, nuts, and washers under 0.5 inches in diameter shall conform to ASTM A307, Grade B, ASTM A563 and ASTM F844 respectively, and shall be galvanized in accordance with ASTM F2329.
- (12) Anchor bolts, anchor bolt assemblies, and concrete embedments shall be galvanized. Galvanizing shall conform to the requirements of ASTM A123, ASTM A153 or ASTM A2329 as applicable.
- (13) Anchor bolts shall conform to ASTM A449, ASTM F1554, Grade 36 or A307. Anchor bolt sleeves shall conform to ASTM A501.
- (14) Column anchor bolts, dowels, reinforcement, embed plates, etc. shall be supported by chairs, bolsters, bar supports, spacers, etc. prior to concrete placement. “Wet Setting” of reinforcement, dowels, anchor bolts, embed plates, etc. is not allowed.
- (15) All structural welding shall conform to the requirements of AWS Standard D1.1.
- (16) Stainless steel shall conform to ASTM A167.
- (17) Design of structural and miscellaneous aluminum shall be in accordance with the latest version of the Aluminum Association’s “*Aluminum Design Manual*” and “*Aluminum Standards and Data*”.
- (18) Materials for structural and miscellaneous aluminum including structural shapes and plates shall conform to ASTM B209 and ASTM B308 and shall be aluminum alloy 6061-T6.
- (19) Bolts and nuts shall conform to ASTM F468 and ASTM F467, respectively, and shall be aluminum alloy 6061-T6. Washers shall be aluminum-clad steel Alclad 2024-T4 or approved equal.

- (20) Vapor retarder: 10 mil polyethylene placed under office floor and anywhere floor finish or coating shall be used to help reduce any moisture migration through the slab. All joints shall be taped and all penetrations shall be repaired and taped.
- (21) Provide cork expansion joint material, ASTM D1752-67, Type II in expansion joints for interior work as required, and seal over with Vulkem 116 or equal. Provide fiber expansion joint material, Flexcell or equal in expansion joints for exterior work as required, and seal over with Vulkem 200 or equal.

10.1.4 Requirements for metal building:

- (1) The O&M Building shall be standardized metal panel and steel support and framing by Butler, Morton, or Owner-approved alternate.
- (2) The main frames shall be clear span, no interior vertical supports are allowed.
- (3) The sidewall columns shall be tapered with inset girts.
- (4) Arkema's KYNAR 500 26-gauge architectural wall panels, or Owner-approved equal, shall be applied to all exterior walls. Architectural panels shall have semi-concealed fasteners. The Premium 70 finish coating system shall have a superior high-build primer application that is then coated with premium fluorocarbon coating that contains seventy percent (70%) KYNAR 500 resin.
- (5) Closure strips, sealing tape, and joint sealants shall be furnished and utilized as needed to complete the metal building erection per Prudent Wind / Solar / BESS Industry Practices.
- (6) To ensure weather tightness and rodent control, a finished base angle at the bottom of each wall sheet shall be included.
- (7) Provision for thermal expansion movement of the standing seam panels shall be accomplished by the use of clips with a movable tab.

10.1.5 Requirements for O&M Building roof:

- (1) The roof pitch shall be 1½:12.
- (2) The roof shall have gable ends.
- (3) The roof covering shall be American's 24-gauge Aluminum Coated Steel 360° Seamless Roof System or Owner-approved equal. The panels shall be 20-feet wide with 3-inch-high crown. The high crown shall include factory-applied, all-weather mastic. The panel overlaps shall be seamed mechanically to ensure weather tightness of the roof system.
- (4) The roof shall have perimeter fascia constructed of 24-gauge steel with factory applied baked enamel finish and color per Section 10.1.33.
- (5) Deluxe eaves which match the rake of the building shall be included.
- (6) Dektite boot flashings at 4-inch to 12-inch pipe penetrations shall be provided.

- (7) Gutters and downspouts shall be furnished and installed. Splash blocks shall be included at all downspouts. Downspouts shall not drain onto sidewalks or aprons. Gutters shall incorporate back-up drain scuppers.
- (8) The roof shall be designed, installed, and constructed to provide a 10-year guarantee against leakage.
- (9) Awnings shall be installed over access doors that are located on non-gable end walls. Awnings shall be directly attached to the building walls (i.e., no exterior columns) and shall be constructed of light gauge steel and shall be designed to divert water to the sides and not in the walking path, without the use of gutters.
- (10) Insulated roof curbing shall be provided as required for all roof-mounted equipment.

10.1.6 Requirements for O&M Building exterior doors:

- (1) Overhead doors shall be 12-foot by 12-foot doors, with vinyl seal on both sides of track, hood baffle, reversing “Feather Edge”, and take-up reel. Each door shall be motor operated, and openers shall come with three-stage (open/stop/close) push button. No coil/roll-up style doors are allowed.
 - (a) Overhead doors shall be 24-gauge factory finished steel insulated (minimum R value of 4.0) with 2-foot panel sections. Doors to have perimeter brush seal weather-stripping, and bottom astragals.
 - (b) Overhead doors shall have chain releases in case of power failure.
 - (c) Overhead doors shall have heavy duty cycling springs, photoelectric sensors and an automatic close function.
- (2) Doors shall be 3-foot by 7-foot painted steel commercial-grade, insulated to meet current energy code, and contain ball-bearing hinges, hydraulic closer, latch guard, weather-stripping, self-sealing sweep, ADA-compliant aluminum threshold, and keyed lockset. One (1) lite kit shall be included per door, see Table 10-2 for size.
- (3) Hollow metal work shall be as manufactured by Steelcraft Mfg. or equal SDI Member, as approved. Frames shall be welded unit type with a minimum thickness of 16 gauge.
- (4) All door jambs shall be completely flashed to give door opening a finished appearance.
- (5) All doors shall be equipped with key card readers, as further described in Section 10.1.18 herein.
- (6) All doors shall be equipped with a lever handle and deadbolt key lock. Panic hardware shall only be used on doors where local fire codes require them.
- (7) Door bumpers shall be provided as required.
- (8) All exterior doors shall push open to the north and west / into the prevailing wind direction.

10.1.7 Requirements for O&M Building interior doors:

- (1) Interior doors shall be 3-foot by 7-foot by 1.75-inch-thick flush solid-core commercial-grade birch wood or sound insulated steel per Table 10-2. All interior doors shall be installed in primed hollow metal frames with three (3) 4.5-inch by 4.5-inch commercial hinges. The frames and steel doors shall be painted and wood doors shall be stained and varnished.
 - (a) Provide flush 5-ply construction with solid particle core bonded to stiles and rails using Type 1 waterproof glue, conforming to AWI Type PC-5. Quality grade of wood doors shall be AWI Premium with AWI Grade A oak face veneer on all sides and edges.
- (2) Hollow metal work shall be as manufactured by Steelcraft Mfg. or equal SDI Member, as approved. Frames shall be welded unit type with a minimum thickness of 16 gauge. Interior hollow metal doors shall be a minimum thickness of 18 gauge. Doors constructed of aluminum are not allowed.
- (3) All interior doors except the bathrooms, SCADA, and Mechanical Room shall have a vertical ¼ light glass.
 - (a) Glass shall be tempered clear float glass, ASTM C1048, Type 1, Class 1, q3, Kind FT, horizontally tempered, ¼” thick, as required for door glass lights.
- (4) All interior doors shall have medium-duty commercial grade lever locksets.
- (5) Doors shall be fire rated as set forth in Section 10.1.19 (Fire Protection System).
- (6) Door bumpers shall be provided on every door.
- (7) Door keying shall be provided on every door. Bathroom doors shall include dead bolt.

10.1.8 Requirements for O&M Building door hardware:

- (1) Provide the following hardware by the listed manufacturers or approved equals:
 - (a) Butts -- Stanley FBB199, US26D, 1 1/2 pair
 - (b) Closer -- LCN 4010/4111 Series, exposed overhead surface type, Aluminum, see table below for applicable locations.
 - (c) Kick Plates -- Hiawatha 10” x 34”, US32D
 - (d) Stops and Holders -- Ives, US32D
 - (e) Push-Pulls -- Hiawatha, US32D, ADA approved
 - (f) Lock Sets -- Schlage L9000 Series, US26D, mortised (no substitutions), Function as noted on Design Documents, ADA approved lever. All exterior doors and SCADA room lock sets shall be card reader capable and comply with security system requirements. Owner shall supply additional requirements.
 - (g) Passage Sets -- Schlage L9010 Passage Function, US26D, mortised (no substitutions), ADA approved lever

- (h) All locks shall be master keyed with a restrictive keyway master keying system as directed by Owner.
- (i) All required blank plates.

10.1.9 Requirements for O&M Building door details (see Table 10-2):

Table 10-2: Door Detail Schedule

Location	Material	Light	Closure	Handle
Breakroom to Hall	Wood	1/4	N	Lever
Breakroom to Shop	Metal	1/4	Y	Lever
Exterior excl Vestibule	Metal	1/4	Y	Lever Lock / Card
Hall to Shop	Metal	1/4	Y	Lever
Mechanical	Wood	None	N	Lever
Offices & Conference	Wood	1/4	N	Lever Lock
Restroom - Guest	Wood	None	Y	Lever Lock
Restroom – Mens	Metal	None	Y	Lever lock w/3 point
Restroom – Womens	Metal	None	Y	Lever w/deadbolt
Restroom – Womens to Hall	Wood	None	Y	Lever w/deadbolt
SCADA	Wood	None	Y	Lever Lock / Card
Vestibule – Exterior	Metal	1/2	Y	Lever
Vestibule – Interior	Metal	1/2	Y	Lever Lock / Card

10.1.10 Requirements for O&M Building windows:

- (1) 4-foot by 4-foot commercial-grade vinyl horizontal slider windows, equal to Plyco Model M3025, shall be provided in the locations shown in Figure 10-1 through Figure 10-8 herein.
- (2) Window frames shall be thermally broken and color per Section 10.1.33.
- (3) Operable units shall include screens.
- (4) Exterior windows shall be glazed with tinted insulated glass and a ½” argon gas filled airspace, total thickness of 1”. All windows shall be properly insulated to meet current energy code requirements.
 - (a) All exterior windows shall be of vinyl construction and face shall snap out for easy glass replacement.
 - (b) All exterior windows shall be IGCC Class CBA when tested per ASTM E773 and E774.
 - (c) Outer and inner lights of ¼” thick tinted glass shall be provided conforming to ASTM C1036 Type 1, Class 1, q3.
 - (d) All exterior windows shall be dual sealed units with primary polyisobutylene seal, secondary silicone seal.
- (5) Windowsills shall be installed on all windows and shall be either marble or granite.

10.1.11 Requirements for O&M Building room finishes:

- (1) Each room in the O&M Building shall include the minimum finishes set forth in Table 10-3 (*O&M Building Room Schedule*) and as further described below. Ceiling heights are noted to be nominal heights.

Table 10-3: O&M Building Room Schedule

Room(s)	Floor	Base	Walls	Ceiling Height	Ceiling Type
Common area Hallways Break room Kitchen	Vinyl composition tile or luxury vinyl plank	Vinyl	Painted drywall	9'0"	Acoustical tiles
Offices Conference room	Carpet tile	Vinyl	Painted drywall	9'0"	Acoustical tiles
Mechanical	Sealed concrete, with floor drain	Vinyl	Painted drywall	9'0" – 10'0"	Acoustical tiles
Comm / SCADA	Anti-static vinyl composition tile	Vinyl	Painted drywall/ ½" plywood	10'0"	Painted drywall
Vestibule	Glazed ceramic/porcelain tile	Glazed ceramic/porcelain tile	Painted drywall	9'0"	Painted drywall
Bathrooms	Glazed ceramic/porcelain tile, with floor drain	Glazed ceramic/porcelain tile	Ceramic tile/ painted drywall or concrete	8'0"	Acoustic tiles
Shop Parts	Sealed concrete, with floor drain	Not applicable	29 ga. white liner (steel)	Sufficient for garage door track and lighting above garage door	29 ga. white liner (steel)

- (2) Paint:
- (a) Strictly follow manufacturer's recommendations for surface preparation and paint application. Colors to be per Section 10.1.33. Paint to be Benjamin Moore, Sherwin-Williams or approved equal.
 - (b) Wooden surfaces shall be sanded and prepared to receive finish. All finished hardwood to receive one coat of stain, one coat of sealer, and two coats of varnish.
 - (c) All metal doorframes and doors and miscellaneous metals shall receive one coat of primer and two coats of enamel.
 - (d) Masonry interior walls shall receive one coat of block filler and two coats of finish paint. Gypsum board walls shall receive one coat of primer and two coats of finish paint.
- (3) Flooring:
- (a) All tile shall be waxed. All tile and grout shall be sealed.

- (b) Vinyl composition floor tile shall be 12-inch by 12-inch by 1/8-inch tile adhesive applied to concrete floors similar to Armstrong “Excelon” or Tarkett “Expressions”.
- (c) Luxury vinyl plank shall have a minimum five (5) year commercial warranty and installed without adhesive.
- (d) Ceramic standard mosaic floor tile shall be provided with smooth, all-purpose edge. Tile shall be 12-inch by 12-inch unglazed as manufactured by American Olean or approved equal.
 - 1. Ceramic tile shall be installed, grouted, cleaned, protected, and cured per standard specifications of the American National Standards Institute (ANSI) and the Tile Council of America (TCA).
- (e) Grout shall be Latex-Portland Cement Tile Grout as made by Custom Building Products, Mapei Corp. or approved equal. Grout and ceramic tile colors to be per Section 10.1.33.
- (f) Porcelain tile shall be set by the thin-set method. Anti-fracture membrane at control joints in floors for bathroom areas shall be provided.
- (g) Carpet tile
 - yarn shall be 100% advanced generation nylon such as type 6.6 produced by BASF, DuPont, or Monsanto and have a minimum yarn weight of 26 ounces and pile height of 0.170 to 0.28 inches with:
 - 1. 1/8 gauge with 8 stitches per inch or,
 - 2. 1/10 gauge with 10 stitches per inch
- (h) Not used.
- (i) Vapor retarder: see Section 10.1.3 herein.
- (4) Walls:
 - (a) The interior walls shall be constructed using 3 5/8-inch, 18-gauge metal studs, 16 inches on center.
 - (b) All drywall shall be 1/2-inch, taped, sanded, and able to accept paint or vinyl finishing.
 - (c) Drywall in bathrooms shall be 1/2-inch moisture-resistant with at least two (2) coats of semi-gloss latex applied.
 - (d) A 29-gauge steel liner panel shall be used along all exposed interior shop walls and shall extend to ceiling height. A 2-inch by 2-inch galvanized base angle to attach liner panel at the concrete floor shall be provided.

- (e) Walls shall be fire rated as set forth in Section 10.1.19 herein.
 - (f) Vapor retarder: on exterior walls and walls between the shop and office space.
 - (g) All interior walls shall be constructed as shown in the design documents.
 - (h) Porcelain wall tile in bathrooms shall be a minimum 4-foot high on all sides.
 - (i) All masonry walls are to be constructed of a minimum of 8-inch standard weight block.
 - (j) Retractable wall: Manual noise reducing panels with one panel including a swing door, design to be confirmed by Owner.
 - (k) Backing (e.g. plywood, wood bracing) shall be installed in areas for wall-mounted TVs, whiteboards, or other expected equipment that would require mounting on walls. Backing shall be installed underneath the finishing drywall.
 - (l) Wall base shall be coved and manufactured by VPI, Johnsonite or approved equal, extend 4 inches from the top of the finished floor and adhesive applied to walls., and installed in rooms per Table 10-3.
- (5) Ceilings:
- (a) Ceiling height shall be as specified in Table 10-3.
 - (b) The ceiling over the men's restroom shall be per the tornado shelter design.
 - (c) Lay-in ceiling shall be a 24 inches by 24 inches with 15/16-inch exposed white grid system. Grid system shall be USG Interiors or approved equal. Acoustical panels shall be non-combustible (Flame Spread A), smooth-texture with reveal edge, factory white finish similar to USG Interiors, Millennia ClimaPlus 76705, 2 feet by 2 feet x 3/4 inch, SLT edge. Acoustical ceiling panels to have a minimum Noise Reduction Coefficient (NRC) rating of 0.7, Ceiling Attenuation Class (CAC) of 35 minimum and Light Reflectance of 85 (LR-1).
 - (d) The ceiling over the SCADA room and Vestibule shall be covered with 5/8 gypsum board taped and sanded to accept paint. It shall be topped with R30 insulation.

10.1.12 Requirements for O&M Building accessories:

- (1) Provide custom millwork in the kitchen consisting of upper and lower cabinets with stove and fridge cutouts. Cabinets shall fill the area from wall to wall, include a short upper cabinet for a microwave over the stove. Millwork shall be of quality fire retardant particleboard core finished with wood veneer (AWI "premium" grade) or plastic laminate (NEMA LD 3, GP-50 for horizontal surfaces and GP-28 for vertical surfaces). Pattern and color per Section 10.1.33. Tops to be 1 3/4 inch thick and sides to be 3/4 inch thick. Countertops and Vanities are to have a 4-inch backsplash. Provide adequate bracing hidden from view.
- (2) Not Used.

- (3) Equipment and installation shall meet all code and ADA requirements along with the following requirements, and be provided in the quantities as indicated in Figure 10-1 through Figure 10-8 herein:
- (a) Water closets – Furnish floor mount, elongated rim, vitreous china water closet with tank and solid plastic open front seat. Unit to be the Toto brand floor mounted tank units.
 - (b) Urinal – Furnish wall hung, vitreous china washout urinal and flush valve. Unit to be equal to American Standard Lynbrook 6601 with Sloan Royal Model 180-ESS flush valve.
 - (c) Vanity surface is to be a high-pressure plastic laminate, color and design per Section 10.1.33. Stand-alone sink units are not acceptable.
 - (d) Water Heater – Furnish a U.L. listed propane or natural gas tankless water heater in the mechanical room.
 - (e) Slop Sink - Provide a 36" x 24" x 10" molded stone service basin with shelf and vinyl bumper guards on exposed faces in the mechanical room. Equip with Chicago chrome plated service mixing faucet with vacuum breaker, wall brace, pail hook, and 3/4" hose thread on spout with 30" long 5/8" rubber hose with 3/4" chrome coupling. Provide 24" high water proof wall boards above sink basin on wall(s) adjacent to the sink along with a mop hanger above unit with three (3) rubber tool grips. Service basin to be Fiat or equal.
 - (f) Wash Tub - Provide a 24" x 24" wash tub in the shop between the bathroom doors. Sink shall have both hot and cold water supplied to it, along with a drain. A separate cold water hose bib shall be located next to the sink.
 - (g) Eye Wash - Provide a wall mount eye wash station with drain next to the shop sink. Eyewash shall meet all applicable OSHA regulations and supply temperate water. Mixing valve shall be near the unit and accessible from ground level.
 - (h) Hose Bibs – Provide freeze less hose bibs, one on each side of the building.
 - (i) Domestic water, waste, and vent piping fittings and joints shall be in accordance with the State Plumbing Code and applicable local ordinances. Insulate hot and cold domestic water pipes with 1" minimum fiberglass insulation by Certainteed or equal insulation when required by location.
 - (j) Kitchen Sink -- Provide Elkay LR series or equal Stainless Steel sink with duo strainer and faucet.
 - (k) Shower -- Provide molded fiberglass shower cabinets complete with 32" x 32" base with drain, door, Chicago or equal flow saver shower head with single lever hot and cold water operator, soap dish, and shampoo bottle holder. Cabinet to be approximately 6'-6" high and shall be seamless, rustproof, and leak proof.
 - (l) Washer and Dryer hookups – Provide hot and cold water and drain hookups for W/D unit in the shop.

- (m) Cleanout -- Provide cleanouts in areas behind water closets and as required by code.
 - (n) Faucets – All faucets shall be dual handle controlled. Auto sensing devices shall not be used.
 - (o) All plumbing faucets, fixtures, etc. shall be of commercial grade. Brand, type, style and color shall be approved by Owner prior to installation. Color shall be per Section 10.1.33.
- (4) Toilet partitions shall be installed between each toilet and urinal. Partitions shall be wall- and floor-mounted with baked enamel finish complete with door, latch, rubber stop, and coat hook at each stall. At least one (1) toilet partition shall conform to ADA standards.
 - (5) Standard mirrors (approximately 36 inches by 40 inches) shall be furnished and installed in each bathroom.
 - (6) Paper towel dispensers and toilet paper holders shall be furnished and installed in each bathroom.
 - (7) Handicap grab-bar hardware shall be furnished and installed in each ADA bathroom stall.
 - (8) Lockers shall be installed in a quantity sufficient for expected staff, Owner approved. At least eight (8) lockers shall be furnished and installed. Each locker shall measure at least 8 feet by 12 inches by 12 inches with color per Section 10.1.33. One (1) movable hardwood bench shall be furnished and installed in front of each set of lockers. Lockers shall be floor mounted and installed in both restrooms.

10.1.13 Requirements for O&M Building signage:

- (1) Men's and women's restroom signs shall be furnished and installed.
- (2) ADA-compliant and visitor parking sign(s) on steel posts in front of the handicap stalls shall be furnished and installed.
- (3) Interior signage, as required by the Applicable Standards and other Requirements, shall be furnished and installed.
- (4) A permanent sign at the O&M Building entrance shall be furnished and installed. This sign shall include Project name, Project address, and Owner name/logo, each subject to Owner approval.

10.1.14 Requirements for O&M Building bollards:

- (1) See Section 4.1.22 herein.
- (2) Bollards shall be installed (a) on each side of the overhead door(s) of the O&M Building; (b) around each propane tank, backup generator, and HVAC pad, respectively, although if such equipment is adjacent to each other then bollards may not be required around every unit; (c) around the septic tank; and (d) around any holding tanks.
- (3) Bollards shall be installed no closer than two (2) feet from equipment.

10.1.15 Requirements for O&M Building exterior concrete and asphalt:

- (1) Concrete works shall be installed in locations per Figure 10-7 and the subsequent sections.
- (2) HVAC pads shall extend beyond the equipment by a minimum of 6 inches in each direction.
- (3) Concrete slabs shall be designed to accommodate AASHTO HS44-20 loading.
- (4) Provide concrete aprons with minimum dimensions of 4 feet by 4 feet at all personnel doors, . Aprons shall be installed on frost footings.
- (5) All aprons and sidewalks shall be reinforced concrete with a broom finish. Minimum thickness shall be 4 inches for the sidewalks and 6 inches for aprons.
- (6) Sidewalk shall be sloped per ADA requirements for handicap access.
- (7) The parking area shall be sufficient to simultaneously accommodate parking for at least 8 vehicles, including ADA parking requirements, and allow deliveries to the O&M Building front entry and warehouse. ADA parking shall be an end stall, if possible.
- (8) All hard surfaced areas shall be shaped for drainage away from the building with a minimum slope of ¼” per foot for sidewalks and a minimum slope of 1/8” per foot for driving paths and parking lots. **Curbs shall not be used, all joints between concrete, pavement, and landscape shall be at the same elevation, and no parking blocks or other raised items shall be installed.**
- (9) Parking lot striping and handicap symbol shall be painted on the paving.
- (10) All parking and driveways shall be 8 inches of compacted subgrade with plant-mixed bituminous paving. Paving shall be applied in 2 layers: 3 inches base and 1 ½ inches of surfacing
- (11) All concrete and paving shall meet the design and installation requirements of the Project’s state Department of Transportation standard specification.

10.1.16 Requirements for O&M Building landscaping:

- (1) Following construction, fertile topsoil (including that has been stripped from the site prior to construction) shall be spread evenly over all seeded grass and sod areas to a minimum of 6 inches.
- (2) Vegetation shall be established on all disturbed land outside the fencing perimeter of the O&M Building site.
- (3) All plants and landscaping shall be suitable for the location and climate in which it is being installed and shall be free of weeds.
- (4) All landscaping and re-vegetation plans and designs shall be submitted to Owner for approval prior to any landscaping or planting activities take place.
- (5) All disturbed areas shall be re-vegetated within the specified time period as indicated in the Project SWPPP to mitigate runoff.

- (6) Wind breaks:
 - (a) Two rows of evergreen trees shall be planted on the exterior of the O&M Building fencing on the north and west sides to provide protection during the winter season.
 - (b) Trees shall be a minimum of 8 feet tall as installed.
 - (c) Trees shall be planted every 18 feet.
 - (d) Each row of trees shall be separated 20 feet.
 - (e) On the west side of the building, trees shall extend past the future building expansion area. Trees on the north side shall extend 100 feet beyond the building.
 - (f) Shrubs shall be planted on the south and east sides.
- (7) Contractor shall provide watering and periodic inspection of all plantings for the duration of construction. Such inspections shall be documented in a maintenance log.
- (8) Washed rock on landscaping fabric shall be utilized in between the exterior walls of the O&M building and sidewalks.

10.1.17 Requirements for O&M Building fencing and gates:

- (1) The O&M Building perimeter shall be fenced.
- (2) All fencing and gates shall comply with the minimum specifications in Section 4.1.10 herein.
- (3) At least one (1) vehicle gate shall be installed at the O&M Building. The vehicle gate shall be a combined 14 feet wide vertical pivot gate (AutoGate model VPL-300) and an 8-foot wide manual horizontal swing gate for a total available vehicle gate width of 22 feet. Each gate shall be 7 feet high plus 1 foot of barbed wire.
 - (a) The vertical pivot gate shall be remote operable with an exterior pedestal mounted access card reader and phone, an interior buried open loop and photo eye safety close device, and be designed to withstand wind loads of 60 mph in operation. The photo eye opposite the gate operator shall be mounted off the horizontal gate hinge post.
 - (b) The manual swing gate shall be mounted to a removable post in between the vertical swing gate and manual swing gate.
 - (c) The vertical swing gate shall include the following aspects:
 - 1. Heater for cold weather operation (cold climates only)
 - 2. Heated melt away kit for under gate (cold climates only)
 - 3. Deep cycle marine AGM batteries
 - 4. AutoGate footing per manufacturer specifications, typically 4 feet by 7 feet by 12 inches with five 12 inch sonotubes to 72 inches deep.

5. High voltage surge suppressor, 115 vac
 6. EMX, IRB-MON commercial thru-scan photo-eye with protective hoods per UL325
 7. LMA-1250-LV vehicle detectors
 8. Patriot Detection, direct bury loops for outside/inside obstruction and inside auto exit
 9. Fire department emergency access device
 10. At least 10 remote-entry devices shall be supplied and programmed by Contractor for Owner's use.
- (4) At least one (1) walk gate shall be installed at the O&M Building within 10 feet of the vehicle entrance gate and one (1) walk gate opposite the vehicle access gate. The walk gates shall be a lockable, single-hung, 4-foot-wide, swing-gate for personnel access.

10.1.18 Requirements for O&M Building electronic security system:

- (1) For all access control components, the subcontractor must be "Software House" certified.
- (2) Security system shall be provided and installed by VTI Security. The security system shall have a UPS, local control pad and monitor, video recording capabilities, and be linked to Owner's Security Operations Center.
- (3) Personnel access control system:
 - (a) This system shall be installed for all man doors and vehicular gates. The system shall consist of stand-alone distributed smart panels that make the access decision and must have a stand-alone storage database capability that is downloaded routinely to the central computer database. The master computer or any other computer unit that has the proper password must be able to query it. The unit must have different levels of password control to access the data or program the unit.
 - (b) The system shall include card readers, associated door handles and locks, and fixed interior cameras on all exterior doors and all controlled access areas within the building as specified by Owner, two exterior mounted PTZ tower cameras and 1 fixed exterior camera with locations specified by Owner, operable entrance gate with loop detector, photo eye sensor, and call box with external dialing capabilities and pin hole camera.
 - (c) The card system must use a proximity or RFID card.
 - (d) This system must have anti-passback capabilities to prevent multiple use of the card in a short time frame. This can be accomplished through read-in and read-out card readers with a timeout feature that prevents multiple uses at the same reader with in a user-defined time frame.
 - (e) This system must be able to work in a local area network and/or wide area network environment and allow access from other computers on the network.

- (f) The software must be capable of providing an audit trail of all who have accessed the database and all changes made by an individual.

10.1.19 Requirements for O&M Building fire protection system:

- (1) The fire protection system design shall receive Owner's approval.
- (2) Portable CO₂ and dry chemical fire extinguishers shall be furnished and installed in the building, in a quantity and type sufficient to ensure compliance with the Applicable Standards and other Requirements. At a minimum, one (1) 10-pound ABC-type fire extinguisher (including mounting device / cabinet) shall be installed at every exit door, break room, and utility room, respectively.
- (3) All local alarm, detection, and suppression panels shall report status to the main fire alarm panel located in the mechanical room.
- (4) All areas of the O&M Building shall be provided with smoke and heat detectors as the form of fire detection.
- (5) Detectors shall be hardwired to a central alarm panel in the mechanical room and be supplied with all necessary equipment to send an alarm signal to the Xcel Energy Security Operations Center.
- (6) The following walls and doors shall be fire rated for the minimum times shown, or as required by the authority having jurisdiction, whichever is greater:
 - (a) Interior wall between warehouse and office areas: 60 minutes.
 - (b) Interior doors between warehouse and office area: 60 minutes.
 - (c) Interior SCADA / communications room walls: 60 minutes
 - (d) Interior door to SCADA / communications room: 60 minutes

10.1.20 Requirements for O&M Building potable water system:

- (1) The potable water system shall be designed to provide potable water, both hot and cold, at the proper pressure, temperature, and flow rate to all plumbing fixtures and equipment.
- (2) The potable water system shall include chlorination, charcoal filters, or other treatment as required.
- (3) Domestic water piping shall be PEX or type L copper tubing with soldered joints and fittings using lead-free No. 95-5 solders. All valves shall have brass bodies and shall be designed for a working pressure of 125 PSI.
- (4) All potable water piping shall be insulated with foam pipe insulation as required by location, climate, and code, and sterilized in accordance with AWWA standards for disinfecting purposes prior to filling. As required by location, domestic water, refrigerant, and roof drain piping shall be insulated.
- (5) Two (2) frost proof exterior hose bibs shall be installed, one on the west wall and the other on the north wall.

- (6) Water well requirements:
- (a) Contractor shall furnish and install a water supply well. The work includes the excavation of a well bore, furnishing and installing a permanent well casing and screen, providing a gravel pack around the screen; installation of surface well seal; disinfection, development and test pumping of the completed well.
 - (b) Casing: Contractor shall furnish and install steel well casing and surface casing material conforming to ASTM A53 (Grade B).
 - (c) Screen: Contractor shall furnish and install a wire-wrapped well screen fabricated of Type 304 stainless steel continuous slot wire wound screen.
 - (d) Gravel pack: the gravel pack shall consist of hard, durable siliceous particles of washed gravel, containing no flat or elongated particles and not more than five percent (5%) particles with a fractured face. The gravel shall be placed by the tremie method without free fall. The gravel shall be disinfected with a chlorine solution containing not less than 200 milligrams per liter of available chlorine prior to placement in the annular space. The acceptable gravel pack envelope for the production wells will be based on the results of the grain size distribution analysis performed on samples collected from a test hole drilled at the production well site. A multiplier range of 3 to 6 times the d30 (cumulative percent passing) of the finest sample within the screened interval of each production well is acceptable for the filter pack. The gravel pack should have a uniformity coefficient of < 2.5 .
 - (e) Production well seal: seal well after test pumping and after gravel pack thickness lost during development and test pumping is replaced in the well. Install a bentonite chip well seal on top of gravel pack; bentonite seal shall be a minimum thickness of five (5) feet. Install cement grout from the top of the bentonite seal to the bottom of the pitless adapter unit by pressure grouting.
 - (f) Well development: after construction of the well, the well shall be fully developed in order to obtain its maximum capacity. Contractor shall furnish all necessary pumps, power units, agitator plungers or other needed equipment, and shall develop the well by such approved methods as shall be necessary to give the maximum yield of water per foot of drawdown and extract from the water bearing formation the maximum practical quantity of such sands as may, during the life of the well, be drawn through the screen when the well is pumped under maximum conditions of drawdown. The well shall be bailed, washed, agitated, surged and developed until the water has a turbidity of not greater than 2 nephelometric turbidity units (NTU) and shall pump no sand.
 - (g) Well test: after the well has been completed and developed, as and to the extent specified in the preceding subparagraph, Contractor shall furnish, install, and operate all test pumping and auxiliary equipment necessary to measure the rate of pumping and determine the drawdown for a period of not less than eight (8) hours at the design pumping rate.

- (h) Disinfection: after the well has been completely constructed, it shall be thoroughly cleaned of all foreign substances including tools, timbers, rope, debris of any kind, cement, oil, grease, joint dope and scum. The casing pipe shall be thoroughly swabbed, using alkalis if necessary, to remove oil, grease or joint dope. The well shall then be disinfected with a chlorine solution.
- (i) Submersible well pump: Contractor shall supply and install a new turbine submersible pump. Pump specifications will be developed based on the field testing conditions observed during the well pumping test. The pump shall have a minimum efficiency of eighty percent (80%) at the designed operating condition and shall be capable of operation at any condition without operating above the nominal horsepower rating of the pump motor, not including service factor. A check valve shall be installed in the drop pipe, immediately above the pump assembly; the check valve will be installed to prevent backflow into the well.
- (j) Pitless adaptor unit: Contractor shall supply and install a Baker Monitor pitless adaptor unit. The unit shall have (a) bury depth sufficient to prevent system from freezing; (b) water-tight cap with screened well vent extending at least two (2) feet above 100-year flood level; and (c) water sampler valve.
- (k) Discharge piping: Contractor shall install discharge piping to connect the pitless unit to the new transmission water lines below grade.
- (l) Water line: Contractor shall provide a water line piping system complete with pipe, pipe fittings, valves, strainers, expansion loops, pipe hangers, inserts, supports, anchors, guides, sleeves, and accessories with this specification and the drawings. Pipe shall be designed to observe limits on flow velocity, pressure drop and gauge pressure associated with the pipe type and characteristics. All pipe and piping components that come in contact with the water process stream shall be NSF61 approved for potable water contact. Pipe shall be designed to withstand all stresses resulting from external loads and internal pressures listed in the following table plus applicable allowance for surge unless otherwise specified.

10.1.21 Requirements for O&M Building sanitary wastewater:

- (1) Sanitary wastewater shall be collected from the various points of origin in the facility and diverted to a city sewer system, if available, or diverted to a septic tank, and discharge from the septic tank shall be routed to a leach field. Drain line from the building to the septic tank shall be at a depth to prevent freezing from HVAC condensate flow.
- (2) A pumped sanitary wastewater system shall only be used if a gravity system is impractical.
- (3) Vehicle parking area of shop shall include a floor trench drain that flows into a minimum 260 gallon oil and water separator located to the north of the west wall garage door and then into a holding tank located outside to the north of the west wall shop door. Minimum trench width shall be 12 inches and depth shall be 8 inches below the bottom of the grating at the low point. Grating shall be galvanized.
- (4) Mechanical room shall include a floor drain shall that is positioned to allow all equipment to drain to it without the use of a condensate pump or in the walk path to the slop sink.
- (5) SCADA room shall include a drain for wall mount AC unit if required.

10.1.22 Requirements for O&M Building heating, ventilating, and air conditioning system:

- (1) Not Used.
- (2) The heating, ventilating, and air conditioning systems shall be commercial grade and satisfy the workspace environmental requirements for personnel occupancy and equipment operation.
- (3) Minimum ventilation rates shall be provided in normally-occupied areas in accordance with the Applicable Standards and other Requirements. In the absence of local codes, ASHRAE Standard 62 requirements shall be met. A minimum of five (5) air changes per hour of ventilation or recirculation air shall be provided for effective mixing during heat removal ventilation or air conditioning of normally occupied spaces.
- (4) The shop ventilation system shall be designed to operate effectively without allowing precipitation to infiltrate the building through the vents. The system shall also have a carbon monoxide (CO) detector with manual override timer.
- (5) All thermostat locations shall be in room programmable units with a minimum 5-2 day program and be hard-wired to a circuit board zone controller. Wireless devices are not allowed.
- (6) Ductwork:
 - (a) Air velocities in ducts and from louvers and grills shall be sufficiently low to maintain acceptable noise levels in areas where personnel are normally located.
 - (b) All ductwork, construction, and installation shall be in accordance with latest SMACNA standards. Ductwork shall be isolated from fans and furnace via flexible connections. Ductwork shall be equipped with fire dampers as required by codes. Branch ducts in mains shall be equipped with dampers for balancing. Flex duct shall be used for the run outs to supply air diffusers and shall not exceed 5 feet.
 - (c) Thermal insulation with vapor barrier shall be installed on all ductwork used for heating or cooling purposes.
 - (d) Supply air diffusers shall be lay-in 2-feet by 2-feet units with manually adjustable butterfly dampers.
 - (e) Return air ducts shall be wall mounted near the floor.

Exhaust systems shall be provided for the restrooms and shall be controlled by the room light occupancy sensor. Insulated duct work, roof curbs, bird screens, and back draft dampers shall be used.
- (7) In-floor Heat:
 - (a) Hydronic in-floor radiant heat system shall be installed throughout the entire building in regions subject to prolonged freezing conditions and shall be manufactured by Wirsbo or equivalent, and zoned to match forced air zones (zones to be approved by Owner).
 - (b) Propane or gas boiler with at least 92% efficiency.

- (8) Forced Air Furnace:
 - (a) Floor mounted propane or gas furnace with at least 92% efficiency.
 - (b) Furnace shall include a 4-inch extended lifefilter housing, air conditioning coil, variable speed supply blower with premium efficiency motor,.
- (9) Electric Heat Pump or Air Conditioner:
 - (a) The equipment minimum EER or SEER ratings for package unit to meet current Code requirements. There shall be low-ambient control and a 10-year compressor warranty.
- (10) Shop Supplemental Heat
 - (a) Overhead radiant or forced air propane or gas heaters shall be installed in the shop to maintain 55F in regions where radiant floor heat is not used and to provide supplemental heat where radiant floor heat is used. Placement and quantity to be approved by Owner.
- (11) SCADA Room Air Conditioning
 - (a) Interior cooling loads shall be based upon actual equipment to be installed and ASHRAE Standard requirements.
 - (b) A ductless mini-split unit shall be used. Condensing unit to be mounted on the ground in shop area along the bathroom wall.
 - (c) An emergency cooling duct with a manual damper shall be installed from the forced air furnace duct stack to the SCADA room.
 - (d) A high temp alarm shall be installed in the room and alarm to the adjacent hallway via sound or flashing light.

10.1.23 Requirements for O&M Building insulation systems / thermal and moisture protection:

- (1) Caulking and backer board, as recommended by the manufacturer and to seal exterior and interior joints at expansion joints, frames of doors, windows, and other wall openings, shall be furnished and installed.
- (2) Roof insulation shall be such that an *R* value of at least 30 is achieved. Thermal blocks shall be included within the roof system.
- (3) All building walls and roof shall be insulated. Exterior wall insulation shall have an *R* value in accordance with current International Energy Code with local and state building code amendments. All interior office walls shall be insulated with 3.5-inch fiberglass batt insulation for sound control.
- (4) Exterior office walls shall have a minimum of one (1) inch thick spray foam applied up to a height of 10 feet to seal all air gaps.
- (5) Miscellaneous insulation for filling voids at roof eave, roof peak, door frames, window frames, and other similar areas shall be furnished and installed.

- (6) The SCADA room shall have a minimum R30 insulation on the ceiling.

10.1.24 Requirements for O&M Building electrical service, general:

- (1) All convenience outlets shall be on 20A circuits and installed as specified in accordance with NFPA 70/NEC.
- (2) All equipment and materials shall bear UL label.
- (3) Underground conduit shall be PVC and shall conform to the specifications for conduit set forth herein.
- (4) Not used.
- (5) The local utility provided transformer shall be installed on the outside of the perimeter fence. Contractor shall provide the secondary service into the building and is responsible for verifying the entrance location with the local utility.
- (6) The electrical service to this building shall be single phase and sized to accommodate all electrical loads, including EV chargers, with 30% contingency and a 400-amp minimum. The service entrance equipment shall be grounded per code, and the grounding conductor installed in conduit.
- (7) The electrical service shall include an automatic transfer switch, segregated backup panel, and a pad-mounted 40 kVA propane or natural gas Generac generator with the extreme cold weather kit. If propane is used the tanks shall be sized to provide sufficient fuel to operate for a minimum of two (2) days without refueling. Owner shall approve all items related to the backup generator prior to procurement.
- (8) Level 2 electric vehicle (“EV”) chargers shall be provided in the shop area in a quantity sufficient to charge the amount of vehicles possible in the shop area. Additional chargers with two (2) ports shall be provided by the east shop garage door and next to the sidewalk by the paved parking area in front of the offices. Placement of all chargers subject to Owner approval.

10.1.25 Requirements for O&M Building grounding:

- (1) Grounding shall be in accordance with NFPA 70/NEC. All feeder and branch circuits shall have a green-colored insulated equipment ground conductor in addition to any metallic conduit being bonded to the equipment grounding system.
- (2) Ground fault protection shall be installed in receptacles in warehouse and workshop where power tools are used, and in restrooms and other locations as required by NFPA 70/NEC.
- (3) The facility shall have a #4/0 AWG bare copper ground counterpoise with 0.75-inch by 10-foot copper-clad steel ground rods. The counterpoise will be connected to service entrance equipment, derived source transformer secondary neutrals, telecommunications main ground bus bar, and all building columns.
- (4) The building shall have an array of air terminals, roof conductors, and down conductors. The lightning protection system shall be interconnected to the ground counterpoise system. Requirements for the building’s lightning protection system shall be as determined and recommended by NFPA 780.

- (5) Provide 5 lug ground bar mounted on the wall of the SCADA room that is grounded directly to the service ground via #6 THHN copper conductor.

10.1.26 Requirements for O&M Building power distribution system:

- (1) Service entrance conductors shall be installed to tie into the main distribution panel and terminated and tested by Contractor. The main distribution panel in the building shall be service-entrance rated.
- (2) Feeders shall extend from the main distribution panel to serve general power panel boards.
- (3) Panel boards and associated feeders shall be sized for twenty percent (20%) spare capacity and additional spare circuit breakers. Panelboards shall be type NQOD and have breakers rated for a minimum of 10,000 A.I.C. at 240V.

10.1.27 Requirements for O&M Building wiring and conduit:

- (1) All wiring shall be in conduit except above the finished office area as allowed by code. Type MC/AC cable shall only be used for lighting connections to/from junction boxes and lights with a maximum length of 10 feet.
- (2) Low voltage wiring shall be provided for all HVAC control and run in conduit.
- (3) Lighting branch circuits, telephone circuits, fiber optic cables and intercommunications circuits shall be routed in separate conduit systems. Lighting circuits shall be routed in electrical metallic tubing for indoor concealed areas, rigid conduit for outdoor areas, and PVC tubing or Schedule 40 PVC conduit for underground. Terminate all conduit runs with insulated bushings.
- (4) All conductors shall be copper and #10 AWG and smaller shall be solid conductor while #8 AWG and larger shall be stranded conductor.
- (5) Not used.
- (6) All feeder and branch circuit wire shall be single conductor and have THWN/THHN insulation.
- (7) All electrical enclosures mounted outdoors shall be stainless or aluminum and NEMA exterior rated.
- (8) Isolate emergency lighting circuit conductors from all other wiring.
- (9) Wiring Devices:
 - (a) Shop to have quiet toggle wall switches. Switches shall be rated at 15 or 20 A, 120 VAC. Switches shall be similar to Hubbell 1221 Series. Receptacles shall be similar to Hubbell 5262 Series.
 - (b) Furnish and install occupancy sensors in offices, conference room, break room, mechanical room, SCADA room, small parts room, locker rooms and restrooms.

- (c) Switches and receptacles shall be white in all areas except the shop, which shall be gray. Cover plates shall match switches and receptacles in all areas except for shop and parts storage areas where the covers shall be galvanized steel.
- (d) Provide 240 VAC outlets in the shop in the following locations:
 - 1. South of the west garage door
 - 2. South of the man door from the office to the parts area
 - 3. In the center of the men's restroom wall
- (e) Provide one 120 VAC exterior receptacle in between the two shop overhead doors and one 120 VAC exterior receptacle on each of the remaining 3 sides of the building.
- (f) Provide a 120 VAC flush mount floor receptacle in the center of the conference and break rooms.
- (g) Provide two 120 VAC twist lock 30A receptacles and one 120 VAC 20A duplex receptacle to Owner corporate network rack. Receptacles shall be mounted in 4 square boxes. Owner to confirm mounting locations.
- (h) Provide two 120 or 240 VAC 30A circuits and one 120 VAC 20A circuit to each Turbine Supplier server cabinet. Confirm size with Turbine Supplier.

10.1.28 Requirements for O&M Building exterior lighting:

- (1) Exterior lighting shall be provided by building-mounted light fixtures and be centered on each exterior wall (quantity of four) along with one additional unit over the shop doors.
- (2) Fixtures shall be LED with a prismatic lens and factory installed photo electric control on each fixture. Lighting levels shall meet the intensities indicated in the IES handbook and NFPA 70/NEC.

10.1.29 Requirements for O&M Building interior lighting:

- (1) Lighting levels shall meet the intensities indicated in the IES handbook and NFPA 70/NEC.
- (2) Provide lighting throughout the building as follows:
 - (a) All rooms except shop, parts storage, and mechanical room: Lay-in type 2, 3, or 4 lamp LED fixtures with parabolic lens, electronic ballasts, T-8 lamps, lighting level 40 foot-candles at 3 feet off floor, Lithonia or equal.
 - (b) Shop, parts storage, and mechanical room: Industrial type 2 lamp, 4 and/or 8 foot long LED fixture with baked enamel reflector, electronic ballast, T-8 lamps, lighting level 20 foot-candles at 3 feet off floor, Lithonia or equal.
 - (c) Exit Lights: LED type exit lights with internal battery backup.
 - (d) Exit Signs: LED type

- (e) Recessed can light with shower trim in each shower stall.
- (3) Individual motion sensors shall be used in all office area rooms to shut off the lights automatically when the room is unoccupied.

10.1.30 Requirements for O&M Building communications:

- (1) A complete data network system shall be provided including all distribution cable and jacks. A telephone line shall be provided to the fax area and admin area.
 - (a) Communication circuits shall be run in cable tray above ceiling with conduit extending down into walls.
 - (b) A single wall box with 2 data ports is required in each office, parts room, admin area, copier area, conference room, and SCADA room.
 - (c) The break room shall have 2 wall boxes with 2 data ports each on each wall, excluding the wall with kitchen cabinets.
 - (d) Flush mounted floor boxes with 4 data ports shall be installed in the center of the conference and break rooms.
- (2) Coordinate installation work with local telephone Owner and Owner's Communication Technicians. Owner will order communication circuits.
- (3) All ethernet wiring shall be Cat 6 type cable.
- (4) A cell phone booster shall be included such that the extents of the O&M building are covered.
- (5) HDMI cables, associated conduit, and ports shall be included in the conference room and break rooms between where TVs are expected to be mounted on the wall and the floor box or a wall box, locations subject to Owner approval

10.1.31 Requirements for O&M Building garbage enclosure (if required by local building codes/ordinances):

- (1) The O&M Building shall include a separate, detached garbage enclosure to the south of the west garage door.
- (2) The enclosure shall be constructed of treated wood or concrete.
- (3) The enclosure shall include at least 12 inches of clear space between the dumpster and enclosure in all directions.
- (4) The front of the enclosure shall include a solid screening gate on a metal frame with hinges and a center latch. Such gate shall swing out to an angle greater than 90 degrees and create an opening wide enough to allow a truck to easily access the dumpster. Pins shall not be required to hold gates open while the dumpster is being accessed.

10.1.32 Requirements for O&M Building storm shelter:

- (1) The storm shelter shall be equipped with three latch points, operated by a single handle, and include a deadbolt lock.
- (2) The men's locker room shall be built to provide an effective storm shelter and safe room constructed of 8-inch reinforced masonry walls or 6-inch reinforced concrete wall, 6-inch hollow core precast plank or 18-gauge roof joists and 18-gauge metal roof decking with 6-inch minimum concrete slab, footing depths to withstand overturning/uplift and designed to withstand wind gusts during an extreme event. Design shall be in accordance with International Code Council 500 (ICC) and FEMA P-361 Safe Rooms for Tornadoes and Hurricanes – Guidance for Community and Residential Safe Rooms. The locker room roof shall be used for storage and signage with roof deck rating shall be posted.

10.1.33 Requirements for O&M Building colors and finishes:

- (1) Contractor shall provide each aspect of the O&M Building with the color and/or finish as prescribed in Table 10-4. Any additions or deletions from this table shall be explicitly approved by Owner.

Table 10-4: Color and Finish Schedule

Material	Color	Location
Acoustical grid	White	
Acoustical tile	White w/reveal edge	
Canopy	Brown	
Canopy soffit	White	
Carpet tile	Dark blue speckled w/various colors	Offices, conference
Ceramic floor tile	Matt dark grey, light black blend	Restrooms, vestibule
Ceramic grout	Pewter	Restrooms, vestibule
Ceramic wall tile	Matte grey / smoke	Restrooms
Door hardware	Satin Nickel	
Laminate cabinet	Honey oak to light cherry	Break room
Laminate countertop	Matte black marble	Break room, restrooms, admin
Locker	Tan	Restrooms
Locker bench	Honey oak	
Metal roof panel	Galvalume	Roof
Metal trim	Tan	Exterior
Metal wall panel	Tan	Exterior
Metal wall panel	White	Shop/parts walls and ceiling
Outlet cover	White	All but shop/parts
Outlet cover	Steel grey	Shop, parts
Overhead door	Brown	Shop
Paint	SW 6101 Sands of Time	Vestibule, admin, hallways
Paint	SW 7059 Unusual Grey	All other areas
Plumbing fixture	Satin Nickel	
Steel door and frame	Black	
Toilet Partition	Slate	
VCT	Tan	Breakroom, SCADA, hallways
Vinyl base	Black	
Wood door	Light cherry	

10.2 Submittals

10.2.1 Contractor shall prepare the O&M Building design documents per the submittal schedule in Exhibit G.1 (Submittal Schedule) and containing the following information, at a minimum: (a) electrical works, including grounding and lighting plans, one-line diagrams, electrical load list, power distribution board, communications, and construction specifications; (b) civil works, including site plan, subgrade preparation, grading/drainage, paving plan/design, and laydown area; (c) structural works, including structural steel drawings, foundation and equipment pads (locations and details), rebar, design calculations, and construction specifications; (d) mechanical works, including equipment arrangements/locations, equipment list, HVAC layout, fire protection and monitoring, piping and plumbing, vendor drawings (as applicable), and construction specifications; (e) architectural works, including building layout/plans/elevations, finishes, schedules for windows and doors, and hardware; (f) drawing index; (g) bill of materials; and (h) inspection, testing, and quality control requirements.

10.2.2 Contractor shall provide a final layout and site plan to Owner within 30 calendar days following execution of the Agreement. Such layout shall be 10% design quality or greater and subject to Owner approval.

10.2.3 Contractor shall provide all O&M Building design, construction plans, specifications, product sheets, and any similar documents in “Issued for Construction” form and approved by Owner prior to commencing construction on the O&M Building or the designated O&M building site area.

10.2.4 Contractor shall provide the landscaping plan to Owner for review. Landscaping work shall not commence prior to Owner approval of such plan.

10.2.5 Contractor shall provide a water quality test report for the O&M Building well water supply. Water shall meet EPA primary and secondary drinking water standards or local state drinking water standards if more stringent.

10.2.6 Contractor shall submit material and color (interior/exterior) samples for Owner approval if material finish and color is not already specified per Section 10.1.33.

10.2.7 Contractor shall submit copies of manufacturer warranties and operation manuals (as applicable) for all permanently-installed equipment and materials.

10.2.8 Contractor shall submit manufacturer’s product sheets (material cut sheets) for all permanently-installed equipment and materials. This shall include, but is not limited to, generators, transformer, electrical panels, signage, fixtures, appliances, and other similar items.

10.2.9 Contractor shall submit a training plan for the O&M building operations and conduct training with select Owner personnel after the building is completed.

Exhibit A.1 – Scope of Work, Wind, Solar, BESS
Xcel Draft (rev A), 20240426

Figure 10-1: Solar / BESS O&M Building Interior Layout – 1,020 square feet

Figure 10-2: Solar / BESS O&M Building Interior Layout – 4,140 square feet

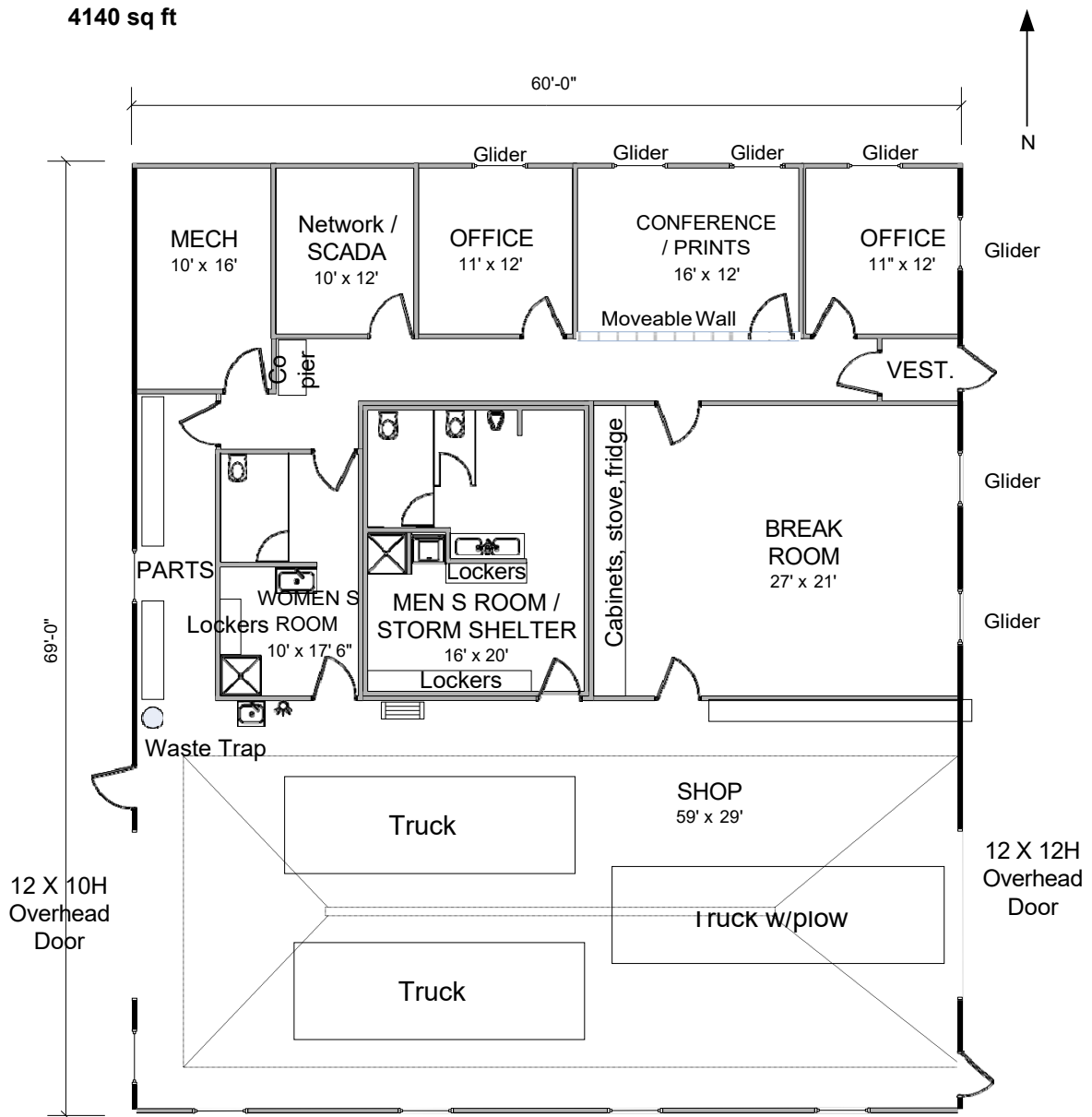


Figure 10-3: Solar / BESS O&M Building Interior Layout – 5,780 square feet

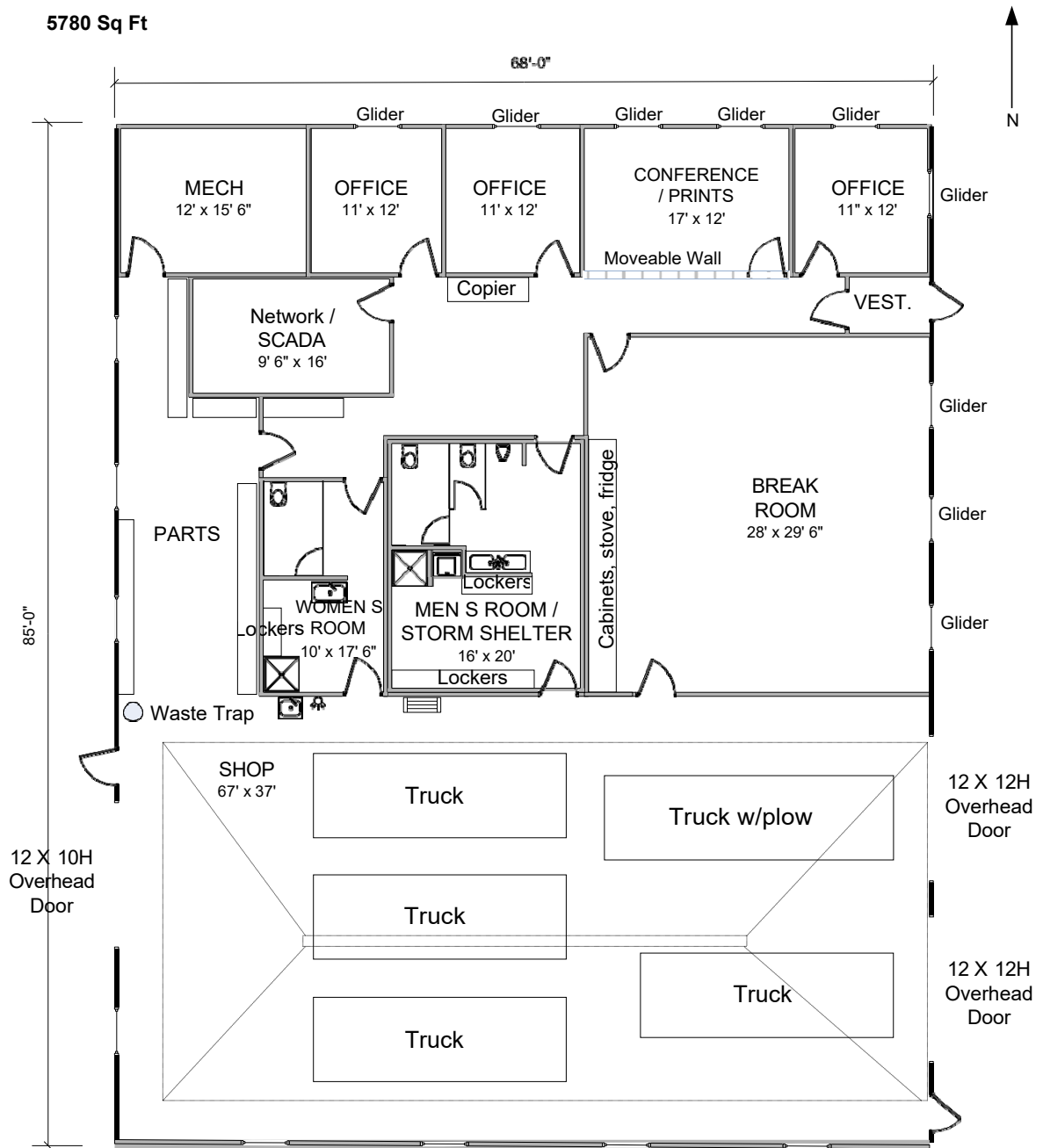


Figure 10-4: Wind O&M Building Interior Layout – 7,520 square feet

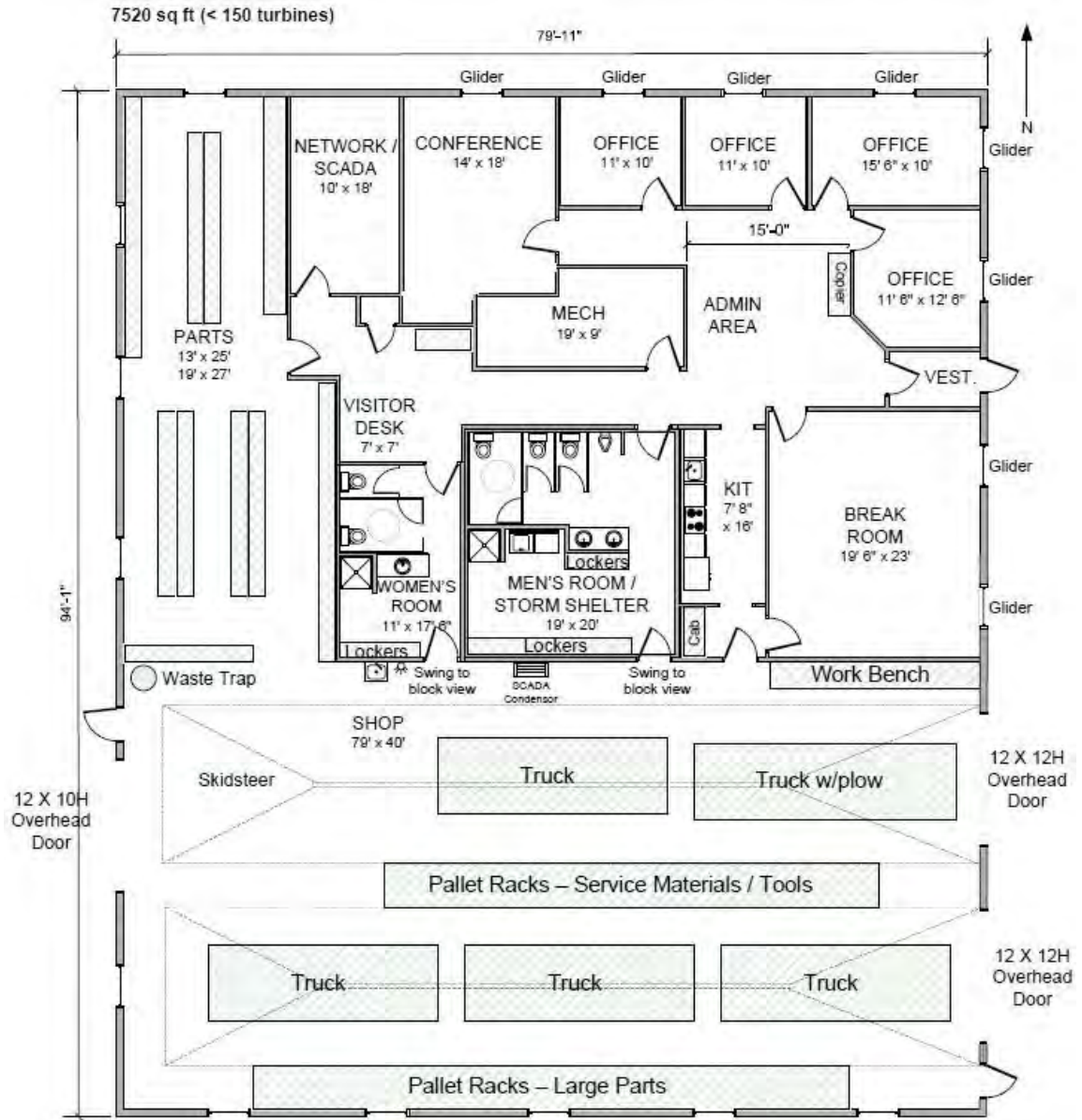


Figure 10-5: Wind O&M Building Interior Layout – 8,320 square feet

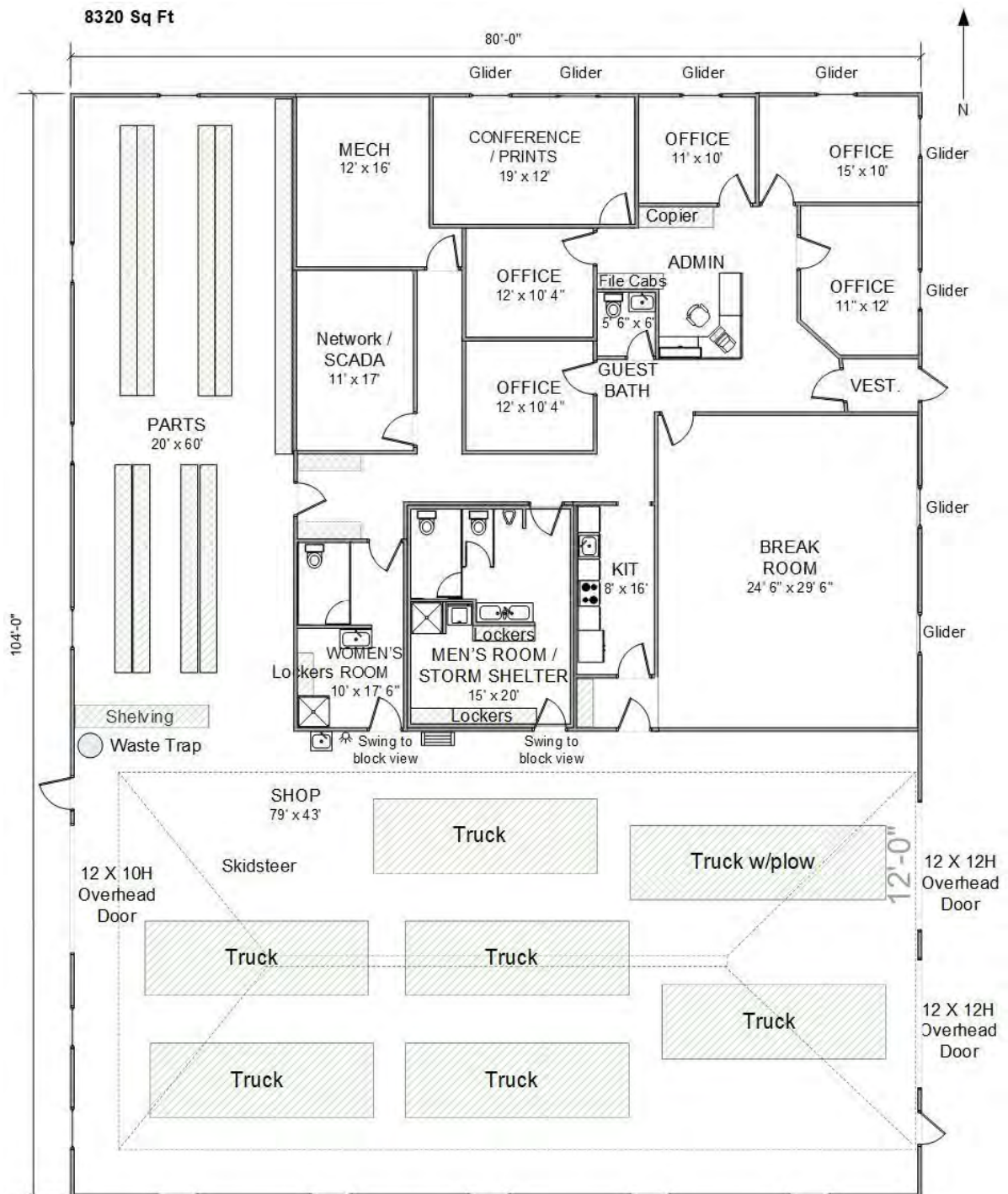


Figure 10-6: Wind O&M Building Interior Layout – 9,440 square feet

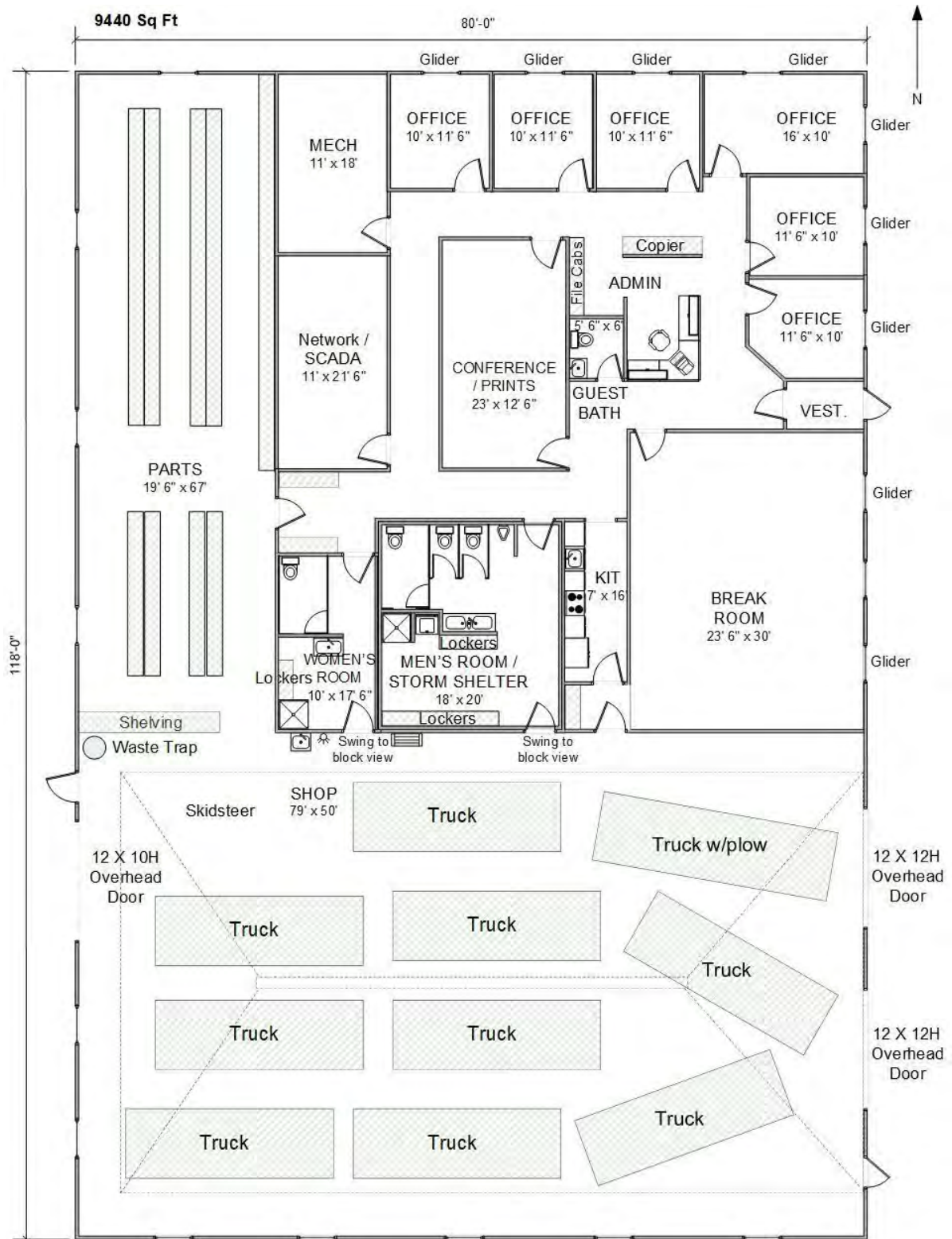


Figure 10-7: O&M Building Typical Exterior Layout

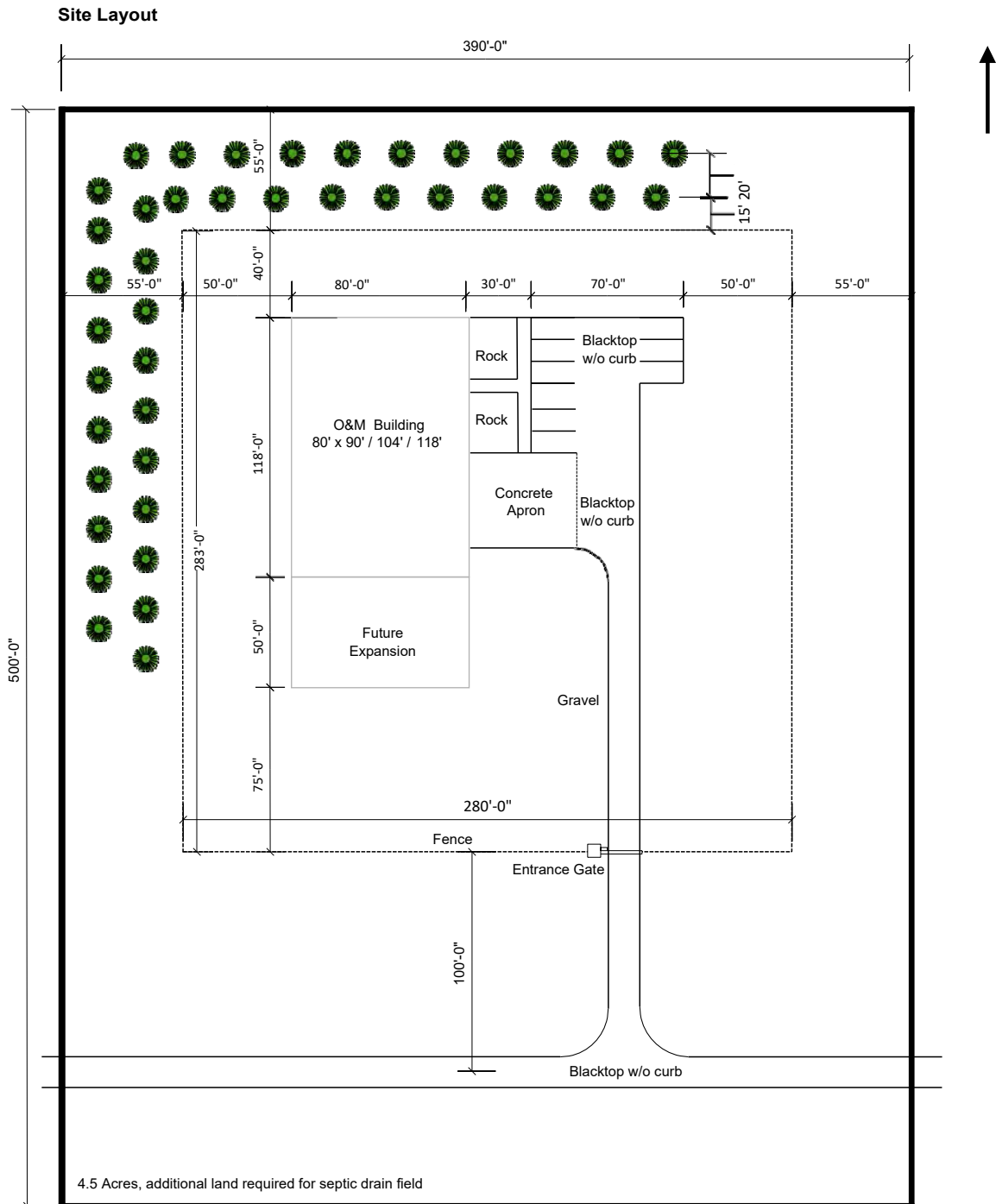
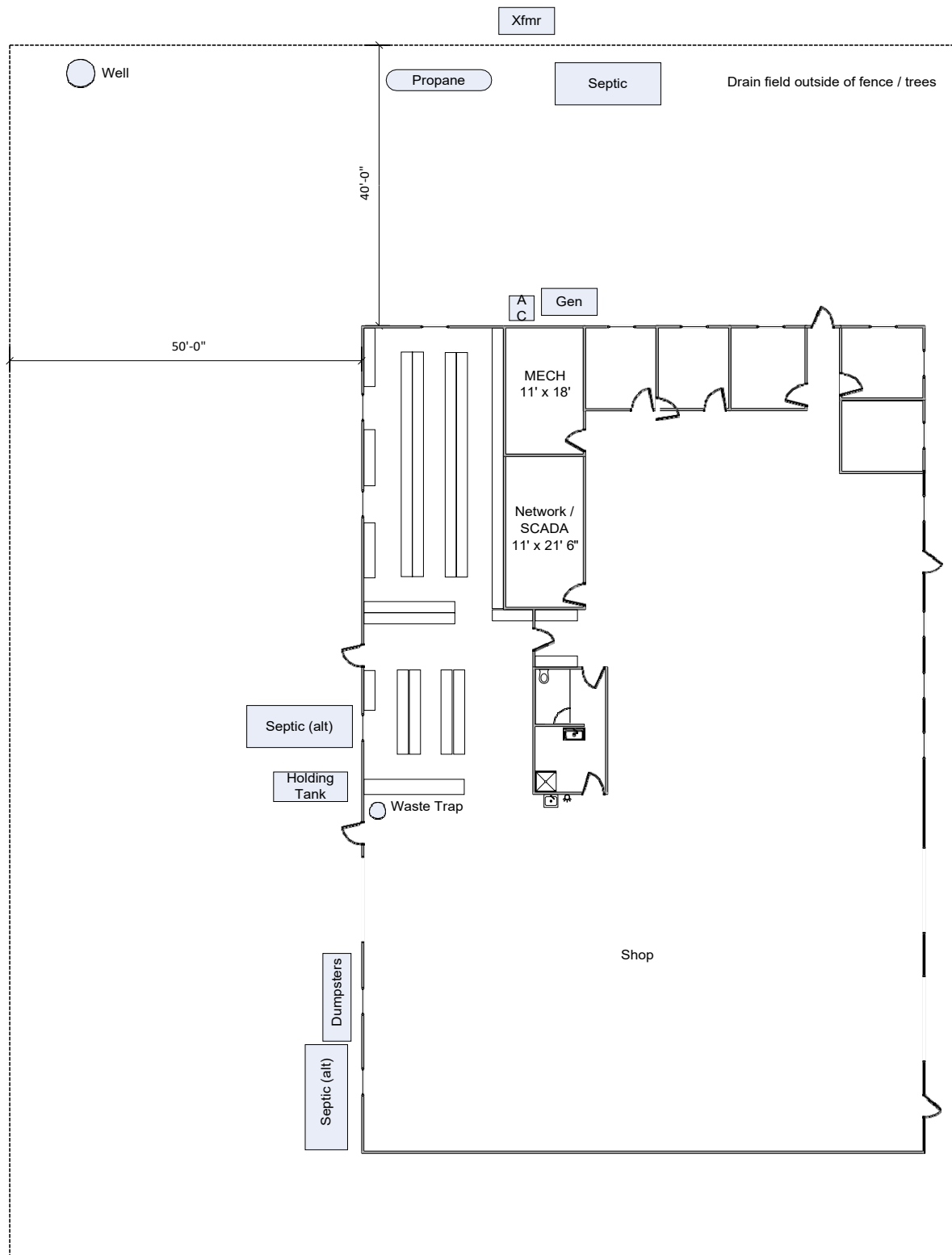


Exhibit A.1 – Scope of Work, Wind, Solar, BESS
Xcel Draft (rev A), 20240426

Figure 10-8: O&M Building Exterior Equipment Layout



11.0 METEOROLOGICAL Stations / METEOROLOGICAL Towers

11.1 General Provisions – Solar Meteorological (MET) Stations

11.1.1 Contractor shall provide, install, calibrate, commission the MET Stations, back of module sensors, and soiling stations per the requirements in this section.

11.1.2 Contractor shall conform to standard industry practices and comply with manufacturer requirements and recommendations.

11.1.3 NIST calibration certificates shall be provided for meteorological instruments.

11.1.4 Contractor shall submit a proposed equipment location map (MET Stations, back of module sensors, soiling stations, and stand-alone plane of array sensors) for Owner review and approval.

11.1.5 Requirements for pyranometers:

- (1) Pyranometers shall be ISO 9060 Class A Certified.
- (2) Sensors shall be heated and ventilated when dew or frost is expected in more than 2% of annual GHI hours as defined by IEC 61724:2021

11.1.6 Requirements for temperature sensors:

- (1) Temperature sensors shall be enclosed in a naturally aspirated radiation shield and installed at a height similar to the average height of the array.
- (2) Temperature sensor shall have a minimum accuracy of ± 0.3 degrees Celsius.

11.1.7 Requirements for back of module temperature sensors:

- (1) Back of module temperature sensors shall satisfy Class A requirements established per IEC 61724-1:2021 and have a minimum accuracy of ± 0.5 degrees Celsius.
- (2) Back of module temperature sensors shall be attached to modules throughout the array in such a way as to reflect temperatures representative of the average of the array.

11.1.8 Requirements for soiling stations:

- (1) Soiling stations shall be reference module based and consistent with the PV module technology used in the Project and mounted at the same tilt and orientation as the PV Array.
- (2) The soiling station modules shall be calibrated and certified to an accuracy of ± 5 percent or better by a third-party laboratory.

11.1.9 All other ancillary meteorological measurements (wind speed and direction, barometric pressure, relative humidity, and rain fall) should satisfy requirements established in the latest IEC 61424-1.

11.1.10 Requirements for data loggers:

- (1) Data logger should be IEC 61400-12-1 and/or IEC 61724-1 Compliant.

- (2) Data averaging interval should be 1 or 5 minutes, comprised of a 1 Hz sampling interval.
- (3) Data should be transmitted via Modbus TCP protocol via either a fiber or ethernet connection.
- (4) Data logger shall be furnished with space heater(s) (if not already provided by the manufacturer of the equipment) that are thermostatically controlled.

11.1.11 The minimum quantity of sensors to be provided is presented in Table 11-1, based on Project capacity.

Table 11-1: MET Station Equipment Quantities

Project Capacity (MWdc)	MET Station Quantity	Back of Module Sensors
0-20	2	8
20-50	3	12
50-100	4	16
100-200	4	24
200-300	8	32
300-400	12	48
400-500	16	64

11.1.12 Requirements for power supply:

- (1) MET Stations shall run off of AC power supply from the PCS.

11.2 Solar MET Stations

11.2.1 Contractor shall supply MET stations in the quantity noted in Table 11-1 to measure solar insolation, irradiance, temperature, wind direction and speed, rainfall, and albedo (if applicable). Each MET Station shall include the following instruments:

- (1) Global Horizontal Irradiance (“GHI”) pyranometer.
- (2) POA pyranometer
- (3) Rear POA pyranometer (for projects utilizing bifacial PV modules)
- (4) Albedometer (for projects utilizing bifacial PV modules)
 - (a) Albedometers shall be in a sufficiently remote location so as not to impact albedo measurements due to object shading.
- (5) Albedometers shall be installed at a representative height of approximately 1.5 meters above ground, where possible. One (1) ambient temperature sensor

- (6) One (1) heated wind speed and wind direction sensor mounted at the top height of the array. Accuracy of the wind speed sensor shall be ± 3 percent at 10 m/s or better, and accuracy of the wind direction shall be ± 5 degrees or better.
- (7) One (1) rain gauge to measure rainfall amounts, with an accuracy of ± 0.01 inch.
- (8) One (1) relative humidity sensor
- (9) One (1) barometric pressure sensor
- (10) One (1) RTU / datalogger to condition the instrument's signals, record data and communicate to the SCADA server.
- (11) Backup power from a dedicated battery module with dedicated PV module for recharging.
 - (a) MET Stations shall have the capability of uninterrupted recording and storing environmental conditions without AC power for at least seven (7) days. This may be accomplished using backup DC battery power, or a UPS system.
 - (b) Chargers shall include an AC power failure alarm, high/low DC voltage alarms , and a ground detection alarm.

11.2.2 All instrumentation shall be of the same make and model at each MET Station.

11.2.3 Back of module temperature sensors shall be installed in the quantity indicated in the quantity noted in Table 11-1.

11.2.4 Standalone POA pyranometers shall be installed in the quantity indicated in the quantity noted in Table 11-1.

11.2.5 Contractor shall provide soiling stations utilizing the same PV module technology used in the Project, mounted at the same tilt and orientation as the array. The soiling station modules shall be calibrated and certified to an accuracy of ± 5 percent or better by a third-party laboratory.

- (1) Back of module sensors installed on soiling stations are not included in the minimum quantity requirement of four (4) BOMs per MET Station.

11.2.6 The stand-alone POA requirements shall meet the same requirements of the POAs associated with the MET Stations.

11.3 Submittals – MET Stations

11.3.1 Contractor shall prepare the meteorological tower design documents per the submittal schedule in Exhibit G.1 (Submittal Schedule) and containing the following information, at a minimum: (a) design basis; (b) foundation plans and details, including all structural calculations, pier details, and footing details; (c) instrument details, including all equipment listed herein; (d) wiring schematics; (e) grounding details; (f) power supply details; (g) fiber termination diagrams; (h) communications block diagram; (i) Communications System details including logic description, points lists, rack layout diagrams, fiber terminations; (j) one-line diagrams, three-line diagrams, and wiring diagrams, including A/C and D/C schematics; (k) drawing index; (l) bill of materials; and (m) inspection, testing, and quality control requirements.

11.3.2 Contractor shall submit manufacturer's approval drawings or product sheets (material cut sheets) for all permanently installed equipment and materials.

11.3.3 Contractor shall issue a final report that includes the following:

- (1) List of instrumentation, serial numbers, header names, heights installed, mounting arrangements and orientations, instrument calibration sheets from sensor manufacturer (to include calibration date, slope, offsets, etc.)
- (2) Final MET station drawing with sensor placements
- (3) Station photographs that reference direction of view and include:
 - (a) Entire station
 - (b) Each sensor
 - (c) Pictures of MET station exposure in all directions, standing at the base of the MET station looking in all directions (N, NE, E, SE, S, SW, W, NW)
 - (d) Logger enclosure, showing internal wiring,
 - (e) Equipment rack
- (4) Check out sheet that reports weather during installation and readings from each instrument after commissioning.
- (5) Final logger wiring diagram
- (6) Data logger program (print out of code, if reasonable in size)
- (7) Remote/uninterruptible power system wiring diagram.

11.4 Testing and Quality Control

11.4.1 Contractor shall install and commission MET Stations at least sixty (60) days prior to initial synchronization of the respective medium-voltage circuit for each MET Station. Meteorological data shall be stored in the SCADA historian once the MET Station is commissioned.

11.4.2 Copies of testing reports (including a summary of testing procedures and acceptance criteria) shall be submitted to Owner within 10 days of completing such test.

11.5 General Provisions – Wind Meteorological Towers

11.5.1 References to “meteorological towers” herein shall be understood to include both permanent and temporary meteorological towers, unless explicitly stated otherwise.

11.5.2 Meteorological towers shall be sized and constructed appropriately to allow instrumentation to be placed at Wind Turbine hub height. A side-by-side (i.e., goalpost) anemometer orientation, as shown in IEC 61400-12-1, shall be utilized; such side-by-side anemometers will be mounted at Wind Turbine hub height on each permanent meteorological tower. Similarly, any height provided by a foundation for the temporary meteorological tower shall be taken into consideration relative to the final constructed hub height of the Wind Turbine.

11.5.3 Meteorological towers shall be designed and fabricated to the latest EIA/TIA-222-FS Structural Standards for Steel Antenna Towers and Antenna Supporting Structures and according to other Applicable Standards.

11.5.4 Meteorological tower designs, including foundation design, shall be approved by Owner prior to procurement of such equipment or materials.

11.5.5 All meteorological towers shall incorporate a safety climb cable.

11.5.6 Sufficient grounding and lightning protection per IEC 61400-12 shall be installed on all meteorological towers, including lightning finials. Meteorological towers shall be independently grounded; meteorological tower grounding shall not be interconnected to the Wind Turbine grounding system.

11.5.7 All anemometers shall be type “first class”, heated sensors. All anemometers shall be calibrated in accordance with MEASNET’s Anemometer Calibration Procedure and performed by a MEASNET-certified organization.

11.5.8 Instrumentation booms shall be oriented to minimize tower shading (e.g., perpendicular to prevailing wind direction).

11.5.9 Requirements for meteorological tower civil and structural works:

- (1) All civil works for the meteorological towers shall comply with the applicable specifications in Section 4.0 (*Civil / Structural Works*).
- (2) All meteorological tower structures, foundations, assemblies, and components shall be designed and constructed in accordance with the applicable structural works specifications in Section 4.0 herein.
- (3) Permanent meteorological towers shall be self-supporting. No guy wires for permanent meteorological towers are allowed.

11.5.10 Requirements for meteorological tower marking and lighting:

- (1) Meteorological towers shall be painted.
- (2) Meteorological towers shall be marked in accordance with the Requirements.
- (3) All meteorological towers shall be provided with aviation obstruction lights, including top- and mid-level as required, and including all mounting assemblies, GPS controller, and photocell as required by the Federal Aviation Administration and all other Applicable Standards. Obstruction lights shall be (a) FAA Type L-810 (red, steady burning), L-864 (red, flashing), or L-865 (white, flashing, medium intensity) as determined in Owner’s *Determination of No Hazard to Air Navigation* letter from the FAA; (b) in compliance with the Requirements, including US DOT-FAA Advisory Circular No. AC 70/7460-1K: *Obstruction Marking and Lighting*; (c) provided with an uninterruptible power supply capable of supplying back-up power for at least one (1) hour; and (d) programmed to blink in unison, including with those aviation obstruction lights that are installed on the Turbines. Contractor shall remove all temporary FAA lights when no longer needed.

11.5.11 Requirements for communications:

- (1) All permanent meteorological towers shall be connected to, and communicate with, the Communications System and allow data recording and storage through the data archival features of the Communications System.
- (2) Communication from each permanent meteorological tower to the Communications System shall be via dedicated fiber optic circuit. Such communication path shall follow the same route as the Collection System Circuits in order to minimize disturbed area.

11.5.12 Requirements for power:

- (1) Permanent power supply for each permanent meteorological tower shall be taken from the nearest Wind Turbine or Collection System Circuit. Such permanent power supply path shall follow the same route as the Collection System Circuits in order to minimize disturbed area.

11.6 Submittals – Wind Meteorological Towers

11.6.1 Contractor shall prepare the meteorological tower design documents per the submittal schedule in Exhibit G.1 (Submittal Schedule) and containing the following information, at a minimum: (a) design basis; (b) foundation plans and details, including all structural calculations, pier details, and footing details; (c) tower details, including boom elevations, boom directions, equipment mounting, guying details, and hardware details; (d) instrument details, including all equipment listed herein; (e) wiring schematics; (f) H-frame diagrams; (g) grounding details; (h) power supply details; (i) fiber termination diagrams; (j) communications block diagram; (k) Communications System details including logic description, points lists, rack layout diagrams, fiber terminations; (l) one-line diagrams, three-line diagrams, and wiring diagrams, including A/C and D/C schematics; (m) drawing index; (n) bill of materials; and (o) inspection, testing, and quality control requirements.

11.6.2 Contractor shall submit manufacturer's approval drawings or product sheets (material cut sheets) for all permanently-installed equipment and materials.

11.7 Power Curve Test Site Calibration Requirements

11.7.1 Installation of the temporary meteorological towers shall be scheduled sufficiently early in the construction of the Project to allow for adequate wind data collection before installation of the respective Wind Turbine at that location, including earthwork or Foundation construction. At least three (3) months of data collection shall be assumed to be required from the time that each temporary meteorological tower is installed until the time it is removed.

11.7.2 Meteorological towers shall be constructed in sets of two, or one permanent meteorological tower and one temporary meteorological tower, in order to maximize data collection time for Owner's site calibration (see Section 11.7.1 herein).

11.7.3 Upon completion of data collection for the power performance test site calibration (see Section 11.7.1 herein) and at the request of Owner, temporary meteorological towers shall be decommissioned and removed, including any temporary foundations and fencing. All equipment and instrumentation from the decommissioned towers shall be returned to Owner at a location requested by Owner. For the avoidance of doubt, and unless explicitly approved by Owner, Wind Turbines may only be installed (including earthwork and construction of Turbine Foundations) *after* the temporary meteorological tower at the respective Wind Turbine location has been removed.

11.8 Existing Meteorological Towers

11.8.1 Contractor shall decommission the existing, temporary meteorological towers at the Project Site. All equipment from these existing towers shall be stored at an Owner-designated location at the Project Site.

11.9 Permanent Meteorological Towers

11.9.1 Contractor shall design, furnish, construct, and install any permit required permanent meteorological towers.

- (1) Contractor shall furnish all labor, equipment, and materials that are necessary for a complete, fully-functional, and safe permanent meteorological tower configuration.
- (2) Permanent meteorological towers shall be installed at a location at the Project Site to be specified by Owner.
- (3) Permanent meteorological towers shall be turbine hub-height, self-supported (non-guyed), galvanized lattice structures, each designed and certified for maximum wind and ice loading for the Project Site conditions.

11.9.2 Contractor shall furnish and install fencing and gates at each permanent meteorological tower.

- (1) Fencing shall be placed to allow a minimum of 10 feet of free space around the tower base and shall have constructed dimensions of approximately 40 feet by 40 feet. Fencing shall be grounded.
- (2) At least one (1) gate shall be installed at each permanent meteorological tower. The gate shall be a lockable swing-gate, sufficiently wide for light-duty vehicle access.
- (3) All fencing and gates shall comply with the minimum specifications in Section 4.1.10 herein.
- (4) The fenced area for the permanent meteorological tower shall be covered throughout with at least six (6) inches of aggregate over a compacted subgrade, with aggregate extending at least one (1) foot beyond the fence in all directions and using the same aggregate material as the Site Access Roads.

11.9.3 Contractor shall furnish and install a 12-foot-wide road to each permanent meteorological tower. Such roads shall be constructed of the same materials and with the same cross section as the primary Site Access Roads.

11.9.4 Each permanent meteorological tower shall include the following instruments:

- (1) Two (2) cup anemometers at Wind Turbine hub height in a goal-post configuration.
- (2) One (1) cup anemometer at mid-blade height.
- (3) One (1) cup anemometer at lower-blade height.
- (4) One (1) vertical anemometer near Wind Turbine hub height (below goal post).

- (5) Two (2) wind direction sensors near Wind Turbine hub height (below goal post). Each shall be MetOne 020C and NRG #200P, respectively.
- (6) One (1) temperature / relative humidity sensor with radiation shields near Wind Turbine hub height (below goal post). Each shall be MetOne 597 or Vaisala HMP60A.
- (7) One (1) barometric pressure sensor near Wind Turbine hub height (below goal post). Each shall be MetOne 092 or Vaisala PTB 110.
- (8) One (1) wind direction sensor at lower-blade height. Each shall be MetOne 020C.
- (9) One (1) temperature / relative humidity sensor with radiation shields at 10 meters above ground level. Each shall be MetOne 597 or Vaisala HMP60A.
- (10) One (1) precipitation sensor. Each shall be Campbell Scientific 237-L.

11.9.5 Each permanent meteorological tower shall include the following auxiliary equipment:

- (1) One (1) NEMA 4X fiberglass enclosure for data logger and auxiliary equipment.
- (2) One (1) data logger. Each shall be Campbell Scientific, model CR3000.
- (3) One (1) satellite or cellular data modem.
- (4) One (1) radio. Each shall be Campbell Scientific, model 401A.
- (5) Signal surge protection terminals. Each shall be Phoenix Contact, type Termitrab 24V.

11.9.6 Each permanent meteorological tower shall include the following other equipment:

- (1) Two (2) obstruction lights, including top- and mid-level, and including mounting brackets. The top-level light shall be mounted below the goal post.
- (2) Grounding and lightning protection, including lightning finial.
- (3) Instrumentation booms.
- (4) Cabling.
- (5) H-frame equipment rack.
- (6) Fiber patch panel.
- (7) Step-up transformer.
- (8) Safety climb cable.
- (9) Temporary power supply for data logger and aviation lights.

11.10 Temporary Meteorological Towers

11.10.1 Contractor shall design, furnish, construct, and install any permit required temporary meteorological towers.

- (1) Contractor shall furnish all labor, equipment, and materials that are necessary for a complete, fully-functional, and safe temporary meteorological tower configuration.
- (2) Temporary meteorological towers shall be installed at a location at the Project Site to be specified by Owner. Care shall be taken by Contractor to ensure that the constructed elevation of the temporary meteorological towers and the hub height anemometers is identical to the final hub height elevation of the respective Wind Turbine at that location.
- (3) Temporary meteorological towers shall be either self-supported (non-guyed) or guy-wire-supported, galvanized lattice structures, each designed and certified for maximum wind and ice loading for the Project Site conditions. Temporary meteorological towers shall be the same height as the permanent meteorological towers.
- (4) Temporary meteorological towers shall not be fenced.
- (5) All guy wires for temporary meteorological towers shall include avian protection, including bird diverters.

11.10.2 Each temporary meteorological tower shall include the following minimum instruments:

- (1) Two (2) cup anemometers at Wind Turbine hub height in a goal-post configuration.
- (2) One (1) cup anemometer at mid-blade height.
- (3) One (1) cup anemometer at lower-blade height.
- (4) One (1) cup wind direction sensor near Wind Turbine hub height (below goal post).

11.10.3 Each temporary meteorological tower shall include the following auxiliary equipment:

- (1) One (1) NEMA 4X fiberglass enclosure for data logger and auxiliary equipment.
- (2) One (1) data logger. Each shall be Campbell Scientific, model CR1000.
- (3) One (1) radio. Each shall be Campbell Scientific, model 401A.
- (4) Signal surge protection terminals. Each shall be Phoenix Contact, type Termitrab 24V.

11.10.4 Each temporary meteorological tower shall include the following other equipment:

- (1) One (1) obstruction light, including mounting bracket. The light shall be mounted below the goal post
- (2) Grounding and lightning protection, including lightning finial.
- (3) Instrumentation booms.
- (4) Cabling.
- (5) H-frame equipment rack.
- (6) Safety climb cable.
- (7) Temporary power supply for data logger and aviation lights.

11.10.5 Contractor shall decommission all temporary meteorological towers at the conclusion of Owner's site calibration test; such work shall include removal and disposal of any meteorological tower foundations. All equipment from these towers shall be stored at an Owner-designated location at the Project Site. Removal of such temporary meteorological towers must occur prior to the commencement of Turbine Foundation construction and Wind Turbine erection activities for the applicable Wind Turbine.

11.11 Testing and Quality Control

11.11.1 Contractor shall test, commission, start-up, and place into successful operation the meteorological towers. At a minimum, testing shall include the minimum requirements below. All testing shall be performed by an independent, experienced third party.

- (1) All meteorological tower equipment shall be tested to demonstrate it meets stated design criteria and is fit for purpose.
- (2) All testing specified in the Applicable Standards.
- (3) All testing reasonably recommended or required by the applicable equipment suppliers.
- (4) Meteorological tower foundations shall be tested for concrete strength and properties, including break tests, grout cubes, slump, air, and temperature, each at the minimum frequencies specified in Section 4.1.12 and Section 4.1.13 herein.
- (5) All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.
- (6) Resistance testing on grounding grid at each tower location.
- (7) Final continuity tests after completion of all system connections. Acceptable continuity tests shall include a Megger test or VLF test at 100 percent of rated voltage.
- (8) Verify all alarms, indications and analog quantities are communicated and received properly by the RTU and displayed correctly on the HMI.
- (9) Verify all communication channels operate as expected.

11.11.2 Contractor shall notify Owner of all testing schedules at least 30 days in advance of testing activities and copies of testing reports (including a summary of testing procedures and acceptance criteria) shall be submitted to Owner within 10 days of completing such test.

12.0 SOLAR PV ARRAY

12.1 General Provisions

12.1.1 The solar PV Array shall have a minimum design life of 35 years based upon the environmental conditions of the Project Site.

12.1.2 The solar PV modules have the technical specifications as noted in Exhibit D.5.2 (PV Module Requirements and QA Inspection Scope).

12.1.3 The solar PV Array shall be designed for fully automatic, unmanned operation.

12.1.4 The solar PV Array shall be oriented to optimize annual energy production with the goal of producing the lowest levelized cost of energy.

12.1.5 PV Modules shall be connected in a manner that does not exceed the DC voltage and DC current or power capabilities of the inverter.

12.1.6 Lighting systems shall provide personnel with illumination to perform general yard tasks, for safety, and security. Outdoor light fixtures shall be switched on and off with motion detectors / photoelectric controllers which will turn on at night when motion is detected but may be manually overridden by a switch. Local task lighting shall be controlled with manual switches at the task. Lights shall be LED type.

12.1.7 Fencing shall be installed around the PV Array. A man gate and vehicle gate shall be installed at each site road entrance for ingress and egress to the equipment. See Section 4.1.10 for additional fencing and gate requirements.

12.1.8 The solar PV Array shall be designed to meet the environmental characteristics noted in Exhibit D.2 (Project Site Data). Alternatives may be reasonably proposed, provided the alternative provides the same or better material functionality and has been approved by Owner.

- (1) The Project shall be designed to withstand and operate within the ambient temperature conditions noted in Exhibit D.2 (Project Site Data) unless more extreme temperatures are indicated for the site.
- (2) PV string sizing shall be made in accordance with the ASHRAE Extreme Annual Dry Bulb Mean Minimum design temperature for the local area.

12.1.9 Requirements for solar PV Array civil and structural works:

- (1) All civil and structural works including, but not limited to, grading, structures, foundations, assemblies, and components for the solar PV Array shall be designed and constructed in accordance with the applicable specifications in Section 4.0 (Civil / Structural Works).

12.1.10 Requirements for PV modules:

- (1) Not used.

12.1.11 Requirements for PV module support systems:

- (1) Acceptable mounting systems shall be ground mounted structures and shall be single- or dual-axis trackers.

- (2) Mounting system shall be designed to withstand the Project Site environmental design conditions and provide a weather “stow” mode for the PV modules.
- (3) Tracking systems and floating support systems shall be provided by a manufacturer with at least five (5) years’ experience in manufacturing module support systems like the proposed design.
- (4) Mounting system manufacturer shall have ISO 9001 manufacturing capability.
- (5) At a minimum, steel piles shall be hot-dipped galvanized after fabrication in accordance with ASTM A123/A123M for fabricated products and ASTM A153/153M for hardware. Any subsequent process that causes damage or otherwise removes the galvanized coating shall be repaired in accordance with ASTM A780/A780M.
 - (a) If additional corrosion control measures are recommended in the geotechnical report then the piles shall be designed/coated to meet such requirements.
- (6) Cold formed sheet steel shall be in accordance with the requirements of one of the following standards ASTM A1008 / A1008M, ASTM A1003/A1003M, ASTM A653/A653M or ASTM A792 with a minimum coating thickness of G90.
- (7) The dimensions and design of the mounting systems shall be compatible with the modules selected for the Project.
- (8) The mounting system shall have provisions to be grounded to the grounding loop of the Project Site, including the solar PV modules (if they have metal frames). The module racking grounding system shall either have each component UL listed or shall be tested as an assembly to UL 2703 or UL 3703. Additionally, if a grounding bond incorporates two dissimilar metals such as tin-plated copper to steel, the joint shall be accomplished with the inclusion of a Belleville washer to prevent loosening due to thermal ratcheting or shall be otherwise installed according to manufacturer directions.
- (9) All grounding connectors within 18 inches of finished grade shall be UL listed for direct burial. All grounding hardware shall utilize stainless steel, bronze, or copper hardware and be compatible for its application and environment. Tin plated aluminum with stainless steel hardware may be allowed for use if listed for the application and not located within 18” of finished grade. All grounding hardware shall be submitted to Owner for review and approval during design phase.
- (10) Tracking systems
 - (a) Tracking systems shall be provided by a manufacturer with at least five (5) years minimum experience in manufacturing tracking systems similar to the proposed design. Contractor shall provide mean time between failures data for the proposed tracking system.
 - (b) Supplier shall provide details of all the support bearings for the tracker including materials of construction, specific bearing loadings, bearing safety factors, lubrication, and monitoring. supplier shall provide, at minimum, the following additional information and drawings about the trackers:
 1. Grade and slope requirements for the trackers

2. Power consumption requirements for the motor controller
 3. Installation manual
 4. Operations & Maintenance Manual
 5. Controller single- and three-line diagrams and control schematics
 6. Details on “anti-shading” methods required in the layout design
- (c) The tracker system may be electrically driven and shall meet all the seismic and wind loading requirements of the applicable local codes and local wind conditions as specified in ASCE 7-10. Tracker shall be suitable for the Project Site Conditions including temperature range and snow loading. If utilizing tracker stowing, function shall be independent of a grid supply of power or able to withstand any code wind conditions in any orientation.
- (d) The materials shall be new and adequate to withstand the environmental design conditions of the Project location. The manufacturer shall provide a wind and snow load analysis (if applicable) and a snow shedding/clearing methodology for the Project to demonstrate the product’s structural integrity.
- (e) For single-axis trackers, the system shall have a minimum tracking range of 55 degrees each way.
- (11) The PV module support system shall allow for a minimum clearance between the bottom of the module and ground of 12 inches above the 100-year flood level and 24 inches above grade, or as required by the Site conditions, local permits or other Requirements, whichever is greater.

12.1.12 Requirements for DC wiring harnesses:

- (1) DC wiring shall consist of single conductors rated for use at the calculated maximum string voltage and shall be type PV Wire or XLPE insulated with connectors compatible with the connectors provided on the module pigtails.
- (2) If factory cable assemblies are used, they shall consist of single conductors rated for use at the calculated maximum string voltage and shall be type PV Wire or XLPE insulated with connectors compatible with the connectors provided on the module pigtails. Assemblies will be pre-cut to length. If a harness contains fuses to protect each string circuit, they shall be accessible for replacement.
- (3) Quick connect terminations shall mate with module terminations.

12.1.13 Requirements for DC fused combiner boxes:

- (1) Enclosure shall be rated NEMA 4 with continuous hinge single door with three-point latch. Side or bottom penetrations only will be permissible. Doors shall be easily interchangeable.
- (2) Factory assembled back panel shall be complete with finger safe fuse holders rated to match the maximum DC system voltage for positive conductors, power distribution blocks, labeling, and signage.

- (3) The fuses and fuse holders shall be rated according to the string size and environmental conditions and shall observe applicable codes.
- (4) The combiner shall be listed to UL 1741 for not less than the maximum DC voltage of the solar PV array, and rated for an operating temperature range of -40C to +50C.
- (5) The power terminal blocks shall be rated for use with both copper and aluminum conductors and rated to match maximum DC system voltage and 90° Celsius (C) conductor temperature.
- (6) DC surge arresters shall be rated to match maximum DC system voltage and a minimum of 85°C ambient temperature.
- (7) The combiner box shall be equipped with a mechanical lug, dual rated for terminations of 90°C copper ground cables.
- (8) All enclosures shall have provisions for padlocking.
- (9) The door handle shall be interlocked with the disconnect switch to prevent opening the enclosure with the disconnect switch in the “on” position. A means of overriding this protection shall be provided for troubleshooting purposes.
- (10) The combiner box shall include provisions for bolted terminations of the output power circuits to the inverter.
- (11) The combiner box shall be properly labeled in accordance with Section 2.6.
- (12) The combiner box shall be powder-coated steel with a white or off-white color.
- (13) Combiner boxes shall be installed plumb and level at a minimum 48-inches above grade at the centerline.
- (14) A Big Lead Assembly (“BLA”) from Shoals Technologies may be utilized in lieu of combiner boxes. In-line fuses for BLA cable systems shall be field serviceable.
- (15) Contractor shall provide two (2) spare combiner boxes / Load Break Disconnects for use during commissioning and to be turned over to Owner for its spare parts use at the end of the project. Parts used during commissioning are to be replaced by Contractor.

12.1.14 Requirements for power conversion systems:

- (1) See Section 5.1.17.
- (2) Each power conversion station shall consist of a minimum of 2 MVA of inverter capacity, inverter step up transformer(s), low voltage AC cabling, corresponding ancillary equipment, grounding system, and an inverter shelter (if needed).

12.1.15 Requirements for MV transformers:

- (1) See Section 5.1.10.

12.1.16 Requirements for PV combining switchgear (as applicable):

- (1) Equipment shall be NEMA rated for the environment, metal enclosed (ANSI C37.20.3). Contractor shall specify and install bus bracing and breaker symmetrical interrupting ratings based on the Facility short circuit study in coordination with the Substation short circuit study.
- (2) Equipment shall be provided with pad locking ability.
- (3) PV combining switchgear shall be rated for conditions in accordance with Exhibit D.2 (Project Site Data). This shall include anti-condensation heaters supervised by a thermostat as required for the conditions.
- (4) Both N.O. and N.C. dry contacts shall be provided on all interrupters for monitoring by the Facility Communications System. Manual air switches shall not include contact monitoring.
- (5) Surge arresters shall be provided, one per phase, mounted in the incoming line compartment.
- (6) Equipment shall be mounted to a cast-in-place or pre-cast concrete foundation or piers.
- (7) The switches shall be motorized. Local controls shall be provided by use of a remote switch.
- (8) Switchgear shall include an auxiliary compartment containing instrument transformers associated with the protective relays and 120/240V control power transformer.

12.1.17 Requirements for DC system wiring installation:

- (1) Series string connections between solar PV modules shall be via quick connect connectors factory-supplied with modules.
- (2) Series string circuits shall be routed to a combiner box. If applicable, parallel connections shall be made using DC wiring harnesses consisting of pre-cut lengths of minimum 12 AWG cable with quick connects ends and shall be supported to mounting structure.
- (3) Contractor shall install solar PV modules of same power class on each combiner box to minimize mismatch losses.
- (4) DC cable routing and rating
 - (a) PV Array feeders and/or combiner box outputs shall be placed in cable tray or routed in conduit or direct buried in accordance with the NESC and any applicable environmental requirements.
 - (b) DC cable must be suitable for direct burial in wet or dry conditions.
 - (c) Cable insulation type shall have a rating to withstand long term ultraviolet sunlight exposure and have a temperature rating of 90°C or better.
 - (d) DC homerun cables may be direct buried. Transitions to above grade shall be via conduit. DC string wiring shall be secured to the racking structure so as to prevent mechanical damage under normal operating conditions and shall be protected against sharp edges where necessary.

- (e) Cable size and insulation levels shall be rated according to the maximum system voltage and in accordance with the NEC Article 690 for "Solar Photovoltaic Systems."
 - (f) Cable size shall also be sized accordingly taking into account any ambient temperature or conduits de-rate factors and voltage drop considerations. A benchmark voltage drop of less than 2 percent (2%) between the PV Array and the inverters shall be used.
 - (g) Exposed / unsupported cables subject to damage to be in split loom or Owner approved equivalent product.
 - (h) Cable ties utilized for managing cables utilized in an outdoor setting shall be UV and weather resistant.
 - (i) Excess slack shall be provided to allow for testing and re-termination in the event of failure.
 - (j) Installation of cable shall not violate the minimum bending radius of the cable.
- (5) All control and instrumentation conductors shall be terminated with ring-tongue connectors.
 - (6) Cable shall be tested in accordance with the most recent NETA ATS standards.
 - (7) For above ground DC collection, all DC cables shall be minimum [24] inches above grade or 12 inches above 100 year flood level at maximum cable sag, whichever is greater.
 - (8) All DC cable terminations shall be minimum 12 inches above 100 year flood level.

12.1.18 Requirements for AC system wiring (600V and below):

- (1) All conductors, lugs and cable accessories shall be listed by a NRTL.
- (2) No splicing shall be allowed.
- (3) System wiring shall be properly rated for the installation and properly rated for the application.
- (4) System wiring installed in direct burial applications shall be type USE-2 with XLP insulation. Conductors may be stranded copper or aluminum.
- (5) When terminating to bus terminal pads, one-hole compression lugs for sizes 2/0 and below and two-hole for sizes 3/0 and greater shall be utilized.
- (6) When terminating aluminum conductors, oxide prohibitor coating shall be used.
- (7) Cable shall be tested in accordance with the current NETA ATS standards.

12.1.19 Requirements for grounding:

- (1) Grounding connections at junction boxes and pad-mounted transformers shall be bolted to facilitate separation of grounds for continuity testing and ground mat testing.

- (2) Ground rods shall be incorporated into the grounding system. Ground rods shall be copper-clad, 5/8-inch diameter, 10-foot-long rods at a minimum.
- (3) Inverter foundations shall include a grounding grid, as further described herein.
- (4) Grounding rings for the PCS shall be designed such that they can be isolated and tested independently.
- (5) MET Stations shall be independently grounded.
- (6) Contractor shall minimize the amount of exposed ground conductors and utilize approaches that hide ground conductors to minimize the potential for theft.

12.2 Submittals

12.2.1 The PV Module manufacturer shall provide the estimated annual degradation of their module and justify the value provided with historical production data.

12.2.2 Contractor shall provide a copy of the preliminary PVsyst model and report for Owner review and comment. Such report is expected to be the basis of the Contractual Energy Model.

12.2.3 Contractor shall submit all manufacturer's product sheets (material cut sheets), warranties, and operations and maintenance manuals (as applicable) for all permanently-installed equipment and materials.

12.2.4 Contractor shall submit a detailed plan for the installation of the PV Module racking and mounting system. Such plan shall be consistent with the manufacturer's instructions and warranties and shall include loading calculations (e.g. wind and snow loading) to confirm the system's compliance with the Project Site Conditions.

12.2.5 Contractor shall provide a complete recommended spare parts list for the Project's PV Array. Such list shall include recommended quantities, part / model numbers, and nominal pricing.

- (1) Contractor shall provide two (2) spare PV racks for use during commissioning and to be turned over to owner for its spare parts use at the end of the project. Parts used during commissioning are to be replaced by contractor.

12.3 Solar PV Array

12.3.1 Contractor shall design, furnish, construct, and install the solar PV Array in conformance with the minimum Requirements set forth herein.

- (1) Contractor shall furnish all labor, equipment, and materials (except specifically the Owner-Supplied Equipment as noted in Exhibit B) that are necessary for a complete, fully-functional, and safe solar PV Array, including, but not limited to, all PV modules, trackers, PCS, combiner boxes, DC cabling and cable management system, MV transformers, grounding, fencing and gates etc.
- (2) All equipment shall be new and unused and come with a manufacturer's warranty.

12.3.2 Contractor shall receive, inspect, store, unload, maintain, erect, clean, align, and prepare all equipment, including Owner-Supplied Equipment in strict accordance with the equipment manufacturer's instructions.

12.3.3 Contractor shall provide lifting lugs on all equipment components or system components requiring removal for maintenance and weighing over 25 lbs.

12.4 Testing and Quality Control

12.4.1 The PV equipment shall be tested for performance prior to commercial operation. This process shall verify that the installed system is performing per the design based on the current weather variables. Performance testing shall follow ASTM E2848 (Standard Test Method for Reporting Photovoltaic Non-Concentrator System Performance).

- (1) Prior to conducting the performance testing, the Contractor shall perform start up and commissioning of the solar array. This shall include:
 - (a) Solar PV inverter start up and commissioning as described in Section 12.4.2 herein
 - (b) Solar PV Array functional tests on each circuit to confirm the equipment is functioning as intended and designed as described in Section 12.4.3 herein.

12.4.2 Central inverter testing at the Project Site shall be performed in coordination with the inverter manufacturer field engineer. Testing shall include all testing recommended by the central inverter system manufacturer and testing required to maintain the central inverter system warranty. Any deviation from this requirement shall be approved by Owner. Testing shall confirm the inverter performance including power outputs, heat rejection, communications, etc. Copies of testing reports (including a summary of testing procedures and acceptance criteria) shall be submitted to Owner within 10 days of completing such test.

- (1) The inverter manufacturer shall provide the following documentation from a certified NRTL:
 - (a) UL 1741 Test Report
 - (b) UL 1741 Certification
 - (c) UL 1741 SA Test Report
 - (d) UL 1741 SA Certification
 - (e) IEEE 1547/519 Harmonics Test Report (including raw test data), current THD < 3 percent
 - (f) NERC PRC-024-2 Voltage and Frequency Ride-Through Test Report
 - (g) California Energy Commission Efficiency Test Results
- (2) The inverter manufacturer shall provide the following documentation from type testing (or from a certified NRTL) to show the inverter meets the specifications outlined in the data sheet. The documentation shall include, at a minimum: active power, reactive power, frequency, DC voltage/current, AC voltage/current, and critical component temperatures (for ambient temperature testing).
 - (a) Active Power

1. Inverter manufacturer shall provide test documentation showing the inverter can operate up to the nameplate power rating (including any “overdrive” or 110% functionality).
- (b) Reactive Power
1. Inverter manufacturer shall provide test documentation showing the inverter can operate up to the maximum reactive power capabilities.
 2. Minimum Requirement: 0.90 lead/lag in 0.01 intervals.
- (c) Plant Controller Response
1. Inverter manufacturer shall provide test documentation showing the inverter can receive active and reactive commands from a simulated plant controller interface.
 2. Inverter manufacturer shall provide test documentation showing the inverter can operate at the maximum and minimum ramp rates for both active and reactive power variation.
- (d) Edge-of-Cloud Effects
1. Inverter manufacturer shall provide test documentation showing the inverter can track the PV array maximum power point (MPP) during high DC voltage and current transients.
- (e) DC Voltage
1. Inverter manufacturer shall provide test documentation showing the inverter can operate over the rated DC voltage operating range.
 2. Inverter manufacturer shall provide active power vs. DC voltage de-rating curves.
- (f) AC Voltage
1. Inverter manufacturer shall provide test documentation showing the inverter can operate over the rated AC voltage operating range.
 2. Inverter manufacturer shall provide active power vs. AC voltage de-rating curves from 0.9 to 1.1 p.u. terminal voltage and 0.9 lead/lag powerfactor.
- (g) Ambient Temperature
1. Inverter manufacturer shall provide test documentation showing the inverter can operate over the entire ambient temperature range (minimum 4 hours at each test condition).
 2. At a minimum, the test documentation must include the following operating conditions: 25°C, 45°C, maximum operating temperature, minimum operating temperature, and any “corner points” on ambient temperature de-rating curves.

3. Inverter manufacturer shall provide active power vs. ambient temperature de-rating curves.
- (h) DC/AC Ratio
 1. Inverter manufacturer shall provide design calculations and/or test data showing the inverter performance and reliability information at multiple DC/AC ratios including, but not limited to, the maximum and minimum DC/AC ratios specified for the Project.
- (i) Reliability
 1. Inverter manufacturer shall provide test documentation summarizing the accelerated life testing (ALT) and highly accelerated life testing (HALT) testing that has been completed.
 2. Inverter manufacturer shall provide mean time between failures (MTBF) and mean time to failure (MTTF) rates for critical components such as IGBTs, DC switches/contactors, AC contactors/breakers, DC link and AC filter capacitors, communications boards, and cooling system components (fans, pumps, etc.)
- (3) At a minimum, the following tests shall be performed on each inverter during production testing:
 - (a) Calibration of all DC and AC voltage, current, and power circuitry/sensors.
 - (b) UL 1741 production testing such as hi-pot and PE/ground testing.
 - (c) GFDI.
 - (d) Emergency stop (fast stop).
 - (e) Remote start/stop.
 - (f) Burn-in (minimum 4 hours per inverter). Burn-in testing should be completed under elevated ambient temperature and high DC current conditions at maximum rated power.
 - (g) Harmonic content verification (during burn-in tests).
 - (h) Efficiency verification.
 - (i) Verify inverter efficiency at multiple DC voltages and power levels which shall be consistent with the levels tested during CEC testing.
 - (j) The official CEC test procedure is not required.
 - (k) Reactive power control range as documented in the Interconnection Agreement or, at a minimum, across a range of 0.95pu lead/lag.
 - (l) Voltage and frequency ride-through verification per IEEE 1547 and/or PRC-024-2.

12.4.3 Requirements for the Solar PV Array functional testing:

- (1) The equipment shall be tested for performance prior to commercial operation. This process shall verify the installed system is performing per the design based on the current weather variables.
- (2) Prior to the performance test, the Contractor shall perform functional tests. As part of the commissioning process of the newly constructed solar array, the Contractor shall perform a functional test on each of the circuits to verify that they are all operating as expected and designed.
- (3) The Contractor shall start up and commission each of the inverters and ensure they are running under their MPPT range for optimal performance as described in Section 12.4.2 herein.
- (4) The Contractor shall inspect the entire array and measure the operating current of each individual string and the respective irradiance level in the plane of the array at the time current testing is completed. Based upon the design of the system, the Contractor shall calculate the expected current level based upon the recorded/observed conditions and compare that to the actual current level to verify that each string is performing as designed.
- (5) The Contractor shall perform an infrared scan to confirm site DC system health prior to conducting the performance tests. The Contractor shall perform repairs or replacements for each string that is not performing as designed.
- (6) The Contractor shall complete a PVsyst report or Owner approved alternative based upon the final design of the system and 30-year historical weather data for the area that shall provide an expected monthly production estimate for each of the 12 months of the year.

12.4.4 Requirements for the Solar PV Array capacity testing:

- (1) This portion of the testing shall be conducted after the Contractor completes the functional tests. The Contractor shall meet a minimum of 98 percent (98%) of the performance guarantee prior to commercial operation.
- (2) The Capacity and Performance Ratio Test shall be conducted prior to commercial operation. The basis for the test procedures is ASTM E2848 – Standard Test Method for Reporting Photovoltaic Non- Concentrator System Performance
- (3) The performance test boundary for the solar array shall be Contractor supplied weather station and the production power meter or other meter as shown on the one-line diagram in Exhibit F.3 (*Interconnection Agreement*).
- (4) The performance test data shall be taken in 1-minute intervals and averaged over 15 minute intervals for calculating the solar array output. The minimum number of data points over the three-day test period shall be 50 (12 hours of data collection). The minimum plane of array (POA) solar irradiance shall be 500 W/m² during data collection. Data shall generally be taken between 10:00 AM to 2:00 PM.

- (5) The weather data and MWh (megawatt hour) output data shall be recorded during the test with the Owner approved DAS (data acquisition software). The measured total MWh output during the test shall be the actual output of the solar array. The measured total MWh output shall include the accuracy of the production power meter, line loss between inverters and meter and temperature coefficient correction factor (defined by panel manufacturer).
- (6) The weather data recorded during the test shall be entered in the PVsyst or equal model included in the As-Built design. The PVsyst model or another numerical model shall be used to calculate the expected MWh output over the duration of the test. The solar irradiance input in the PVsyst model shall be corrected for the accuracy of the weather station pyranometers.
- (7) This portion of the performance guarantee shall be met if the actual measured MWh output is greater than or equal to the expected MWh output calculated by PVsyst or another numerical model. If the actual measured MWh out is less than the expected MWh output, the Contractor shall repair or replace components as required and retest the solar facility to meet this portion of the performance guarantee.
- (8) This portion of the performance test may be suspended and restarted due to transient weather conditions as mutually agreed to by the Owner and Contractor. The data collected during the test suspension shall be excluded from the performance calculations. The test suspension period shall not extend the overall test period.
- (9) Contractor shall submit a preliminary Performance Test procedure for review 90 days prior to the Performance Test.

13.0 BATTERY ENERGY STORAGE SYSTEM

13.1 General Provisions

13.1.1 The BESS, including all components, shall have a minimum design life of 20 years based upon the Project Site Conditions and be compliant with the most recent NFPA 855 (Standard for the Installation of Stationary Battery Energy Storage Systems) and any other applicable codes and standards noted in Exhibit A.2.

13.1.2 Outside of Section 13.0 and all other applicable BESS references in this Scope of Work document, Contractor shall adhere to material supply specifications highlighted in Exhibit D.5.3.

13.1.3 Battery cell / module design shall be of proven technology and shall have been installed in similar applications for a minimum of one (1) year. It is expected that replacement modules of the same design or of a directly compatible design will be readily available from the manufacturer for a minimum of 10 years such that battery rack modifications are not required. The BESS supporting infrastructure shall be designed and constructed to withstand a 100-year, 24-hour storm event. Final constructed grade shall be at least twelve (12) inches above such flood depth, as determined in the Contractor-provided hydrology study.

13.1.4 The BESS shall be designed and constructed to a high level of reliability, with ease of maintenance and shall meet or exceed the requirements set forth by the interconnection utility.

13.1.5 Contractor shall design and construct the BESS in accordance with the Interconnection Requirements, as more particularly detailed in Exhibit F, including all sub-exhibits thereto.

13.1.6 Contractor shall receive explicit approval from Owner or Owner's representative(s) of the design of the BESS supporting infrastructure prior to construction. Owner shall have unlimited access to such designs throughout the design process, and construction of all such facilities shall be completed by one of Owner's approved subcontractors, as more particularly detailed in Exhibit A.3 (Approved Suppliers).

13.1.7 Requirements for BESS civil and structural works:

- (1) All civil and structural works including, but not limited to, grading, structures, foundations, assemblies, and components for the BESS shall be designed and constructed in accordance with the applicable specifications in Section 4.0 (Civil / Structural Works).

13.1.8 Requirements for BESS operating criteria:

- (1) Contractor shall design the BESS operation to assume the duty cycle and other minimum operational requirements noted in Table 13-1.
- (2) Convenience power: $120V_{AC}$.
- (3) Instrumentation voltage: $24 V_{DC}$ and/or $48 V_{DC}$ and/or $125 V_{DC}$.
- (4) Minimum battery operational requirements are listed in Table 13-1.
- (5) The BESS shall meet the functional specifications listed in Table 13-2:

Table 13-1 – Minimum Lithium-Ion Battery Operational Requirements (Non-Black Start)

Description	Requirements
Intended Applications	Primary application is Firm Capacity but applications may include Arbitrage, Firm Capacity or Peaking Capacity, Operating Reserve, Ramping / Load following
Useable Power - AC Power at the Point of Interconnection (“POI”)	[TBD XX.0 MW]
Useable Energy (useable at the POI net of Station Power usage) at Continuous Power (“CP”)	[TBD XXX.0 MWh (XX MW over X.0 hours)]
Maximum average Resting and Annual State of Charge (“rSOC” / “aSOC”)	Refer to Exhibit D.5.3 (<i>Bess Specifications</i>).
Minimum End of Life Energy	Refer to Exhibit D.5.3 (<i>BESS Specifications</i>) for expected annual degradation curves based on specified Duty Cycle.
Capacity Retention	Maintain 100% Useable Power for 20 years at POI– no augmentation shall take place in the first three (3) operating years.
System Design Life	20 Years
Duty Cycle	2 cycles per day
System Frequency	60 Hz (+/- 3%)
Noise Emissions	<75 dB measured at the fence line
Total Harmonic Distortion (“THD”)	<3%
Environmental Conditions	Refer to Exhibit D.5.3 (<i>Bess Specifications</i>).
Guaranteed Monthly Availability	Minimum 98%.
Roundtrip Efficiency (“RTE”)	Minimum 87% initial RTE. Contractor to provide table with annual RTE over the System Design Life.
Response Time	Maximum 1 second response time from idle to 100% discharge output or charge input, from time of receipt of signal to discharge / charge appearing at the Point of Interconnection (“POI”).
Battery Power Meter	The Battery Power Meter will be located at the 34.5 kV AC bus, on the low side of the Main Power Transformer (“MPT”).
Point of Measurement (“POM”)	The POM for performance guarantees and Liquidated Damages (“LDs”) will be the same as the Battery Power Meter described above.

Description	Requirements
Capacity Retention	Maintain 100% Useable Power for 20 years at Point of Measurement (“POM”) – no augmentation shall take place in the first three (3) operating years.
Thermal Management	Liquid Cooled
Charging Method	Constant current / constant voltage
Discharging Method	Constant current / constant voltage
Inverter Nominal Voltage Range	Refer to Exhibit D.5.3 (<i>BESS Specifications</i>).
Battery Maximum Continuous Discharge to Inverter	Refer to Exhibit D.5.3 (<i>BESS Specifications</i>).

Table 13-2 – Minimum BESS Functional Specifications

Description	Requirements
General	Refer to Exhibit D.5.3 (<i>BESS Specifications</i>).
Nominal DC Voltage	Refer to Exhibit D.5.3 (<i>BESS Specifications</i>).
Depth of Discharge	Refer to Exhibit D.5.3 (<i>BESS Specifications</i>).
Codes and Standards	Batteries, Packs and System, where applicable by the International Fire Code, NFPA as well as local codes and standards, must adhere to the following codes and standards or its equivalent at a minimum: • <u>UL 1642 (2012)</u>: Standard for Safety of Lithium Batteries • <u>UL 1973 (2018)</u>: Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications • <u>UL 9540 (2021)</u>: ESS and Equipment • <u>UL9540A</u>: Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems (Test results must be made available prior to shipping) • <u>U.N. 38.3</u>: Safety of Primary and Secondary Lithium Cells and Batteries During Transport • See Exhibit D.5.3 for additional information
Battery Racks	
Description	Requirements
General	Refer to Exhibit D.5.3 (<i>BESS Specifications</i>).
Enclosures	
Description	Requirements
Enclosure Requirements	Refer to Exhibit D.5.3 (<i>BESS Specifications</i>).
Enclosure Type	Container or pre-fab enclosure.
Enclosure foundation(s) and Slabs	Container foundations may be formed in place concrete, pre-cast concrete, piers, piles, or earth augers at the option of the engineer of record, to meet OEM warranty requirements and recommendations as well as have the be stamped by a licensed structural engineer.

Environmental Controls	As required for the operation of the BESS system and to maintain temperature within warranty conditions. EMS shall be capable of starting and stopping the environmental control system.
Access	All BESS components shall be fully accessible for maintenance and inspection. Enclosure design shall include means for safely removing battery modules and other components.
Monitoring	Refer to Exhibit D.5.3 (<i>BESS Specifications</i>).
Fire Detection and Suppression	
Description	Requirements
General	Refer to Exhibit D.5.3 and Section 13.1.10 (7) for further requirements
Fire protection and detection system	System to include all components, connections, programming and equipment to provide a complete, automatic fire protection and detection system including, but not limited to, fire alarm control panel(s), detection devices, annunciation devices, automated ventilation, suppression piping and agents, and enclosures. The fire suppression system will be installed in the enclosure but will not be connected to on the site level or by the general contractor. Each battery enclosure will possess a mini-Fire Alarm Control Panel (FACP), however, an additional Fire Alarm Control Center Panel (FCC) will need to be procured for cluster and site-level control of the enclosure FACPs. Final site level fire alarm requirements shall be approved by local AHJ and implemented by Contractor as required.
Enclosure Fire Rating	1 hour or per local requirements
Heat/Smoke Detectors	Heat and smoke detectors shall be part of fire detection system. Refer to Exhibit D.5.3 (<i>BESS Specifications</i>).
Suppression Agent (Manual Sprinkler)	Refer to Exhibit D.5.3 (<i>BESS Specifications</i>).
Off-Gas Detection	Refer to Exhibit D.5.3 (<i>BESS Specifications</i>).
Active Venting (provide option)	Refer to exhibit D.5.3 (<i>BESS Specifications</i>). Integrated into controls with options for manual activation.
Horn/Lights	Horn not required. Lights on BESS Enclosure must be visible from access road.

13.1.9 Requirements for battery modules:

- (1) Battery modules shall be provided with a permanent label in accordance with Section 2.6.
- (2) Battery cells shall be UL1642 (Lithium-Ion Batteries), UL-9540A (Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems), and UL 2591 (Component certification for lithium-ion battery cell separators) listed.
- (3) Module-to-module terminations shall utilize supplier provided quick disconnects or allow for NEMA standard connections. Any cables and connectors provided by manufacturer shall be sized in accordance with the NEC and UL listed where applicable.
- (4) Positive and negative string-level post connections shall accept stranded copper conductor, NEMA standard connections, or supplier provided quick disconnects. Connections shall be sized to accept conductor rated per NEC requirements. Any cables and connectors provided by manufacturer shall be sized in accordance with the NEC and UL listed where applicable.

- (5) Battery module enclosure shall be designed to be easily inserted and removed from the supplier provided battery rack. This may include non-tooled locking mechanisms, handles or lifting points, and/or track sliding.
- (6) Battery modules utilizing an open rack design shall provide fans directing air flow over the battery module such that a hot/cold aisle arrangement can be designed.
- (7) Battery cells shall incorporate safety features such as burst disks, replaceable fuses, and positive temperature coefficient switches.
- (8) All battery modules shall be physically mounted in a battery rack system.
 - (a) Battery rack system shall be designed to withstand the Project Site conditions noted in Exhibit D.2 (*Project Site Data*).
 - (b) Battery rack system manufacturer shall have ISO 9001 manufacturing capability.
 - (c) Steel framing shall be hot-dipped galvanized after fabrication in accordance with ASTM A123/A123M for fabricated products and ASTM A153/153M for hardware. Any subsequent process that causes damage or otherwise removes the galvanized coating shall be repaired in accordance with ASTM A780/A780M.
 - (d) Cold formed sheet steel shall be in accordance with the requirements of one of the following standards ASTM A1008 / A1008M, ASTM A1003/A1003M, ASTM A653/A653M or ASTM A792 with a coating thickness of G90.
 - (e) The dimensions and design of the battery rack systems shall be compatible with the battery modules selected for the Project.
 - (f) Metal battery racks shall be bonded or provide provisions for bonding of all components.
 - (g) The battery rack system shall have provisions to be grounded to the grounding loop of the Project Site. If a grounding bond incorporates two dissimilar metals such as tin-plated copper to steel, the joint shall be accomplished with the inclusion of a Belleville washer to prevent loosening or shall be otherwise installed according to manufacturer directions.
 - (h) All outdoor grounding connectors within 18 inches of finished grade shall be UL listed for direct burial. All grounding hardware shall utilize stainless steel, bronze, or copper hardware and be compatible for its application and environment. All grounding hardware shall be submitted to Owner for review and approval during design phase.

- (i) Battery rack systems shall be factory pre-assembled into vertical sections. Rack dimensions shall be manufacturer's standard, designed for installation into a building or environmental enclosure arranged in back-to-back rows. Racks shall include all bracing required for the site seismic conditions and to ensure racks cannot tip during module installation. Racks shall be suitable for installation directly onto a finished concrete floor or electrical enclosure floor. Racks shall be anchored using drilled concrete anchors and leveling shims as required. Rack design shall include provisions to protect personnel from inadvertent contact with exposed energized parts, such as ventilated doors or insulated covers over live parts.
 - (j) Each rack section (or pair of sections for long duration systems) shall include a load-break disconnecting means to allow isolation of the rack's modules from the DC bus by the BMS.
- (9) All battery modules shall be interchangeable in regard to size and output voltage rating as to allow any module to be inserted in place of any other module at the Project site. This shall include interchangeable replacements as needed through the design life of the BESS.
 - (10) Battery modules shall be provided in a containerized system, that includes, but is not limited to the battery modules, battery racks, module interconnections, DC disconnects, battery thermal management system / HVAC, etc.

13.1.10 Requirements for containerized BESS:

- (1) Containers shall be shipped fully assembled to the extent practical, except for loading of the battery modules in the field.
- (2) Battery thermal management / air conditioning units may be removed for shipment if required.
- (3) All materials shall be non-flammable.
- (4) Occupancy Class
 - (a) Containerized systems shall be classified as equipment enclosures rather than occupiable buildings.
 - (b) The layout of equipment in containerized systems shall be such that personnel cannot occupy the enclosure.
 - (c) Access to battery modules and other equipment shall be via doors arranged along the length of the container such that personnel have adequate working space and are not required to enter the container to perform maintenance.
- (5) Windows
 - (a) Viewing windows that allow the main DC disconnect position to be viewed or thermal / infrared viewing windows for monitoring the temperature of connections or components are allowed.
- (6) Doors

- (a) Doors are not required for personnel ingress/egress.
 - (b) Doors for equipment access should be provided along the long sides of the container. Doors arranged in “French Door” fashion are preferred.
 - (c) Door opening width shall be as required to provide access to battery racks for module installation and removal.
 - (d) Doors shall be lockable and keyed alike. Door lock hardware shall be tamper resistant. Locks shall incorporate security features such as hardened alloys for drill or grinder resistance, shackle guards to provide protection against bolt cutters being used to remove them, cover / hood over the lock, etc.
 - (e) Exterior hardware shall be stainless steel.
 - (f) It is preferred that breakers or disconnects be able to be operated without opening doors. Breakers and disconnects shall be padlockable in the disconnect position.
 - (g) Doors with ventilation openings shall include additional security features on the rear of the door ventilation area such as bars to block forced entrance through the ventilation area on the door.
- (7) Fire Detection and Suppression
- (a) Containerized BESS systems shall comply with all applicable fire and building codes including NFPA 855 (Standard for the Installation of Stationary Energy Storage Systems).
 - (b) Fire detection schemes shall incorporate early off-gas detection and interlock to shut down affected BESS equipment prior to fire or smoke detection are encouraged.
 - (c) BESS system shall be designed and constructed to take the recommendations noted in Exhibit A.2.3 (*Lesson Learned - Battery Energy Storage System Cascading Thermal Runaway*) including, but not limited to the following:
 - 1. Work with and/or select a BESS supplier to minimize or eliminate battery cell-to-cell and module-to-module heat transfer to stop battery thermal runaway.
 - 2. Implement fire detection and suppression system designs that will fully manage a thermal runaway.
 - 3. Include monitoring and reporting of flammable gas concentrations with ventilation systems to mitigate the flammable gas concentrations.
 - (d) Contractor shall perform a hazard mitigation analysis that includes a review of the BESS UL 9540a test data. The analysis shall be performed by a registered fire protection engineer. This report shall be provided to Owner for review. The fire protection engineer shall provide Owner with a pre-incident guide (per NFPA 1620) specific to the Project that outlines the hazards and response tactics that should be employed during an incident.

1. Prior to placing the BESS in service, a familiarization tour shall be conducted with local fire and emergency services along with any specialized units (e.g. HAZMAT) who may respond during an incident. This tour shall include supplying fire and emergency services with the pre-incident guide developed for the BESS system.
- (8) Container shall include a thermal management system to maintain the battery modules and any other instruments or components with the manufacturers specifications. HVAC equipment with a minimum SEER rating of 16 shall be utilized.
- (9) Thermal Management system utilized for the batteries shall be liquid cooled.
 - (a) Refer to Exhibit D.5.3 for other Thermal Management requirements.
- (10) Container shall have provisions for equipment removal and replacement.
- (11) Container shall have adequate task lighting to perform all maintenance activities.
- (12) Container shall be configured to have no roof penetrations of any kind, except for HVAC equipment needs, if any.
- (13) Container manufacturer shall provide detailed engineering design drawings and calculations complying with the requirements of the applicable building code(s) and local and state laws that have jurisdiction where the building will be delivered and erected. Drawings shall be stamped by a Professional Engineer registered in the Project state and are subject to Owner review and approval.
- (14) Container shall have air terminal lightning protection in accordance with NFPA 780 standards.
- (15) Container shall have a means of prohibiting access when energized.
- (16) Owner shall have the option to conduct a factory visit for inspection of the manufacturing/assembly process and inspection of at least one containerized battery module system. This shall take place before the shipment of the first unit to the Project Site. Owner shall pay all its own costs associated with this visit.

13.1.11 Requirements for Battery Management System (BMS):

- (1) The Buyer shall have the ability to access all data provided by the Battery Management System (BMS) through the site controller and/or Human Machine Interface (HMI) and all data shall be logged for a minimum of 6 months with the appropriate resolution required for Original Equipment Manufacturer (OEM) warranty fulfillment. Contractor shall provide training on the BMS and provide login access to the Buyer prior to the Warranty Period ending so that the Buyer can properly maintain and navigate the BMS through the life of the Project. Primary functions include but are not limited to:
 - (a) Monitoring at Cell, Module, and Rack Level:
 1. State of Charge (SOC)
 2. State of Health (SOH)

3. Voltage/Current
4. Temperature
5. Status
- (b) Protection of the Cell, Module, and Rack from:
 1. Overcurrent
 2. Over/under-voltage
 3. High/low temperatures
- (c) Charge/discharge management
- (d) Cell, Module, and Rack Balancing
- (e) Warning and alarms
- (f) Internal protective measures
- (g) Any other data relevant to battery warranty
- (h) HVAC or thermal management system operating status, setpoints, warnings and alarms.
- (i) Logs of operations
- (j) Management of any software versions
- (k) Cyber Security management of the BESS
- (l) Data exchange with the BESS
- (m) Safety assurance and monitoring for each site
- (2) The BMS shall be the battery OEM's standard product, providing the following functions, at a minimum:
 - (a) Measurement of battery operating parameters
 - (b) Measurement of battery cell voltages
 - (c) Measurement of battery cell temperatures
 - (d) Measurement of battery string current
 - (e) Measurement of battery string voltage
 - (f) Calculation of battery string State of Charge (SOC)
 - (g) Calculation of battery string State of Health (SOH).

- (h) Cell Balancing
 - (i) Battery Protection from the following:
 - 1. Cell under voltage
 - 2. Cell over temperature
 - 3. Cell under temperature
 - 4. Cell over current
 - (j) Pre-charge protection
- (3) At a minimum, the BMS shall monitor the data points listed in **Error! Reference source not found.**3. The BMS shall monitor all data points required and store data a minimum of 24 hours of pre- and post- event (or as required by the battery OEM) for root cause / post-mortem analysis and warranty claim disposition. Data points shall also be transmitted to the site controller / Historian for long term data storage and retrieval.
- (4) Rack BMS to System BMS communication protocol shall be manufacturer standard.
- (5) Rack and System BM should provide the following protection and supply associated alarms and warnings as applicable:
- (a) Overcurrent
 - (b) Over/under-voltage
 - (c) High/low temperatures
 - (d) Communication issues
 - (e) Other abnormalities
- (6) BMS Supplier shall manage all software/firmware versions of the installed devices during system and project integration and provide associated point maps for the delivered system revision to the project integrators
- (7) System BMS to site controller communication protocol shall be coordinated with the site Communication System / SCADA.

Table 13-3 – Minimum Monitored BMS Parameters

Description	Points to be Monitored. <i>Sample interval: 1 second</i>
System Level	Fault Status
	Alarm Status
	System Current
	System Voltage
Each Rack or String	Rack Voltage

Description	Points to be Monitored. <i>Sample interval: 1 second</i>
	Rack Current
	Rack SOC
	Rack SOH
	Rack Fault Status
	Rack Alarm Status
	Maximum Cell Voltage Value
	Maximum Cell Voltage Position
	Minimum Cell Voltage Value
	Minimum Cell Voltage Position
	Maximum Cell Temperature Value
	Maximum Cell Temperature Position
	Minimum Cell Temperature Value
	Minimum Cell Temperature Position
	Rack DC Switch Status

13.1.12 Requirements for power conversion systems:

- (1) See Section 5.1.17.
- (2) The PCS shall meet the requirements of Table 13-4:

Table 13-4 – Minimum PCS Functional Specifications

Description	Requirements
General	The PCS shall be capable of operating in all four power quadrants at rated power (kVA/MVA). Any combination of kW/MW and kVAR/MVAR output shall be possible that is consistent with the BESS's rated power at all levels of SOC. PCS shall be designed to operate using grid power provided through the auxiliary power system and shall not use power from the battery. The PCS, in conjunction with the Master Site Controller (MSC), shall be capable of completely automatic, unattended operation, including self-protection, synchronizing and paralleling with the utility, and disconnect functions. The control of the PCS shall be integrated with the EMS. PCS shall also include all necessary self-protective features and self-diagnostic features to protect itself from damage in the event of component failure or from parameters beyond safe range due to internal or external causes. The self-protective features shall not allow the PCS to be operated in a manner that may be unsafe or damaging. Faults due to malfunctions within the PCS, including commutation failures, shall be cleared by the PCS protection device(s).
Reactive Capability	Inverters shall be capable of operation between 0.9 lagging to 0.9 leading power factor with active power de-rating
Charging Method	Constant current / constant voltage
Discharging Method	Constant current
Cooling	Forced Air or Liquid Cooled
Enclosure Protection	IP 65 or above
Inverter Overload Capability	120% of rated power (10 seconds maximum)
Insulation Coordination	Overvoltage Category III up to 3,000 m
Minimum Peak Efficiency	98.9%
Minimum Full Load Efficiency	98.5%

13.1.13 Requirements for BESS Energy Management System (BESS) / SCADA:

- (1) Refer to Exhibits A.7 (BESS EMS Scope of Work), and Exhibit D.5.3 (BESS Technology Specifications) for EMS requirements. The Contractor is responsible for the design, procurement and installation of the required BESS EMS control system. The EMS shall be designed to provide for automatic, unattended operation of the system. However, the control system design shall provide for local manual operation, remote operation, dispatch of the system from remote SCADA system, or a local portal. All modes of operation and setpoints shall be remotely adjustable from remote locations. Both remote and local control should:

- (a) Allow changes in settings and control modes.
- (b) POI data (not limited to): MW, MVar, voltages, currents.
- (c) Inverter data (not limited to): MW, MVar, voltages, currents.
- (d) Battery System data (not limited to): SOC, SOH, MW, voltages, currents.
- (e) Battery Module level data (not limited to): SOC, SOH, temperature, current, voltage, etc.
- (f) Have ability to be the MSC for real and reactive power commands.
- (g) Provide HVAC status per unit and alarm on units de-rated or off-line based on a loss of colling or high ambient temperature.
- (h) Provide HVAC on/off control.

Note: in addition to this Section, the EMS / SCADA provider shall coordinate other Project requirements with applicable sections of the Agreement, inclusive of other Exhibits.

(2) General

- (a) The BESS system supplied under these specifications will be used by the Owner to operate under various operating modes. The site controller shall coordinate with the PCS and BMS to perform the functions specified in this section.
- (b) The site controller shall interface with the Owner's SCADA system including the remote dispatch system. Contractor shall coordinate with owner as required.
- (c) The site controller shall aggregate the operation of the individual PCS such that the BESS may be remotely operated as if a single asset. The site controller / SCADA shall include a data historian function able to store a minimum of 1 month of required BESS operating data locally. The site controller / SCADA shall include a local HMI station and shall be located in the Project Substation control building.
- (d) The site controller hardware and application software shall be of proven technology and shall have been installed in similar applications for a minimum of one (1) year.

(3) Functions and operating modes

- (a) At a minimum, the BESS site controller shall provide the following BESS functions and operating mode capabilities that may be enabled.
 - 1. Interactive functions.
 - a. Monitoring function – the BESS site controller provides nameplate, configuration, status, measurements, and other requested data.
 - b. Disconnect/connect function – disconnect or connect the BESS from the grid at its electrical connection point (“ECP”).

- c. Cease to energize and return to service – cease any current flow at the ECP or point of common coupling (“PCC”) or allow current flow at the ECP or PCC
2. Emergency Modes.
- a. Low/high voltage ride-through mode – The BESS rides through temporary fluctuations in voltage.
 - b. Low/high Frequency Ride-Through Mode – The BESS rides through temporary fluctuations in frequency.
 - c. Frequency-Watt Emergency Mode – The BESS responds to large frequency excursions during H/LFRT events at a referenced ECP by changing its charging or discharging rate.
 - d. Dynamic Reactive Current Support Mode – The BESS reacts against rapid voltage changes (spikes and sags) to provide dynamic system stabilization.
 - e. Dynamic Volt-Watt Mode – The BESS system dynamically absorbs or produces additional watts.
3. Active Power Modes.
- a. Active Power Limit Mode – Limits the discharging and / or charging level of the BESS based on the referenced ECP.
 - b. Charge / Discharge Mode – Set the BESS to charge or discharge at the Referenced ECP.
 - c. Coordinated Charge / Discharge Management Mode – The BESS determines when and how fast to charge or discharge so long as it meets its target state of charge level obligation by the specified time.
 - d. Peak Power Limiting Mode – The ESS limits the load at the Referenced ECP after it exceeds a threshold target power level.
 - e. Load Following Mode – The BESS counteracts the load by a percentage at the Referenced ECP, after it starts to exceed threshold target power level.
 - f. Generation Following Mode – The charging and / or discharging of the BESS counteracts generation power at the referenced ECP.
 - g. Automatic Generation Control (AGC) Mode – The BESS responds to raise and lower power level requests to provide frequency regulation support.
 - h. Active Power Smoothing Mode – The BESS produces or absorbs Active Power in order to smooth the changes in the power level at the Referenced ECP.
 - i. Volt-Watt Mode – The BESS responds to changes in the voltage at the Referenced ECP by changing its charging or discharging rate.

- j. Frequency-Watt Mode – The BESS responds to changes in frequency at the referenced ECP by changing its charging or discharging rate based on frequency deviations from nominal as a means for countering those frequency deviations.
- 4. Reactive Power Modes
 - a. Constant VARs Mode – The BESS VAR's are set to a fixed value.
 - b. Fixed Power Factor Mode – The BESS power factor is set to a fixed value.
 - c. Volt-VAR Control Mode – The BESS responds to changes in voltage at the Referenced ECP by supplying or absorbing VARs in order to maintain the desired voltage level.
 - d. Watt-Var Mode – The BESS responds to changes in power at the referenced ECP by changing its power factor.
 - e. Power Factor Correction Mode – The BESS supplies or absorbs VARs to hold the power factor at the Referenced ECP.
- 5. Additional Capabilities
 - a. Pricing Signal Mode – The BESS uses the pricing signal for determining other actions
 - b. Scheduling of Power Settings and Modes – The BESS follows the schedule which consists of a time offset (specified as a number of seconds) from the start of the schedule and is associated with:
 - i. A Power system setting.
 - ii. The enabling/disabling of an operational mode.
 - iii. A price signal.
 - c. Historical Information – Detailed measurement and performance data which may be valuable to record in an operational historian.
 - d. Provide Black Start Capability – Ability to start without grid power and the ability to add significant load in segmented groups.
- (4) Functions to be implemented in coordination with Owner include the Functions and Modes listed below. In addition, Contractor is responsible to implement all functions and modes required for NERC compliance.
 - (a) Interactive Functions:
 - 1. Monitoring
 - 2. Disconnect/Connect
 - 3. Cease to Energize and Return to Service

- (b) Emergency Modes. – Contractor to coordinate implementation of Emergency Modes as required to comply with the applicable NERC standards.
 - 1. Low/High Voltage Ride-Through Mode
 - 2. Low/High Frequency Ride-Through Mode
 - 3. Frequency-Watt Emergency Mode
 - 4. Dynamic Reactive Current Support Mode
 - 5. Dynamic Volt-Watt Mode
- (c) Active Power Mode:
 - 1. Active Power Limit Mode
 - 2. Charge / Discharge Mode
 - 3. Coordinated Charge / Discharge Management Mode
 - 4. Peak Power Limiting Mode
 - 5. Load Following Mode
 - 6. Generation Following Mode
 - 7. Automatic Generation Control (AGC) Mode
 - 8. Active Power Smoothing Mode
 - 9. Volt-Watt Mode
 - 10. Frequency-Watt Mode
- (d) Reactive Power Modes:
 - 1. Constant VARs Mode
 - 2. Fixed Power Factor Mode
 - 3. Volt-VAR Control Mode
 - 4. Watt-Var Mode
 - 5. Power Factor Correction Mode
- (e) Additional Capabilities
 - 1. Pricing Signal Mode
 - 2. Scheduling of Power Settings and Modes: a power system setting, the enabling/disabling of an operational mode, and a price signal.

3. Historical Information

4. Provide Black Start Capability

13.1.14 Requirements for Backup Auxiliary Loads:

- (1) Auxiliary load includes all loads necessary to operate and protect the BESS, such as: controls, PCS, cooling systems, fans, pumps, life safety, fire mitigation, back-up power, instrumentation, controls, communications and heaters.
- (2) Auxiliary loads are internal to the system and will be measured separately from the BESS nameplate capacity.
- (3) Backup auxiliary power may also be used for temporary construction power.
- (4) Backup auxiliary power source shall be integrated in the base design of the project site which is capable of powering the critical components including but not limited to thermal management, fire protection, monitoring and control systems upon loss of the normal auxiliary power source.
- (5) The system design needs shall account for all expected auxiliary loads such that the BESS system design capacity is maintained at the POI after auxiliary loads of the battery enclosures and BESS are applied.

13.1.15 Requirements for grounding:

- (1) Grounding shall be designed and provided as required by the NEC, NESC, IEEE 80 and local code requirements. Ground grids or ground loops shall be provided under/around major electrical equipment (step-up transformers, medium voltage switchgear, inverters, fence, etc.).
- (2) All equipment ground conductors shall be copper. Grounding electrodes may be copper or copper-clad steel. Cable may be bare if exposed or protected by a conduit sleeve and green insulated if in a raceway along with the circuit conductors.
- (3) Ground connections shall be exothermic or mechanical and acceptable for copper conductor termination. All exposed grounding connections within 18 inches of grade shall be listed for direct burial. All exposed grounding connections more than 18 inches above grade shall use materials compatible for the exposed application.
- (4) A grounding electrode system consisting of a ring shall be installed at each power conversion system and shall consist of bare copper or copper-clad steel buried below grade, sized and located according to the Project Substation grounding study. Four (4) ¾-inch by 10-foot minimum copper-clad steel ground rods shall be placed equidistant along the ring. Below grade connections shall be exothermic. Ground grid connections to equipment shall be bolted to facilitate separation of grounds for continuity testing and ground mat testing. Ground electrode cable size shall be such to not allow ground loop resistance to exceed requirements per the NESC.
- (5) Equipment grounding conductors shall be routed with the phase conductors.
- (6) Module mounting structure and combiner boxes shall be grounded per NEC requirements.

- (7) Transformers and inverters/PCS units shall be bonded to the ground ring.
- (8) One (1) ground test well shall be furnished at each PCS. A flush cover shall expose one ground rod and cable with mechanical cable to rod connectors to allow disconnection for testing purposes.
- (9) Grounding connections shall be tested in accordance with the NETA ATS standards.

13.1.16 Requirements for labeling and identification:

- (1) Labels for equipment shall be provided, at a minimum, in accordance with the specifications as noted in Section 2.6.

13.2 Submittals

13.2.1 Contractor shall provide a grounding study for the BESS. Such study may be included as part of the Project Substation grounding study.

13.2.2 Contractor shall provide a BESS integration plan for the coordination, integration, and implementation of the BESS into the protection and controls of the Project Substation.

13.2.3 Contractor shall provide data sheets for the modules from the manufacturer for Owner approval, including nominal module power and energy ratings at specific environmental conditions, power and energy rating tolerance, temperature coefficients, and voltage, current, and environmental ratings. Contractor to provide performance curves for the items listed below. Data should be provided under multiple variables such as ambient temperatures, C-rates, elevation, cycles / state of health, and battery age.

- (1) Energy capacity / degradation
 - (a) DC design capacity
 - (b) Useable / Guaranteed megawatts
- (2) Round-trip efficiency
- (3) Charge / discharge rates
- (4) Cycle life / energy throughput
- (5) Heat loads
- (6) Operating voltage
- (7) Operating current
- (8) Self-discharge
- (9) Available short circuit current and duration

13.2.4 Contractor shall provide a minimum 5-year warranty plan for the BESS, including the assumptions for degradation and operation over the warranty period.

13.2.5 Contractor shall provide a complete recommended spare parts list for the BESS. Such list shall include recommended quantities, part / model numbers, and nominal pricing.

13.2.6 Contractor shall submit all manufacturer's product sheets (material cut sheets), warranties, and operations and maintenance manuals (as applicable) for all permanently-installed equipment and materials. This shall include, but is not limited to, HVAC, breakers, cabling, PCS, transformers, battery units, racking system, and fire protection system.

13.3 Battery Energy Storage System

13.3.1 Contractor shall design, furnish, construct, and install the BESS in conformance with the minimum requirements set forth herein.

(1) Contractor shall furnish all labor, equipment, and materials that are necessary for a complete, fully-functional, and safe BESS system, including, but not limited to, battery modules, PCS, DC cabling, transformers, etc.

13.3.2 Contractor shall furnish and install fencing and gates at the BESS.

(1) The BESS perimeter shall be fenced. The fence shall be tied into the grounding grid, as applicable.

(2) At least two (2) vehicle gates located on opposite sides and one (1) pedestrian gate shall be installed at the BESS. If co-located with the Project Substation, the gates for the Project Substation may be utilized for access to the BESS.

(3) All fencing and gates shall comply with the minimum specifications in Section 4.1.10 herein.

13.3.3 Contractor shall offload, inspect, and install the BESS in accordance with the BESS specifications.

13.3.4 Contractor shall integrate the BESS systems and controls into the Project Substation protection and control schemes and shall actively coordinate with the BESS supplier and Owner with respect to such work.

13.3.5 The BESS shall be located within the Project Substation footprint.

13.3.6 The BESS shall be coupled to the AC side of the PV Array or Wind Project (if applicable) and shall allow for charging/discharging from the grid.

13.4 Testing and Quality Control

13.4.1 Contractor shall provide reports and outputs of functional tests performed during integration of the BESS.

13.4.2 Copies of testing reports (including a summary of testing procedures and acceptance criteria) shall be submitted to Owner within 10 days of completing such test.

13.4.3 Requirements for capacity and functional testing: TBD

Exhibit A.1 – Scope of Work, Wind, Solar, BESS
Xcel Draft (rev A), 20240426

14.0 WIND TURBINE ERECTION SERVICES

14.1 General Provisions

14.1.1 Contractor shall meet with Owner and Turbine Supplier prior to installation of the first Wind Turbine to participate in an in-person page turn of the Wind Turbine installation manual.

14.1.2 Contractor shall clean and wash all external Wind Turbine surfaces prior to erection to remove dirt generated by delivery and on-site storage. All exterior Wind Turbine surfaces shall be cleaned via pressure washing; light brushing with mild, biodegradable detergent shall be performed as necessary. Following cleaning, all surfaces shall appear clean at a minimum distance of 50 feet. All washing, including runoff, shall be in accordance with the Applicable Permits and other Requirements.

14.1.3 Wind Turbine erection shall follow a “reference” approach, wherein complete erection of the first Wind Turbine of each Wind Turbine model type shall occur prior to erecting any subsequent Wind Turbines of that model. Such initial Wind Turbine erection shall be reviewed and approved by Owner and Turbine Supplier before continuing Wind Turbine erection activities, and such approval shall not be unreasonably withheld or delayed. The “reference” Wind Turbine, once accepted, shall serve as a model finished product for all subsequent Wind Turbine erections.

14.1.4 Wind days shall be actively minimized by scheduling Wind Turbine erection activities at times of day when wind speeds are projected to be lowest.

14.1.5 Wind Turbines shall be erected such that the tower door orientation is downwind of the of the prevailing wind direction.

14.1.6 Each crane, including the main erection crane(s) and any base/mid crane(s), shall be equipped with redundant anemometers at Wind Turbine hub height for measurement of wind speeds. Wind speeds shall be recorded from these instruments prior to the start of all lifting activities, and measurements shall be recorded on a Contractor-furnished data logger. Handheld anemometers shall also be furnished to determine safe wind speeds for all other operations. All such wind data shall be shared with Owner upon request.

14.1.7 Transportation, offloading, storage, and erection of Wind Turbines shall be performed in accordance with the applicable instructions provided by Turbine Supplier and the specifications provided herein, including critical lift plans.

14.1.8 Mechanical completion of each Wind Turbine, including documentation of progress on Turbine Supplier-furnished forms, shall be successfully achieved in accordance with the instructions set forth in the installation manual and mechanical completion checklists provided by Turbine Supplier.

14.1.9 All rigging utilized for the transportation, offloading, or erection of Wind Turbines shall be rated; inspected daily; and load tested in accordance with Applicable Standards or other more rigorous requirements set forth in the HSSE Plan. Inspection reports shall be maintained at the Project Site and available for review by Owner.

14.1.10 Copies of testing certificates and calibration records for all tooling shall be maintained at the Project Site and available for review by Owner.

14.2 Submittals

14.2.1 Not used.

14.3 Wind Turbine Deliveries

14.3.1 Contractor shall coordinate with Turbine Supplier on a test run for Wind Turbine deliveries at the Project Site by use of non-loaded trucks to demonstrate that road dimensions will be appropriate for successfully delivering components to the Wind Turbine Pads. Such trial run will be performed by Turbine Supplier prior to commencing deliveries of Wind Turbine equipment to the Project Site. Any non-compliant areas shall be immediately corrected by Contractor.

14.3.2 Contractor shall furnish and operate assist vehicles as necessary for delivery and movement of Wind Turbines at and within the Project Site.

14.3.3 Contractor shall receive, visually inspect, and inventory all deliveries of Wind Turbine equipment (including Wind Turbines, transformers, down-tower converters, switchgear, service lifts, Turbine SCADA System, Special Tools, and shipping containers / Owner-Supplied Equipment to the Project Site. Contractor shall submit reports to Owner within 24 hours of delivery regarding receipt, inspection, and inventorying of all such deliveries, including any damage identified.

14.3.4 Contractor shall offload, stage, and actively coordinate deliveries and offload with Turbine Supplier.

14.3.5 Contractor shall furnish and maintain protective tarps (or similar) to eliminate unwanted materials from entering Wind Turbine equipment after removal of any shrink wrapping from the shipping process.

14.3.6 Contractor shall furnish and install adequate measures to prevent Wind Turbine equipment from being blown over or otherwise damaged while stored at the Project Site. This shall include tie down of blades and other similar measures. Such measures shall be consistent with Turbine Supplier requirements.

14.4 Wind Turbine Installation

14.4.1 Contractor shall apply touch-up paint as necessary to repair any damage to Wind Turbine equipment, including damage that occurred prior to or during Wind Turbine erection. Paint repair shall be performed in accordance with Turbine Supplier's requirements with Owner-approved paint.

14.4.2 Contractor shall assemble, install, construct, and erect all Wind Turbines, including all components, equipment, switchgear / down-tower assembly, stairs, service lifts, and other similar items, and including furnishing of the main crane(s) with suitable capacity for Wind Turbine erection and in strict compliance with Turbine Supplier's requirements and procedures.

- (1) Contractor shall furnish all labor, equipment (including rigging, tooling, hoisting equipment, and lifting devices), and materials that are necessary to assemble and install the Wind Turbines.
- (2) Contractor shall fabricate and furnish all anchor bolt template rings as required to support Wind Turbine installation.

- (3) Contractor shall install three precast 2-foot by 2-foot concrete paving pads at the base of the stairs matching the stair step height for each Wind Turbine. The surrounding gravel shall be graded to be flush with the top of the pads. The stair support legs shall be set on gravel, not on the paving pads .
- (4) Contractor shall grout, install, shim, and level all tower base sections, including providing all necessary grease, shim packs, leveling feet, and other necessary items or consumables.
- (5) Contractor shall provide all crane breakdowns, both partial and full, necessary to complete the Work.
- (6) Contractor shall furnish and install one (1) fire extinguisher (sized per the Applicable Standards and other Requirements) and one (1) fire extinguisher bracket in each maintenance vehicle / in each Wind Turbine, as required by local fire codes or other Requirements.
- (7) Contractor shall install the Wind Turbines at the locations specified per the component serial numbers as identified by the Turbine Supplier and/or design documents. Parts designated for a specific Wind Turbine location shall not be moved to another Wind Turbine location without explicit Owner approval.

14.4.3 Contractor shall install the electrical wiring and cabling in each Wind Turbine, including all necessary pulling, dressing, lugging, taping, splicing, and terminations, to interface with the Turbine Foundation.

- (1) Contractor shall furnish all labor, equipment, and materials that are necessary for the electrical connection of the Wind Turbines to the Collection System Circuits, including all down-tower cabling.
 - (a) All cabling and connectors on the Wind Turbine-side of the down-tower switchgear shall be furnished and installed by Contractor or Turbine Supplier.
 - (b) All cabling and connectors on the grid-side of the down-tower switchgear shall be furnished and installed by Contractor.
- (2) Contractor shall install the grounding system in each Wind Turbine, including grounding of Wind Turbine stairs.
- (3) Contractor shall furnish and install (a) all temporary Turbine obstruction lights, including wiring and mounting brackets and (b) all permanent Turbine obstruction lights, including wiring and mounting brackets. Obstruction lights shall be (i) the model as determined in Owner's *Determination of No Hazard to Air Navigation* letter from the FAA (ii) in compliance with the Requirements, including US DOT-FAA Advisory Circular No. AC 70/7460-1K: *Obstruction Marking and Lighting*; (iii) provided with an uninterruptible power supply capable of supplying back-up power for at least one (1) hour; (iv) programmed to blink in unison, including with those aviation obstruction lights that are installed on meteorological towers (iv) compatible with the ADLS operating system; and (v) night vision goggle compliant. Contractor shall remove all temporary FAA lights when no longer needed.

14.4.4 Contractor shall provide any required Wind Turbine maintenance, including any necessary generators and fuel, prior to successfully achieving Wind Turbine Mechanical Completion.

14.4.5 Contractor shall successfully achieve Wind Turbine Mechanical Completion of each Wind Turbine, including documentation of progress on Turbine Supplier-supplied forms for each Wind Turbine, in accordance with the applicable instructions set forth in the manufacturer's installation manual and mechanical completion checklists .

14.4.6 Contractor shall provide a final broom cleaning of each Wind Turbine prior to handoff following Wind Turbine Mechanical Completion. Further, each Wind Turbine should be reasonably clean and free from grease, oil, and other grime prior to Wind Turbine Mechanical Completion.

14.4.7 Contractor shall collect and repackage all returnable items on loan from Turbine Supplier, including, but not limited to, shipping frames, delivery devices, brackets, lifting and rigging equipment, specialized tooling, and other returnable items. Contractor shall repackage all such items inside emptied parts containers per instructions provided by Turbine Supplier and shall provide inventory tracking and packing lists for such repackaged items. Contractor shall load all such repackaged items on transport trucks as made available by Turbine Supplier at the Project Site per the schedule set forth in the Agreement. Contractor shall be responsible for moving all such items from the Wind Turbine Pads to the designated loading area(s) for transport as necessary.

14.4.8 Contractor shall provide qualified personnel to perform lock-out / tag-out, switching, and other similar activities during the commissioning of the Wind Turbines by Turbine Supplier up until Contractor's Substantial Completion.

14.5 Coordination

14.5.1 Contractor shall actively coordinate the sequence of Work with Owner and Owner's contractors (including Turbine Supplier) to support the Project Schedule.

14.5.2 Contractor shall coordinate with Turbine Supplier on the handoff following Wind Turbine Mechanical Completion. At a minimum, such coordination shall ensure that Turbine Supplier is aware that the respective Wind Turbine has successfully completed mechanical completion so that Turbine Supplier may commence inspection and commissioning activities. Additionally, Contractor shall share reasonable information with Turbine Supplier and turn over Wind Turbine access to Turbine Supplier as part of this coordination.

14.5.3 Contractor shall attend and actively participate in all Wind Turbine Mechanical Completion walk-downs with Turbine Supplier.

14.5.4 Contractor shall provide qualified support personnel to perform all lock-out-tag-out, switching, startup and testing activities in connection with Turbine Supplier's commissioning, start-up and testing of the Wind Turbines.

14.5.5 Contractor shall coordinate with Turbine Supplier on any termination of power or fiber optic cabling in Wind Turbines following Wind Turbine Mechanical Completion.

14.6 Testing and Quality Control

14.6.1 Contractor shall test the Wind Turbine tower electrical wiring and cabling. At a minimum, testing shall include the minimum requirements set forth below. All testing shall be performed by an independent, experienced third party.

- (1) All Wind Turbine electrical wiring shall be tested to demonstrate it meets stated design criteria and is fit for purpose.
- (2) All testing specified in the Applicable Standards, including NETA.
- (3) All testing reasonably recommended or required by the applicable equipment suppliers.
- (4) Structural works testing for grout properties, in accordance with Section 4.1.13 herein.
- (5) Visual inspection, insulation resistance testing, and continuity testing of the Turbine cabling as described in Section 5.4.1 herein.
- (6) Other testing set forth in the preliminary design documents in Exhibit B (*Preliminary Design Documents*).

14.6.2 All wind turbines will be commissioned and tested in strict compliance with the Turbine Supplier's requirements and procedures. Once all turbines are commissioned, the site shall operate at a 97% availability for 72 continuous hours without bypassing any normal operating parameters or controls, or manually resetting faults instead of resolving the root cause (auto resets performed by the turbine controller are allowed).

14.6.3 Gearbox oil in each turbine shall be sampled and analyzed to confirm the oil meets all Wind Turbine and oil manufacture specifications.

14.6.4 Contractor shall notify Owner of all testing schedules at least 30 days in advance of testing activities and copies of testing reports (including a summary of testing procedures and acceptance criteria) shall be submitted to Owner within 10 days of completing such test.

15.0 WIND - AIRCRAFT DETECTION LIGHTING SYSTEM

15.1 General Provisions

15.1.1 Requirements for ADLS civil and structural works:

- (1) All civil and structural works including, but not limited to, grading, structures, foundations, assemblies, and components for the ADLS shall be designed and constructed in accordance with the applicable specifications in Section 4.0 (*Civil / Structural Works*).

15.1.2 Radar towers shall be self-supported (non-guyed), galvanized lattice structures, each tower shall be designed and certified for the maximum wind and ice loading for the Project Site conditions.

15.1.3 All FAA obstruction lights shall be of the same make and model and consistent with the requirements in Section 14.4.3 and shall be compatible with the Wind Turbine and ADLS communication system, respectively.

15.1.4 The ADLS shall detect when an aircraft is at a defined outer perimeter around the Project Site and place the Wind Turbine aircraft obstruction lighting system in the "ON" state. When aircraft is outside of the defined perimeter of the Project Site, the ADLS system shall maintain the lights in the "OFF" state to minimize light pollution from the obstruction lighting.

- (1) A failure of the ADLS radar system shall be automatically detected and place the obstruction lights in the "ON" state.

15.1.5 Contractor shall perform all required studies and analyses of the Project Site for siting of the ADLS radar tower(s). Contractor shall propose a minimum of two potential locations for the ADLS Radar tower(s) within the Project boundary on participating landowner parcels. Potential locations shall provide adequate coverage for the entire Project site.

- (1) Contractor shall optimize the system considering items such as number of radar towers, radar tower height, available tower locations, distance from Collection System Circuits, etc. Contractor shall actively attempt to minimize the number of tower locations for the Project Site.
- (2) Contractor shall coordinate the selection of the radar tower location(s) that are studied / analyzed and the final selected radar tower location(s) with the Owner. Selection of the radar tower location(s) shall include a site visit by the ADLS manufacturer prior to finalizing the tower location(s) to confirm the suitability of each location.

15.1.6 Requirements for power supply:

- (1) Power for each radar shall be derived from the nearest Collection System Circuit or via a nearby Project source (e.g., O&M Building, Substation).
- (2) Power cable shall be installed at the same depth as the Project Collection System, unless otherwise explicitly approved by Owner.
- (3) The Collection System Circuit cable power the ADLS shall include a 34.5-kV junction box extending the 34.5-kV cable from the junction box to each radar tower location. An oil-filled, distribution style pad-mounted transformer (with the requirements as in Section 5.1.10) and low-voltage Nema 4 distribution panelboard shall be utilized to step down the power to the required low voltage of the radar tower to power the radar devices.
 - (a) The following exceptions are made to the requirements of the pad-mounted transformer as noted in Table 5-1:
 1. MV bushings: (2 or 3) 200A or (2 or 3) 600A.
 2. Phases: One (1) or Three (3)
 3. Vector Group HV/LV: HV = Ungrounded (Single phase or Delta) / LV = Grounded (single phase or Delta or Wye) as specified by Engineer of Record to provide the ADLS power requirements. Note that a three-phase transformer with a 34.5 kV Delta high voltage winding and a low voltage winding of 240V Delta with a center tap bonded to ground on one phase is allowed as a means of providing a solidly grounded low voltage system with both 240V three phase and 120/240V single phase power.
 4. Grounding: Solid (MV source, LV winding); un-grounded delta or single phase 34.5 kV (MV winding on transformer)
 5. Temperature gauge; Nitrogen pressure level indicator; Oil sampling valve; Nitrogen filling orifice: Option pricing for instrument being located in an external padlockable compartment is not required.

6. Infrared viewing windows with metal cover: Option pricing is not required.

15.1.7 Requirements for ADLS communications:

- (1) The ADLS communication system shall comply with the applicable requirements in Section 9.0 (Communication Systems).
- (2) The ADLS communication system shall be capable of controlling and communicating between the Wind Turbine obstruction lights and Owner's SCADA system with reporting/view-only function available at the Project Substation.
- (3) Communications for each tower location shall include the installation of direct buried fiber optic cable extending to the ADLS radar tower.
- (4) The ADLS fiber cable shall be co-located with the power cable.

15.1.8 Requirements for ADLS grounding:

- (1) The grounding system for the ADLS tower shall include a ground ring at least three (3) feet outside the perimeter fence of the ADLS tower and shall be bonded to the fence, tower, and electrical system. It shall be designed as required to meet acceptable levels of both touch and step potential and ground potential rise. See Section 6.1.26 for grounding system requirements.

15.1.9 Contractor shall comply with all applicable permits, the AHJ, the Federal Communications Commission ("FCC"), the Federal Aviation Administration ("FAA"), and any applicable rules established by the State where the project is located and the State Public Utilities Commission.

15.2 Submittals

15.2.1 Contractor shall submit for Owner review the locations to be studied / analyzed for each radar tower prior to proceeding with study of the location.

15.2.2 Contractor shall submit for Owner review the study / analysis for each radar location including, but not limited to the viewshed analysis for each location, required height of the radar tower structure.

15.2.3 Contractor shall prepare the ADLS design documents per the submittal schedule in Exhibit G.1 (Submittal Schedule) and containing the following information, at a minimum: (a) general arrangement plan and physical layout diagrams; (b) civil works drawings; (d) one-line diagrams, wiring diagrams, schematics. (e) communications block diagram, including all Communications System equipment, Owner-Supplied Equipment, and turbine manufacturer supplied equipment; (f) Communications System details, including HMI screen development, and fiber termination diagrams; (g) cable specifications and arrangements; (h) conduit and cable schedules; (i) panel schedules; (j) elevation drawings; (k) structural design documents, including foundation plans and details (with structural calculations to be provided with each set of foundation drawings); shop drawings showing fabrication of structural-steel components; details of cuts, connections, splices, camber, holes, and other pertinent data; indication of welds by standard AWS symbols, distinguishing between shop and field welds, and showing size, length, and type of each weld; indication of type, size, and length of bolts, distinguishing between shop and field bolts; mill test reports and structural steel properties, including chemical and physical; and fastener properties (mechanical/chemical), including bolts, nuts, and washers, and indicating coatings used to satisfy anchor bolt protection plan; (l) ground grid calculations; (m) ground grid plans; (n) conduit details; (o) fencing and gate details; (p) drawing index; (q) bill of materials; and (r) inspection, testing, and quality control requirements.

15.2.4 Contractor shall submit for Owner review and approval all manufacturer's product sheets (material cut sheets), warranties, and operations and maintenance manuals (as applicable) for all permanently installed equipment and materials, including but not limited to:

- (1) Radar system including its control system components and power requirements.
- (2) Obstruction lighting and lighting communication modules.
- (3) Radar tower.
- (4) Pad-mount transformer.
- (5) Distribution panelboard.

15.2.5 Contractor shall submit for Owner review a description of the data that is provided by the ADLS to the SCADA system and sample reports that can be generated by the SCADA system that provide the performance data for the ADLS.

15.2.6 Contractor shall provide a complete recommended spare parts list for the ADLS system. Such list shall include recommended quantities, part / model numbers, and nominal pricing.

15.2.7 Contractor shall submit all required permits or approvals obtained for the ADLS system for Owner review

15.3 Aircraft Detection Lighting System

15.3.1 Contractor shall design, furnish, construct, and install an ADLS, radar-controlled aircraft obstruction lighting system for the Project. The ADLS-controlled lighting system shall include, but not be limited to, the power supply, grounding / surge protection, communications, radar tower structure, fencing and gates, access roads, ADLS radar, Wind Turbine obstruction lighting, lighting control modules, ancillary equipment, and any other materials or work as necessary to provide a complete and functioning system.

15.3.2 Contractor shall furnish all labor, equipment, and materials that are necessary for a complete, fully-functional, and safe ADLS radar-controlled lighting system.

15.3.3 Contractor shall furnish and install fencing and gates around each ADLS radar.

- (1) A perimeter fence with at least one gate entrance shall surround the radar tower site including the tower, pad-mounted transformer, distribution panelboard, radar control and communications equipment.
- (2) Fencing shall be placed to allow a minimum of 10 feet of free space around the radar tower base including the transformer, panelboard, and radar control equipment. Fencing shall be grounded. The gate shall be a lockable swing-gate, sufficiently wide for light-duty vehicle access. See Section 4.1.10 for fencing and gate requirements.
- (3) The fenced area for the radar tower shall be covered throughout with at least six (6) inches of aggregate over a compacted subgrade, with aggregate extending at least one (1) foot beyond the fence in all directions and using the same aggregate material as the Site Access Roads.

15.3.4 Contractor shall furnish and install a 12-foot-wide road to each radar tower. Such roads shall be constructed of the same materials and with the same cross section as the Site Access Roads. See Section 4.1.6 for site road requirements.

15.4 Testing and Quality Control

15.4.1 Contractor testing plan for the ADLS system shall be submitted to Owner for review and approval. Contractor shall notify Owner of all testing schedules at least 30 days in advance of testing activities and copies of testing reports (including a summary of testing procedures and acceptance criteria) shall be submitted to Owner within 10 days of completing such test.

15.4.2 The ADLS system communication testing shall comply with Section 9.4.

15.4.3 Acceptance of the Work shall be determined by Owner only when the ADLS is fully commissioned including, but not limited to, remote access capability, ADLS report generation capability, and the ADLS is in compliance with the Requirements.

EXHIBIT A.2

APPLICABLE STANDARDS

1.0 GENERAL

- 1.1 The Applicable Standards shall include (i) each of the standards and industry codes listed below and (ii) each of the relevant standards and codes issued by the organizations listed below, and as they apply to the Work of developing, designing, constructing and operating a utility-scale solar PV, wind, or battery energy storage system. For the avoidance of doubt, any standards or industry codes not identified herein but pertinent to the Work shall also apply.
- 1.2 Unless otherwise specified, all engineering, procurement, and construction associated with the Project shall comply with the latest revision of all Applicable Standards, but not limited to, those listed herein. Any departure from the referenced codes and standards must be fully explained in writing and submitted for Owner's review and approval prior to implementation.
- 1.3 All specific standards applicable to pieces of equipment, structures, and/or buildings may not be listed herein. Specifications may describe the specific standards that may apply.
- 1.4 Any general standard or organization listed below shall be understood to include all relevant codes, standards, and/or guidelines under that particular standard or organization. For example, ACI shall include ACI 301, ACI 305, ACI 306, ACI 318, etc.
- 1.5 Unless otherwise specified herein, in the case of conflict between any Applicable Standards, the more stringent requirement shall apply.

2.0 DEFINITIONS

- 2.1 Unless defined in this exhibit, terms that begin with an upper case shall have the meaning defined in Exhibit A.1 (*Scope of Work*).

3.0 APPLICABLE STANDARDS

- 3.1 Applicable state requirements, including State Department of Transportation, Department of Environmental Quality, regional flood control districts, building codes, mechanical codes, etc.
- 3.2 Applicable local requirements including local building codes, plumbing codes, etc.
- 3.3 Applicable local utility and Independent System Operator or Balancing Authority requirements
- 3.4 Aluminum Association ("AA")
- 3.5 American Association of State Highway and Transportation Officials ("AASHTO")
- 3.6 American Concrete Institute ("ACI")
- 3.7 Americans with Disabilities Act ("ADA")
- 3.8 American Institute of Steel Construction ("AISC")
- 3.9 Association of Iron and Steel Engineers ("AISE")

- 3.10 American National Standards Institute (“ANSI”)
- 3.11 American Railway Engineering and Maintenance Association (“AREMA”)
- 3.12 American Society of Civil Engineers (“ASCE”)
- 3.13 American Society of Heating, Refrigeration, and Air Conditioning Engineers (“ASHRAE”)
- 3.14 American Society of Mechanical Engineers (“ASME”)
- 3.15 American Society of Nondestructive Testing (“ASNT”)
- 3.16 American Society of Testing and Materials (“ASTM”)
- 3.17 American Welding Society (“AWS”)
- 3.18 American Water Works Association (“AWWA”)
- 3.19 Building Industry Consulting Services, Intl (“BICSI”)
- 3.20 Code of Federal Regulations (“CFR”)
- 3.21 Crane Manufacturer Association of America (“CMAA”)
- 3.22 Concrete Reinforcing Steel Institute (“CRSI”)
- 3.23 Expansion Joint Manufacturers Association (“EJMA”)
- 3.24 United States Environmental Protection Agency (“EPA”)
- 3.25 Federal Aviation Agency, Department of Transportation (“FAA”)
- 3.26 Federal Energy Regulatory Commission (“FERC”)
- 3.27 Federal Highway Administration (“FHWA”)
- 3.28 Factory Mutual (“FM”)
- 3.29 IAPMO Uniform Plumbing Code
- 3.30 International Building Code (“IBC”)
- 3.31 Insulated Cable Engineering Association (“ICEA”)
- 3.32 Institute of Electrical and Electronic Engineers (“IEEE”)
- 3.33 International Electrotechnical Commission (“IEC”)
- 3.34 Illuminating Engineering Society (“IES”)
- 3.35 Instrument Society of America (“ISA”)

- 3.36 International Fire Code (“IFC”)
- 3.37 International Organization for Standardization (“ISO”)
- 3.38 National Association of Corrosion Engineers (“NACE”)
- 3.39 National Electric Code (“NEC”)
- 3.40 National Electrical Contractors Association (“NECA”)
- 3.41 National Electrical Installation Standards (“NEIS”)
- 3.42 National Electrical Manufacturers Association (“NEMA”)
- 3.43 National Environmental Balancing Bureau (“NEBB”)
- 3.44 National Institute of Standards and Technology (“NIST”) cyber security and the cyber security framework standards
- 3.45 North American Electric Reliability Corporation (“NERC”)
- 3.46 National Electric Safety Code (“NESC”)
- 3.47 National Electrical Testing Association (“NETA”)
- 3.48 National Fire Protection Association (“NFPA”) as referenced by IFC and IBC
- 3.49 National Safety Council (“NSC”)
- 3.50 Occupational Safety and Health Administration (“OSHA”)
- 3.51 Post-Tensioning Institute (“PTI”)
- 3.52 Scientific Apparatus Makers Association (“SAMA”)
- 3.53 Sheet Metal and Air Conditioning Contractors National Association (“SMACNA”)
- 3.54 Society for Protective Coatings (“SPC”)
- 3.55 Steel Structures Painting Council (“SSPC”)
- 3.56 Telecommunications Industry Association/Electronic Industries Association (“TIA/EIA”)
- 3.57 Underwriter’s Laboratories (“UL”)
- 3.58 Uniform Building Code (“UBC”) Defer to IBC unless the AHJ specifically requires the UBC.

NERC

NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

Reliability Guideline

Improvements to Interconnection Requirements
for BPS-Connected Inverter-Based Resources

September 2019

RELIABILITY | RESILIENCE | SECURITY



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Preface

Electricity is a key component of the fabric of modern society and the Electric Reliability Organization (ERO) Enterprise serves to strengthen that fabric. The vision for the ERO Enterprise, which is comprised of the North American Electric Reliability Corporation (NERC) and the six Regional Entities (REs), is a highly reliable and secure North American bulk power system (BPS). Our mission is to assure the effective and efficient reduction of risks to the reliability and security of the grid.

Reliability | Resilience | Security
Because nearly 400 million citizens in North America are counting on us

The North American BPS is divided into six RE boundaries as shown in the map and corresponding table below. The multicolored area denotes overlap as some load-serving entities participate in one Region while associated Transmission Owners/Operators participate in another.



MRO	Midwest Reliability Organization
NPCC	Northeast Power Coordinating Council
RF	ReliabilityFirst
SERC	SERC Reliability Corporation
Texas RE	Texas Reliability Entity
WECC	Western Electricity Coordinating Council

Preamble

It is in the public interest for NERC to develop guidelines that are useful for maintaining or enhancing the reliability of the Bulk Electric System (BES). The NERC technical committees (i.e., the Operating Committee (OC), Planning Committee (PC) and the Critical Infrastructure Protection Committee (CIPC)) are authorized per their charters¹ by the NERC Board of Trustees (Board) to develop reliability (OC and PC) and security guidelines (CIPC). These guidelines establish a voluntary code of practice on a particular topic for consideration and use by BES users, owners, and operators. These guidelines are coordinated by the technical committees and include the collective experience, expertise, and judgment of the industry. The objective of this reliability guideline is to distribute key practices and information on specific issues critical to maintaining the highest levels of BES reliability. Reliability guidelines are not to be used to provide binding norms or create parameters by which compliance to standards is monitored or enforced. While the incorporation of guideline practices are strictly voluntary, reviewing, revising, or developing a program with these practices is highly encouraged to promote and achieve the highest levels of reliability for the BES.

NERC, as the Federal Energy Regulatory Commission (FERC) certified ERO,² is responsible for the reliability of the BES and has a suite of tools to accomplish this responsibility, including, but not limited to, lessons learned, reliability and security guidelines, assessments and reports, the Event Analysis Program, the Compliance Monitoring and Enforcement Program, and mandatory Reliability Standards. Each entity as registered in the NERC compliance registry is responsible and accountable for maintaining reliability and compliance with the mandatory standards to maintain the reliability of their portions of the BES. Entities should review this guideline in detail in conjunction with the periodic review of their internal processes and procedures and make any needed changes to their procedures based on their system design, configuration and business practices.

¹ [http://www.nerc.com/comm/OC/Related%20Files%20DL/OC%20Charter%2020131011%20\(Clean\).pdf](http://www.nerc.com/comm/OC/Related%20Files%20DL/OC%20Charter%2020131011%20(Clean).pdf)
[http://www.nerc.com/comm/CIPC/Related%20Files%20DL/CIPC%20Charter%20\(2\)%20with%20BOT%20approval%20footer.pdf](http://www.nerc.com/comm/CIPC/Related%20Files%20DL/CIPC%20Charter%20(2)%20with%20BOT%20approval%20footer.pdf)
<http://www.nerc.com/comm/PC/Related%20Files%202013/PC%20Charter%20-%20Board%20Approved%20November%202013.pdf>

² <http://www.ferc.gov/whats-new/comm-meet/072006/E-5.pdf>

Executive Summary

Inverter-based resources pose benefits as well as challenges for the BPS,³ and the industry is faced with a growing penetration of these resources connected to the BPS. Inverter-based resource response to grid conditions is dominated by advanced controls programmed into the inverters and plant-level controls. These controls are configurable and capable of providing similar essential reliability services (ERSs) as synchronous generating resources. However, the challenge centers on ensuring clear and consistent performance specifications for these resources since their response is driven predominantly by controls rather than the physical design of the equipment.⁴ Past BPS disturbances that involved solar photovoltaic (PV) resources⁵ highlight the need for flexible yet clear requirements for inverter-based resources that ensure coordinated and effective interconnection of these resources in conjunction with other transmission-connected devices and synchronous generation.

This guideline serves as a resource for utilities to further develop those interconnection requirements. [Chapter 1](#) provides a summarization of recommended improvements to interconnection requirements for TOs to consider as they continually develop and enhance interconnection requirements per FAC-001-3 and interconnection study requirements per FAC-002-2.⁶ [Chapter 2](#) covers the performance aspects while [Chapter 3](#) cover modeling considerations (both key components to the interconnection process).

The reliance on local interconnection requirements continues to grow as the majority of newly interconnecting and proposed inverter-based generating resources are not subject to NERC Reliability Standards since they do not meet the size criteria as defined by the NERC BES definition.⁷ For example, many dispersed power-producing resources (i.e., wind and solar PV facilities) are either connecting at voltages less than 100 kV or with capacity less than 75 MVA. While each individual resource may not have a substantial impact to the BES, the overall response, behavior, and control of these resources impact BPS reliability and stability. It is therefore critical to have consistency across the generating fleet, and this guideline serves as a reference in this regard.

Further, this guideline references the IEEE P2800⁸ effort currently underway that is standardizing the performance and capability of newly interconnecting BPS-connected inverter-based resources. This guideline is intended to serve as a bridge solution until IEEE P2800 is fully developed, approved, and adopted by relevant jurisdiction. This is expected to take a couple years, so the guideline fills this gap by providing clear guidance for key reliability aspects in the TO interconnection requirements and can serve as a useful reference for the IEEE P2800 effort.

The scope of the recommendations provided in this guideline are applicable to TOs developing interconnection requirements for inverter-based resources connected to the BPS as well as Generator Owners (GOs), TPs, PCs, Reliability Coordinators (RCs), TOPs, and BAs. Consideration of distributed energy resources is outside the scope of this guideline.

³ https://www.nerc.com/files/glossary_of_terms.pdf

⁴ As has been the case with synchronous machines.

⁵ Namely the Blue Cut Fire, Canyon 2 Fire, Angeles Forest, and Palmdale Roost disturbances.

⁶ <https://www.nerc.com/pa/stand/Pages/ReliabilityStandardsUnitedStates.aspx?jurisdiction=United%20States>

⁷ <https://www.nerc.com/pa/RAPA/Pages/BES.aspx>

⁸ <https://standards.ieee.org/project/2800.html>.

Introduction

With the increasing penetration of inverter-based resources connected to the BPS, the industry is faced with interconnecting new technologies with new capabilities as well as a rapidly changing landscape. Unlike synchronous generators that predominantly respond to grid events with classical mechanics, inverter-based resource response is driven by advanced controls. These controls are configurable and capable of providing similar ERSs as synchronous generating resources; however, the industry is faced with providing sufficient guidance during the interconnection process to clearly describe what capabilities and control settings are desired. Due to the electronic nature of inverter-based resources, it is important to have flexible yet clear requirements for how these resources should behave. Leaving requirements vague or incomplete can lead to abnormal or even adverse⁹ behavior for the reliability of the BPS.

The NERC Inverter-based Resource Performance Task Force (IRPTF) published a guideline¹⁰ on recommended performance of BPS-connected inverter-based resources, providing industry with clear recommendations as to how BPS-connected inverter-based resources should behave. However, that guideline is voluntary in nature, and TOs, Transmission Planners (TPs), Planning Coordinators (PCs), and other BPS reliability entities have raised questions as to how the recommendations in that guideline can be translated into interconnection requirements for newly interconnecting generating resources. This guideline serves as a resource for utilities to further develop those interconnection requirements. [Chapter 1](#) provides a summarization of recommended improvements to interconnection requirements for TOs to consider as they continually develop and enhance interconnection requirements per FAC-001-3 and interconnection study requirements per FAC-002-2.¹¹ [Chapter 2](#) covers the performance aspects while [Chapter 3](#) cover modeling considerations (both key components to the interconnection process).

Reliable Integration of Non-BES Resources Connected to the BPS

Another challenge the industry is facing is that the majority of newly interconnecting inverter-based generating resources are not subject to NERC Reliability Standards since they do not meet the size criteria as defined by the BES definition.¹² For example, dispersed power-producing resources (i.e., wind and solar PV facilities) are either connecting at voltages less than 100 kV or with capacity less than 75 MVA. While individual resources may not have a substantial impact to the BES, the overall response, behavior, and control of these resources does impact BPS reliability and stability. It is therefore critical to have consistency in terms for capabilities and performance as well as an understanding of how these resources will behave so they can be sufficiently modeled in reliability studies. The recommendations provided in this guideline are applicable to TOs developing interconnection requirements for inverter-based resources connected to the BPS that can be applicable to both BES and non-BES resources connected to the BPS. Considerations for distributed energy resources are outside the scope of this guideline.

Applicable NERC Facility Interconnection Standards

NERC Reliability Standard FAC-001-3¹³ requires that each TO¹⁴ “document and make facility interconnection requirements available so that entities seeking to interconnect will have the necessary information.” Interconnecting resources must adhere to the requirements specified by the local interconnecting transmission utility, state regulator,

⁹ Momentary cessation is an example of an operating mode for inverter-based resource behavior that was allowed in some interconnection agreements (although not required), and inverters were programmed with this operating mode since no other guidance was provided on performance expectations during grid disturbances.

¹⁰ <https://www.nerc.com/comm/PC/Pages/Inverter-Based-Resource-Performance-Task-Force.aspx>

¹¹ <https://www.nerc.com/pa/stand/Pages/ReliabilityStandardsUnitedStates.aspx?jurisdiction=United%20States>

¹² <https://www.nerc.com/pa/RAPA/Pages/BES.aspx>

¹³ NERC FAC-001-3, “Facility Connection Requirements,” September 2017:

https://www.nerc.com/_layouts/15/PrintStandard.aspx?standardnumber=FAC-001-3&title=Facility%20Interconnection%20Requirements

¹⁴ And in some cases the GO

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and regional TOP/RC. These interconnection requirements describe the minimum performance characteristics that a generating resource must meet in order to maintain reliable operation on the BPS. These requirements are often set forth in interconnection agreements between the Applicable GO¹⁵ and the transmission utility and can also be established in operating and planning manuals, grid codes, or other rules developed by the transmission entity.

NERC Reliability Standard FAC-002-2¹⁶ focuses on facility interconnection studies, and Requirement R1 states that each TP and PC shall study the impacts of newly interconnecting generation and the impacts of materially modifying existing interconnections of generation.¹⁷ These studies include the following:

- The reliability impact of the new interconnection or materially modified existing interconnections on affected system(s)
- Adherence to applicable NERC Reliability Standards, regional and TO planning criteria, and facility interconnection requirements
- Steady-state, short-circuit, and dynamics studies to evaluate system performance under both normal and contingency conditions as necessary
- Study assumptions, system performance, alternatives considered, and coordinated recommendations. While these studies may be performed independently, the results shall be evaluated and coordinated by the entities involved.

Requirement R2 describes that the GO seeking to interconnect new generation or materially modify existing generation “shall coordinate and cooperate on studies with the [TP] or [PC], including but not limited to the provision of data as described in R1 [of FAC-002-2]...” Further, according to Requirement R5, each GO “shall coordinate with its TP or PC on studies” regarding these requested interconnections.

A relationship exists between FAC-001-3 and FAC-002-2. Requirement R1, part R1.2, includes the “Facility interconnection requirements” as one set of performance requirements (along with applicable NERC Reliability Standards, and regional and TO planning criteria) that must be met during the study process. Ensuring that sufficiently clear, concise, and necessary performance, modeling, and study requirements are outlined in each TO’s facility connection requirements documentation per FAC-001-3 is an essential component of the interconnection process (including interconnection studies). Specifically for inverter-based resources whose response is dominated by the control settings programmed into the inverters and plant-level controller, as described above, TOs providing clarity to expected performance can help ensure consistent response and behavior across the generation fleet.

Throughout the rest of this document, the recommendations pertain to the TO in most cases as the

Applicability of Recommendations

The recommendations in most cases of this guideline pertain to the TO as the entity responsible for establishing interconnection requirements per FAC-001-3 and the TP and PC as the entity responsible for studying the impacts of interconnecting new (or materially modifying existing) facilities on the BES per FAC-002-2. In some cases, the recommendations may also apply to the TP, PC, BA, and other entities, as applicable. All these recommendations are intended to be coordinated amongst these entities such that the interconnection requirements that reside with the TO are developed effectively and efficiently.

¹⁵ Note that NERC FAC-001-3 applies to the Applicable GO who is a “Generator Owner with a fully executed Agreement to conduct a study on the reliability impact of interconnecting a third party Facility to the Generator Owner’s existing Facility that is used to interconnect to the transmission system.” In many cases, the interconnecting generation entity may be a developer rather than a NERC-registered GO. NERC FAC-002-applies to both the Applicable GO and the GO separately. Throughout this guideline, the term GO is used to refer to both entities, as applicable.

¹⁶ NERC FAC-002-2, “Facility Interconnection Studies,” November 2014:

https://www.nerc.com/_layouts/15/PrintStandard.aspx?standardnumber=FAC-002-2&title=Facility%20Interconnection%20Studies

¹⁷ This also applies to studying the impacts of newly interconnecting or material modification to transmission and electricity end-user facilities.

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entity responsible for establishing interconnection requirements per FAC-001-3 and the TP and PC as the entity responsible for studying the impacts of interconnecting new (or materially modifying existing) facilities on the BES per FAC-002-2. In some cases, the recommendations may also apply to the TP, PC, BA, and other entities as applicable. All these recommendations are intended to be coordinated amongst these entities such that the interconnection requirements that reside with the TO are developed effectively and efficiently.

Coordination with IEEE P2800

The IEEE P2800¹⁸ effort is developing a performance-based standard that establishes the “interconnection capability and performance criteria for inverter-based resources interconnected with transmission and networked sub-transmission systems. Included in this standard are recommendations on performance for reliable integration of inverter-based resources into the [BPS].” The IEEE P2800.1¹⁹ effort is developing a guideline that “provides test and verification procedures for inverter-based resources interconnecting with transmission electric power systems”.

The IEEE P2800 effort is expected to develop a detailed performance standard that addresses all relevant performance aspects of inverter-based resources connected to the BPS. However, this standard will likely take multiple years to develop, approve, and adopt by local TOs and other applicable jurisdictions. Therefore, this guideline is intended to provide a bridging reference document between the current state and future adoption of the IEEE P2800 standard. Upon IEEE approval and publication of the P2800 standard, it is recommended that TOs adapt their interconnection requirements to align with, and possibly integrate, IEEE P2800.

¹⁸ <https://standards.ieee.org/project/2800.html>.

¹⁹ https://standards.ieee.org/project/2800_1.html

Chapter 1: Interconnection Requirements Improvements

This chapter provides a list of improvements to interconnection requirements that TOs should consider to maintain adequate BPS reliability. Experience has shown that clear and effective communication of these requirements results in more reliable operation of inverter-based resources. TOs should provide clarity to the required performance and behavior of inverter-based resources that are connected to the BPS. Transmission entities should use this guideline to ensure that their interconnection requirements for newly interconnecting inverter-based resources are clear and accurate. This chapter does not prescribe any uniform performance characteristics across all interconnections nor prescribe how requirements should be met; rather, it provides considerations that the local transmission entity may adopt for developing their facility interconnection requirements. The goal of this chapter is to provide recommended improvements that make the interconnection requirements instructive, explicit, definitive, and unambiguous. Many of the recommendations are based on the guidance provided in NERC *Reliability Guideline: BPS-Connected Inverter-Based Resource Performance*.²⁰

Table 1.1 provides recommended improvements to interconnection requirements related to inverter-based resource performance, and is intended to be a concise reference for TOs in their development and improvement of clear interconnection performance requirements. A description and technical basis behind these recommended performance requirements improvements is discussed in more detail in [Chapter 2](#).

Table 1.1: Recommended Improvements to Interconnection Requirements	
Topic	Recommended Improvement
Momentary Cessation	TOs should require that newly interconnecting inverter-based resources continuously inject current within the “No Trip Zone” of the currently effective version of PRC-024. Momentary cessation should be approved only as an exception based on system studies performed by the TP or PC to mitigate potential local reliability or controls-related stability issues.
Phase Jump Immunity	TOs should establish a dialogue with interconnecting GOs to understand the means in which the inverters may trip on instantaneous changes in phase (either due to fault events or line switching events). TOs may perform system studies to identify possible worst-case phase jumps at the point of interconnection (POI) of the interconnecting resources. TOs may consider identifying worst case balanced phase jump limits or state that inverter-based resources should not trip for studied credible contingency events (similar to fault ride through (FRT)).
Capability Curve	TOs should require that newly interconnecting inverter-based resource owners (along with all GOs) provide a “composite capability curve” that includes the overall active and reactive capability of the resource as measured at the Point of Measurement (POM). ²¹ This includes a complete P-Q graph (or table of data representing these data points) at nominal voltage. ²² Note that the reactive capability within that curve should be “dynamic” per FERC Order No. 827. TOs may also require that the capability curve of each type of individual inverter be provided, since this helps verify aggregate capability in the planning models (along with the overall capability curve provided).

²⁰ https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Inverter-Based_Resource_Performance_Guideline.pdf.

²¹ This is the “high-side of the generator substation” transformer, according to FERC Order No. 827. This guideline aligns with FERC on the use of POM rather than POI, unless referencing a specific NERC Reliability Standard that uses the POI.

²² Requirements should be clear in identifying the voltage range for which the reactive capability requirements apply. This provides inverter manufacturers with information to suitably design the reactive capability for each project.

Chapter 1: Interconnection Requirements Improvements

Active Power-Frequency Controls	TOs should ensure that the performance from newly interconnecting generating resources aligns with FERC Order No. 842. BPS reliability needs based on specific system characteristics and studies may drive the need for additional requirements for newly interconnecting resources. The TO should specify dynamic active power-frequency response performance of inverter-based resources to ensure consistent and expected performance across the BPS generating fleet. Refer to the NERC <i>Reliability Guideline: BPS-Connected Inverter-Based Resource Performance</i> , ²³ which outlines recommended dynamic response characteristics in Appendix A, Item 3.3.
Fast Frequency Response (FFR)	Interconnection studies should identify system needs for FFR, and the TO should ensure the capability is available for grids where FFR may be needed. Requirements should be clear in stating whether nonsustained forms of FFR are acceptable and any additional requirements pertaining to the timing aspects of FFR. These issues are not specific to inverter-based resources, yet the TO in coordination with the TP and PC should ensure sufficient frequency response capability to arrest large frequency deviations for credible contingency events.
Reactive Power-Voltage Control	TOs should ensure that the performance from newly interconnecting generating resources aligns with FERC Order No. 827. Additional requirements may be needed for BPS reliability needs based on specific system characteristics. The TO should clearly differentiate between large and small disturbance behavior for voltage response. For small disturbance behavior, where voltage remains within the continuous operating range of the inverters and plant controller, the TO should have clear specifications for the time in which that voltage support should be provided. Refer to the NERC <i>Reliability Guideline: BPS-Connected Inverter-Based Resource Performance</i> ²⁰ for more details regarding reactive power-voltage control for small disturbance behavior.
Reactive Current-Voltage Control	TOs should ensure that the large disturbance behavior from inverter-based resources provides dynamic voltage support through their reactive current-voltage controls, when voltage falls outside the continuous operating range of the inverters (and local inverter controls take over). This includes both the magnitude and timing of reactive current injection, and the prioritization between reactive and active current. Refer to the NERC <i>Reliability Guideline on BPS-Connected Inverter-Based Resource Performance</i> ²⁴ for more details regarding reactive current-voltage control from inverter-based resources during large voltage disturbances.
Reactive Power at No Active Power Output	TOs may require inverter-based resources to exchange reactive power with the BPS (to provide voltage control) when no active power is generated. Refer to the NERC <i>Reliability Guideline on BPS-Connected Inverter-Based Resource Performance</i> ²⁵ for more details.

²³ https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Inverter-Based_Resource_Performance_Guideline.pdf.

²⁴ Ibid.

²⁵ Ibid.

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Inverter Current Injection during Fault Conditions	TOs should clearly articulate expected inverter behavior during and immediately following fault events in coordination with the small disturbance active and reactive current controls. This includes the magnitude of the current, the phase relationship of current with respect to voltage, and the timing of current injection. TOs may consider, based on detailed system studies (likely electromagnetic transient (EMT) studies), establishing fault current requirements for newly interconnecting inverter-based resources since this response is dominated by the controls programmed into the inverter. As the penetration of inverter-based resources continues to grow, pockets of the BPS may require unconventional relaying techniques to ensure secure protection schemes. The IEEE P2800 effort should consider standardizing fault current injection for inverter-based resources after further deliberation by inverter manufacturers, relay manufacturers, and protection and stability engineers.
Return to Service Following Tripping	TOs, in coordination with their BA, should specify the expected performance of inverter-based resources following a tripping event. This may include automatic reconnection after a predefined period of time or may include manual reconnection by the BA. Ramp rates during return to service conditions should be specified as well. Following “system black” conditions, inverter-based resources should not attempt to automatically reconnect to the grid (unless directed by the BA) so as to not interfere with blackstart procedures.
Balancing	TOs, in coordination with their BAs, should require the capability to limit active power ramp rates (in both directions) to mitigate any significantly large power swings over a short period of time, depending on weather when applicable. This is a balancing ramp rate typically expressed in terms of percentage output change per minute. Inverter-based resources should be required to receive automatic generation control (AGC) dispatch signals if the market/agreement structure indicates this.
Monitoring	TOs should specify data recording and real-time monitoring requirements for inverter-based resources (and all generating resources) to effectively monitor resource performance and provide information necessary to perform event analysis. This should include capturing high resolution data available at the POI, some inverter-level high speed data, and sequence of events recording. Refer to the NERC <i>Reliability Guideline: BPS-Connected Inverter-Based Resource Performance</i> ²⁶ for more information regarding data time synchronization, data retention and retrieval, inverter- and plant-level event triggers, and recommended measurement points from the facility.

²⁶ https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Inverter-Based_Resource_Performance_Guideline.pdf.

Chapter 1: Interconnection Requirements Improvements

Operation in Low Short-Circuit Strength Systems	TOs should ensure they understand and have studied areas of their systems where potential low short-circuit strength conditions could occur. TOs should have sufficient requirements in place to reliably study and integrate inverter-based resources to the BPS, including these areas. In situations where potential low short-circuit strength conditions could occur (now or in the foreseeable future), the TO should ensure they have sufficient data and information needed to perform studies in these areas. This includes coordination with the GO, particularly during the interconnection studies process, to obtain EMT models or provide the GO with sufficient information to prove reliable control and capability to operate in these types of conditions. ²⁷ Refer to Chapter 2 for a more detailed description of the recommended process for coordination between the TO and GO and considerations for developing effective requirements to ensure sufficient data and information is exchanged prior to plant commissioning.
Fault Ride-Through Capability	TOs should consider the reliability need for establishing FRT requirements²⁸ for interconnecting generating resources and other grid-supportive devices. These requirements apply to both synchronous and nonsynchronous generating resources. These requirements may include qualitative and quantitative requirements described here: • Qualitative: Generating resources may be required to have FRT capability for all expected (studied) credible contingency events unless the plant is consequentially isolated due to the fault, the plant is part of a remedial action scheme, or the plant is allowed to trip by exception from the TP based on system studies. These requirements are applied during the FAC-002 interconnection studies process. • Quantitative: These requirements typically involve a performance envelope (FRT capability) that must be met by the resource, typically derived based on interconnection studies, grid codes, Reliability Standards, and other factors deemed necessary by the TO. Having these requirements ensures that the resource, particularly inverter-based resources, are unlikely to operate in a mode of operation that has not been previously studied. These types of requirements also ensure inverter manufacturers are designing equipment robust enough to withstand BPS transient events.
Grid Forming	TOs should thoroughly understand when and where grid forming inverter capability may be needed on the BPS prior to specifying its use in any interconnection requirements. Its use may include systems with a high penetration of inverter-based resources (localized or widespread) or systems that may be utilizing inverter-based resources for blackstart purposes. Industry is still developing the technology and its recommended use in conjunction with other solution options. If the inverters employ grid forming technology, this information should be provided to the TO.

²⁷ The TO may choose to perform these studies, in which case necessary data from the GO needs to be provided (in coordination with the inverter manufacturer). In other cases, the TO may establish requirements for these studies to be performed by the GO and results provided to the TO for further consideration and approval.

²⁸ Fault ride-through (FRT) is the capability of a plant to remain connected to the BPS, continue injecting some form of active and reactive current, and meet a set of performance requirements during and following a BPS fault event. NERC PRC-024 focuses only on the voltage and frequency protective relaying aspects of generator protection, and is not a comprehensive FRT standard.

Chapter 1: Interconnection Requirements Improvements

System Restoration and Blackstart Capability	System restoration and blackstart capability considerations are part of NERC EOP-005-3 and EOP-006-3. While not specifically part of the interconnection requirements, two considerations worth highlighting include the following: • During system restoration, the TOP and BA typically require coordination and instruction prior to a GO returning to service. This should be explicitly stated such that inverter-based resources do not unexpectedly automatically reconnect during the system restoration process. • Inverter-based resources are not required to have blackstart capability; however, if they do, that information should be provided to the TOP and TO as part of the interconnection process.
Protection Settings	TOs should review the key findings and recommendations from the disturbance reports involving solar PV resource tripping, and may consider incorporating these findings into interconnection requirements, as applicable. This may include: • Clarification that PRC-024 sets the minimum performance requirements, and inverter protection should be set at the limits of equipment safety and reliability. • Tripping on calculated frequency should be based on an accurately calculated and filtered measurement over a time window and should not use an instantaneously calculated value. • Inverter overvoltage protection should be set as high as possible within equipment limitations. The PRC-024 curve uses a filtered RMS voltage measurement and should not be applied for transient, sub-cycle overvoltages. • The TO should specify expected performance during successive fault events within a predefined period of time.²⁹ • Any dc reverse current protection and phase lock loop (PLL) loss of synchronism should not result in inverter tripping, in most cases, for BPS fault events within the “No Trip Zone” of the currently effective version of PRC-024. Tripping within the PRC-024 “No Trip Zone” should be allowed for inverter faults that can lead to failure. Inverter rate-of-change-of-frequency (ROCOF) protection should be disabled unless an equipment limitation exists that requires the inverter to trip on high ROCOF. In most instances, ROCOF protection should not be used for BPS-connected resources.

²⁹ A NERC standard drafting team is developing a revision to PRC-024-2 that may address these issues; however, clarity in the interconnection requirements based on local system needs may be warranted.

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Power Quality	TOs should specify recognized outage scenarios for inverter-based resources to assess power quality impacts. Inverter-based resources may request TOs to provide grid harmonic impedance characteristics (from TO reliability studies), in particular reactive facility data, in order to manage potential resonance issues. TOs may measure background power quality indices prior to inverter-based resource interconnections for design reference and later power quality responsibility separation. Permanent power quality monitoring is recommended for commercial operations. As needed, TOs should characterize actual harmonic distortion performance during the trial operation (during plant commissioning) period prior to the commercial operation date. Any harmonic distortion issues should be addressed based on the requirements established by the TO. The TO should require that the GO provide advanced notice prior to implementing firmware updates to the facility as firmware updates can improve or degrade power quality performance.

Table 1.2 provides recommended improvements to modeling requirements for inverter-based resources, and is intended to be a concise reference for TOs in their development and improvement of clear requirements.³⁰ A description and technical basis behind these recommended modeling requirements improvements are discussed in more detail in [Chapter 3](#).

Table 1.2 Recommended Improvements to Modeling Requirements	
Topic	Recommended Improvement
Timing and Quality of Modeling Data Submittals during Interconnection Process	The modeling data submitted during the feasibility study and into the system impact study should be the most accurate and reasonable modeling information available to the GO at the time. This data should be screened for basic correctness as prescribed by the TP and PC. Once the interconnection studies are approved, the data should become final. Any changes to the data should become subject to material modification determinations. Changes to control system settings, increases in output, facility topology changes, and any other change that modifies the electrical characteristics or response of the plant should trigger the need for a material modification determination. During the commissioning process, GOs should submit the desired control system settings to the TOs to review and comment prior to implementing them. The submission should include a side-by-side comparison with the modeling data. This gives the TOs an opportunity to capture performance deficiency while the commissioning team is still onsite. TOs should be enforcing requirements for GOs to submit the finalized as-built modeling data after the plant has been commissioned and is in-service within a prescribed time frame (e.g., 120 days after in-service date). This final step ensures modeling data matches as-built specification sheets, oneline diagrams, and inverter and plant-level control settings. The material modification determinations should apply during the entire time of in-service operation, and is not only applicable to the interconnection process. TOs should have clear specifications for what constitutes a “material modification” per NERC FAC-001-3. ³¹

³⁰ These recommendations are intended to help clarify the modeling data needed to facilitate reliability studies per NERC Reliability Standard FAC-002-2. They add clarity and consistency to current industry practices.

³¹ Refer to the Guidelines and Technical Basis section of NERC Reliability Standard FAC-001-3. This section states, “Entities should have documentation to support the technical rationale for determining whether an existing interconnection was “materially modified.” Recognizing that what constitutes a “material modification” will vary from entity to entity, the intent is for this determination to be based on engineering judgment.” The use of the term “material modification” referred to here, related to the FAC-001-3 requirements, is not related to the “Material Modification” term used in the FERC LGIP/SGIP.

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Table 1.2 Recommended Improvements to Modeling Requirements

Topic	Recommended Improvement
Steady-State Modeling	TOs should have clearly documented requirements for steady-state modeling that ensures that sufficient data is gathered to model these resources in local and interconnection-wide powerflow base cases. In most cases, dispersed power-producing resources (i.e., wind and solar PV) should be represented in the powerflow base case using an equivalent representation clearly specified by the TO in their requirements. ³² A single-line diagram showing impedances and equipment ratings should be provided to the TO with the accompanying model. The TO should also ensure that all necessary control settings and ratings used for modeling purposes are collected during this process to ensure accurate controls configuration in the base case.
Positive Sequence Dynamics Modeling	TOs have different requirements based on their local modeling and studies practices, which may differ from any interconnection-wide case creation requirements. The TO may only allow standard “generic” ³³ simulation library models with accurate parameters to reflect each specific facility, may require detailed user-defined models, or may require both a detailed user-defined model and a generic model in some cases. Detailed models are often used for local interconnection reliability studies (localized studies as well as interconnection study process studies) while generic models are typically used in the interconnection-wide base cases per MOD-032-1. In any case, the TO should be clear in the types of models that are expected to be provided for the interconnection process. The latest library models used for dynamic simulations should be required; these are updated occasionally by industry stakeholder groups. TOs should refer to the NERC list of acceptable models for more guidance on interconnection-wide modeling. ³⁴
Short-Circuit Modeling	TOs should have clear requirements regarding how to model inverter-based resources and all generating resources for short-circuit studies. The necessary elements for these short-circuit models should be specified in the requirements including relevant transmission circuits, transformers, collector systems, diagrams and equipment ratings, inverter-level data, and other data for the purposes of modeling. Short-circuit modeling practices are evolving; however, necessary data should be collected to have the information needed for the TO to improve these models as they evolve in coordination with the GO. The current recommendation from IEEE Power System Relaying and Control Committee C24 Working Group is to provide a table of positive and negative sequence current injection for different positive sequence voltage levels for different fault types. Refer to Chapter 3 of this guideline for more information. The GO can obtain this data from the inverter manufacturer, who can provide it with any other necessary short-circuit models and modeling data.

³² References exist for deriving the equivalent generator, equivalent pad-mounted transformer, and equivalent collector system quantities.

³³ In no situations should a generic library model with generic/default parameters be acceptable. The commonly used industry term “generic” simply refers to the standard library models, not the use of generic or default parameter values within those models.

³⁴ [https://www.nerc.com/comm/PC/Pages/System-Analysis-and-Modeling-Subcommittee-\(SAMS\)-2013.aspx](https://www.nerc.com/comm/PC/Pages/System-Analysis-and-Modeling-Subcommittee-(SAMS)-2013.aspx).

Chapter 1: Interconnection Requirements Improvements

Table 1.2 Recommended Improvements to Modeling Requirements

Topic	Recommended Improvement
Electromagnetic Transient Modeling	TOs should clearly articulate the level of EMT modeling necessary as part of their interconnection requirements or modeling requirements documentation. EMT simulations may be needed in certain situations or scenarios involving inverter-based resources. These include, but are not limited to, subsynchronous control interactions near series compensation or interaction with other neighboring inverter-based resources, low short-circuit strength pockets, or other sub-synchronous or super-synchronous controls issues. TOs should specify requirements for inverter-based resources to provide EMT models in situations where an EMT-type study may be needed now or in the foreseeable future. Obtaining EMT models after the fact becomes challenging, so obtaining the models during the interconnection process and requiring model updates as changes are made within the facility are important aspects of maintaining accurate system models. Refer to Chapter 3 for more details regarding potential EMT modeling requirements that should be considered by the TO.
Benchmarking Positive Sequence and EMT Models	TOs should ensure verification that the positive sequence dynamic model reflects the behavior of the overall inverter-based resource. This is particularly critical for the large disturbance behavior of the resource that may not be captured as part of the currently effective MOD-026 and MOD-027 testing and verification requirements. Interconnection requirements should clarify and detail the necessary steps to provide the required level of verification. This may include benchmarking simulations or testing by the inverter manufacturer to ensure that the positive sequence model matches the EMT model. The EMT model should be based on the real code implemented in the inverters installed in the field. It is important for the TO to ensure that the models reflect the most accurate possible assumptions during the interconnection study process and that the dynamic models (both EMT and positive sequence RMS models) reflect the as-built settings upon commissioning. Refer to Chapter 3 for more details regarding EMT and positive sequence RMS dynamic model benchmarking considerations.

Chapter 2: Detailed Description of Requirements Improvements

This chapter provides the technical basis and additional discussion related to the interconnection requirements improvements for interconnecting inverter-based resources introduced in [Chapter 1](#). The recommendations described throughout this chapter are based on those defined in the *Reliability Guideline: BPS-Connected Inverter-Based Resource Performance*,³⁵ and should be used as a reference when developing local interconnection requirements suitable for each specific TO's system.

Momentary Cessation

Momentary cessation is a mode of operation during which no current is injected into the grid by the inverter during low or high voltage conditions outside the continuous operating range. This leads to no current injection from the inverter and therefore no active or reactive current (and no active or reactive power).³⁶ Based on data gathered from the NERC Alerts following the Blue Cut Fire and Canyon 2 Fire disturbances, the use of momentary cessation outside of the continuous operating range³⁷ was implemented in the majority of solar PV inverters connected to the BPS. The ERO, while working with industry stakeholders, identified that the continued use of momentary cessation for BPS-connected inverter-based resources with these settings is a potential reliability risk if not eliminated to the extent possible.

Interconnection requirements for newly connecting inverter-based resources should explicitly state that inverters be designed and configured to continue current injection³⁸ inside the “No Trip Zone” of the frequency and voltage ride-through curves of the currently effective version of PRC-024 unless a reliability study identifies a system need to cease injecting current. Inverter-based resources should be designed and configured to use momentary cessation only outside the “No Trip Zone” if this helps mitigate potential tripping conditions based on interconnection studies.³⁹ Current injection should be specified to be either active, reactive, or a combination of current based on the results from interconnection studies. Refer to the NERC *Reliability Guideline: BPS-Connected Inverter-Based Resource Performance*⁴⁰ for more information.

Phase Jump Immunity

The inverter PLL continually monitors the phase angle difference between the inverter ac voltage command and the grid-side ac voltage.⁴¹ The PLL adjusts the internal phase angle of current injection to remain synchronized with the ac grid.⁴² [Figure 2.1](#) shows an example of this phase angle comparison on the d-q axis. For a close-in fault or relatively large switching action on the grid, the rapid change in inverter terminal phase angle can pose challenges for the PLL to track the terminal voltage angle. Inverter manufacturers have different means of handling these situations; some choose to freeze the phase angle on detection of such events, continue to generate d-q axis current references, and inject currents based on the frozen phase angle. While these types of controls may help with PLL ride-through, they

³⁵ https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Inverter-Based_Resource_Performance_Guideline.pdf

³⁶ During momentary cessation, the inverter remains electrically connected to the grid.

³⁷ Typically below 0.9 pu or above 1.1 pu voltage.

³⁸ Inverter-based resources can utilize various ride-through methods to continue injecting current within the “No Trip Zone” of the currently effective version of PRC-024. It is generally understood that Type 3 wind turbines do not utilize momentary cessation since the inverter is not the sole interface with the grid. The terminals of these resources are generally considered to be the high-side of the turbine pad mount transformer.

³⁹ Any use of momentary cessation should be based on equipment limitations or based on reliability studies identifying a system need. Return from momentary cessation upon voltage recovery to within the continuous operation range should occur as quickly as possible with no intentional time delay while maintaining stability.

⁴⁰ https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Inverter-Based_Resource_Performance_Guideline.pdf.

⁴¹ Voltage source converter technology used in inverter-based generating resources, such as WTGs and solar PV inverters, uses fully decoupled current vector control. The fundamental idea of such control is to create time invariant d-axis and q-axis components from sinusoidal three-phase ac quantities. The new set of axes (i.e., d- and q-axis) rotate at synchronous speed.

⁴² Since most inverter-based resources do not create the reference angle, rather following the external grid reference angle to generate the d-q axis components, they are referred to as “grid following” inverters.

can also pose issues, such as high dc bus voltage that can lead to tripping. In some cases, PLL “loss of synchronism” refers to a protective function that operates when the angle difference between the phase generated by the PLL and the grid phase exceeds a threshold for a predetermined period of time (on the order of a couple milliseconds). This protection has been used by some inverter manufacturers historically since, during these short time periods of large phase difference, the inverter is injecting current with an incorrect phase relationship since it is designed to minimize this difference in the d-q frame. If this is not brought under control quickly (on the order of a couple of milliseconds), it could result in oscillatory instability or loss of synchronism.

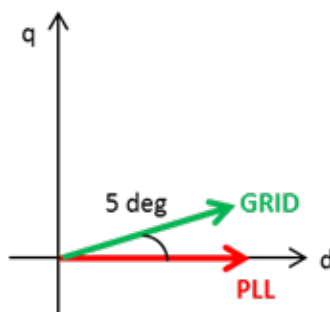


Figure 2.1: PLL Angle Difference Illustration
[Source: TMEIC]

Rapid changes in phase angle are common on the BPS, particularly during BPS fault events and large power swings. In January 2019, an event occurred where a solar PV plant tripped upon line re-energization following a fault. The line was tripped, and upon re-energizing the line, the solar PV plant tripped because the phase angle threshold between PLL phase and BPS grid phase exceeded a threshold value⁴³ with an instantaneous trip time setting. When the line was energized, the power flow changed nearly instantaneously by nearly 1,000 MW. Off-line steady-state simulations showed that the angle change at the generation facility POI was about 17 degrees after a new steady state was reached, and 28 degrees maximum change during the transient period (see Figure 2.2).

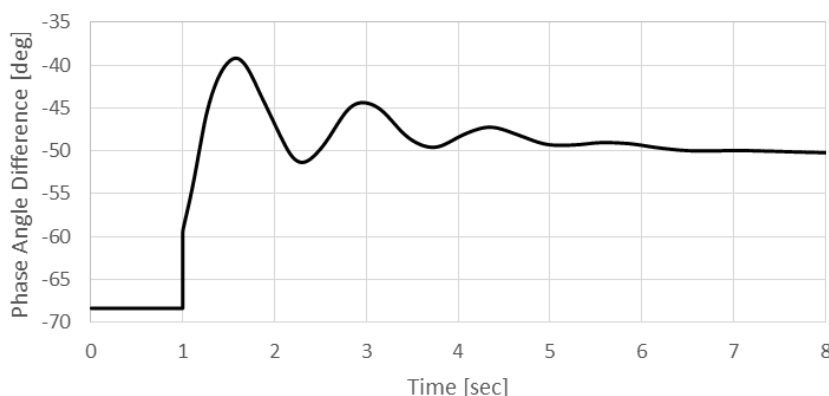


Figure 2.2: Simulation of January 2019 Switching Operation–Bus Phase Angle Jump

Nearly all grid following inverter-based resources rely on a PLL tracking the BPS phase angle to remain synchronized to the grid. TOs should establish a dialogue with interconnecting GOs to understand the means in which the inverters

⁴³ The inverters at this facility were set with a limit of five degrees instantaneous phase jump. Upon further investigation, the inverter manufacturer determined that this limit could be significantly relaxed and also include a time delay to avoid erroneous tripping on instantaneous phase angle changes.

may trip on instantaneous changes in phase either due to fault events or line switching events. TOs may perform system studies to identify possible worst-case phase jumps at the POI of the interconnecting resources, may consider identifying worst case balanced phase jump limits, or state that inverter-based resources should not trip for studied credible contingency events. IEEE P2800 may consider establishing balanced and unbalanced instantaneous phase jump limits for inverters such that inverter manufacturers have a standardized design specification inclusive of nearly all worst case phase jumps on the BPS.

Capability Curve

The active and reactive power capability of an inverter-based resource can be specified or defined with a P-Q graph (or table of data representing these data points), similar to a synchronous machine. This P-Q graph should represent the capability of the overall inverter-based resource at the POM at nominal ac and dc voltage.⁴⁴ TOs may also require that the capability curve of each type of individual inverter be provided since this helps verify aggregate capability in the planning models along with the overall capability curve provided. Reactive power limits are affected by changes in ac and dc voltage, and the capability curve is a function of these voltages in reality.⁴⁵ The voltage dependency and any different curves for the overall plant are not always readily available but should be provided to the TO if they are. In any case, the TO should require at least a nominal voltage capability curve. Further, this P-Q capability curve should represent the “composite capability” that includes any factors that limit or derate the output of the generator (e.g., collector system voltage limits, auxiliary voltage limits, current limits, and specific ambient temperature conditions). Refer to PRC-019-2 for more information related to coordinating resource capability, limiters, and protection. [Figure 2.3](#) shows an illustration of this type of plot.

Per FERC Order No. 827,⁴⁶ the reactive capability of newly interconnecting resources should be dynamic rather than static and be able to supply and absorb reactive current to control POM voltage. Static reactive compensation is only to be used for compensating for losses in the collector system.

To ensure accurate modeling in planning and operations studies and understanding of the capability of all resources connected to the BPS, TOs should require that a composite capability curve be provided upon commissioning and for any changes to capability.

⁴⁴ Inverter manufacturers generate P-Q curves based on the inverter terminals. The plant design engineer then applies the plant active power losses, inductive losses, and capacitive losses to achieve a P-Q capability curve at the POM.

⁴⁵ TOs may consider providing clarity on the required or expected voltage-reactive capability (V-Q) from inverter-based resources for off-nominal capabilities. This should be coordinated and discussed between the interconnecting GO and the TO (and TP and PC) to understand any voltage limitations or impacts to the capability curve.

It is also recommended that all requirements would refer to the same reference point (e.g. HV side of substation transformer)

⁴⁶ Federal Energy Regulatory Commission, Order No. 827, June 16, 2016: <http://www.ferc.gov/whats-new/comm-meet/2016/061616/E-1.pdf>.

Chapter 2: Detailed Description of Requirements Improvements

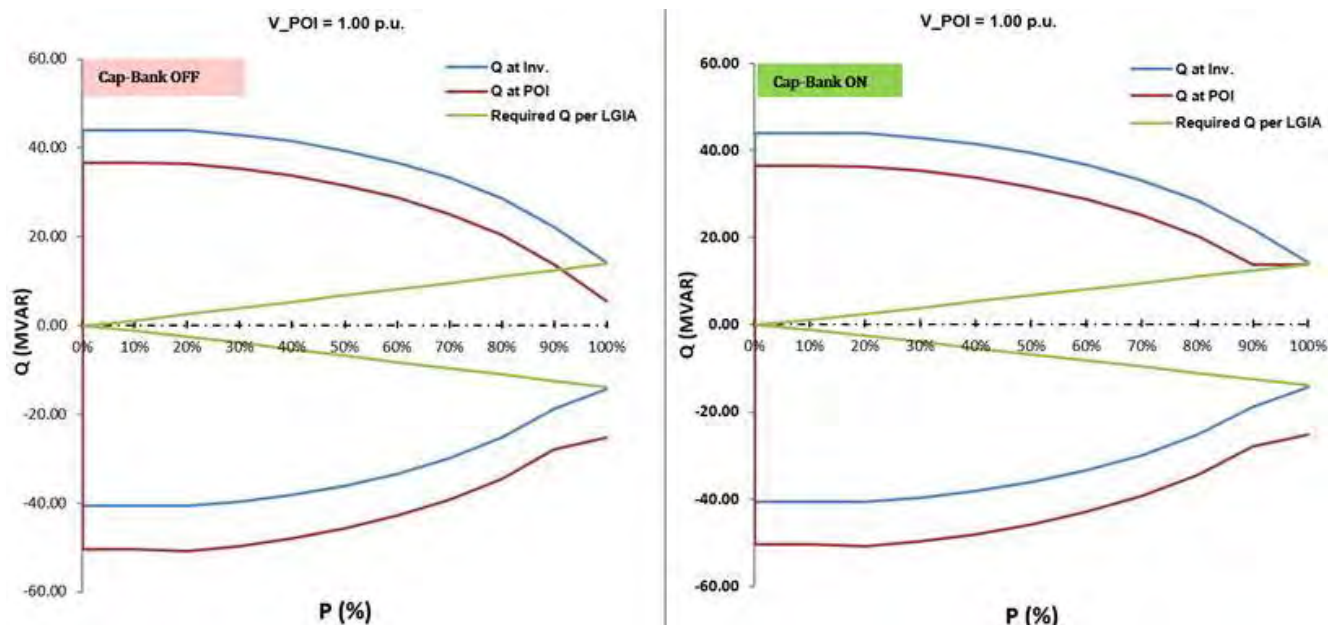


Figure 2.3: Inverter-Based Resource Plant Capability Curve Example
[Source: First Solar]

Active Power-Frequency Control

This section describes the recommended performance from BPS-connected inverter-based resources as specified in *NERC Reliability Guideline: BPS-Connected Inverter-Based Resource Performance*.⁴⁷ TOs should consider developing interconnection requirements that align with these recommended performance specifications as deemed necessary.

FERC Order No. 842 requires all newly interconnecting generating resources within its jurisdiction to install, maintain, and operate a functioning governor or equivalent controls as a precondition of interconnection, effective May 15, 2018. FERC Order No. 842 requires new generation units to have functioning primary frequency response capability. The FERC Order also requires resources to respond to frequency excursion events when plant POM frequency falls at least outside a ± 0.036 Hz deadband, and to adjust output in accordance to a maximum of 5% droop.⁴⁸ This response must be timely and sustained rather than injected for a short period and then withdrawn. However, reserving generation headroom to provide frequency response for underfrequency events is not mandated by FERC Order No. 842. These resources should respond to overfrequency excursion events outside the deadband by reducing active power output in accordance with the 5% droop specification.

The *NERC Reliability Guideline: BPS-Connected Inverter-Based Resource Performance* outlines recommended dynamic response characteristics. The closed-loop dynamic response of the active power-frequency control system of the overall inverter-based resources, as measured at the POM (or possibly the POI), should have the capability to meet or exceed the performance specified in [Table 2.1](#).⁴⁹ TOs may consider using or adapting these specifications based on a technical basis (i.e., system studies). The requirements defined should not conflict with any inverter-based resource protection systems.

⁴⁷ https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Inverter-Based_Resource_Performance_Guideline.pdf.

⁴⁸ Permanent droop should be based on the maximum MW capability of the facility, not on the available MW. This ensures a consistent droop characteristic across all operating points.

⁴⁹ Refer to the *NERC Reliability Guideline: BPS-Connected Inverter-Based Resource Performance*, Appendix A, Item 3.3: https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Inverter-Based_Resource_Performance_Guideline.pdf.

Chapter 2: Detailed Description of Requirements Improvements

Table 2.1: Dynamic Active Power-Frequency Performance		
Parameter	Description	Performance Target
For a step change in frequency at the POM of the inverter-based resource		
Reaction Time	Time between the step change in frequency and the time when the resource active power output begins responding to the change ⁵⁰	< 500 ms
Rise Time	Time in which the resource has reached 90% of the new steady-state (target) active power output command	< 4 sec
Settling Time	Time in which the resource has entered into, and remains within, the settling band of the new steady-state active power output command	< 10 seconds
Overshoot	Percentage of rated active power output that the resource can exceed while reaching the settling band	< 5%**
Settling Band	Percentage of rated active power output that the resource should settle to within the settling time	< 2.5%**

Fast Frequency Response

As the penetration of inverter-based resources continues to increase, the rate of change of frequency (ROCOF) following loss of generation or load disturbances will also continue to increase assuming that the magnitude of the disturbance remains the same and the inverter-based resources do not support system frequency response.⁵¹ This reduction in responsive system inertia (i.e., higher instantaneous penetration of nonresponsive inverter-based resources) drives the need for faster responding resources to arrest and stabilize grid frequency. The fast response of resources that provide additional energy to the grid to help with this arrest and stabilization is commonly referred to as FFR. There are many different types of sources of energy that can provide this capability, including but not limited to the following:

- Rotating inertia of a synchronous machine
- Fast-responding frequency response capability from inverter based resources (e.g., some wind, solar PV, and battery energy storage)
- Automatic load tripping
- Nonsustained energy extracted from the rotor of a wind turbine generator

These types of FFR include both sustained forms of energy injection (i.e., fast-responding frequency response from solar PV and batteries) as well as nonsustained forms of energy injection (i.e., wind-based energy extraction from the rotor and synchronous inertia). Both types of FFR support grid reliability and are used in different situations based on each interconnection's needs and capabilities. Interconnection studies should identify system needs for FFR, and the TO should ensure the capability is available for grid where FFR may be needed. Requirements should be clear in stating whether nonsustained forms of FFR are acceptable and any additional requirements pertaining to the timing aspects of FFR. The NERC IRPTF will be further analyzing FFR and will provide additional guidance on the subject.

⁵⁰ Time between step change in frequency and the time to 10% of new steady-state value can be used as a proxy for determining this time.

⁵¹ This is particularly important for underfrequency disturbances since most inverter-based resources operate at maximum available power and do not have available frequency responsive reserves.

Reactive Power-Voltage and Reactive Current-Voltage Control

This section describes the recommended performance from BPS-connected inverter-based resources as specified in NERC *Reliability Guideline: BPS-Connected Inverter-Based Resource Performance*.⁵² TOs should consider developing interconnection requirements that align with these recommended performance specifications as deemed necessary.

FERC Order No. 827⁵³ eliminated exemptions for newly interconnecting wind generators under its jurisdiction from the requirement to provide reactive power and now requires all nonsynchronous resources to provide dynamic reactive power within the power factor range of 0.95 leading to 0.95 lagging (measured at the POM) unless the transmission provider has established a different power factor range. TOs should ensure these requirements are implemented correctly by the GO. Similar to synchronous machines, it is recommended that, if additional reactive power capability is available from the inverter-based resources for a specific active power output, that capability should not be artificially limited.

Per NERC Reliability Standard VAR-002-4.1, all GOPs with applicable resources are required to “operate each generator connected to the interconnected transmission system in the automatic voltage control mode (with its automatic voltage regulator (AVR) in service and controlling voltage)” unless instructed otherwise by the TOP. Inverter-based resources should be configured to control voltage at the POM with a closed-loop, automatic voltage control mode to maintain the scheduled voltage provided by the TOP. Studies should be performed by the TP or PC to ensure that voltage schedules and voltage controls are coordinated across generating facilities and other transmission-connected reactive power devices. The use of reactive droop may be required for plants connected electrically close to one another. Voltage control at a remote POM with line impedance compensation may be required.

Interconnection requirements should clearly differentiate between the small disturbance and large disturbance performance requirements for inverter-based resources. Generally, small disturbance behavior is where voltage stays within the continuous operating range and large disturbance behavior is where voltage falls outside this range (i.e., “ride-through mode”). Small disturbance behavior is typically dominated by the plant-level controls while large disturbance behavior is typically dominated by the individual inverter controls.

The NERC Reliability Guideline on BPS-Connected Inverter-Based Resource Performance outlines recommended reactive power-voltage (small disturbance) and reactive current-voltage (large disturbance) response characteristics. The closed-loop dynamic response of the overall inverter-based resources, as measured at the POM (or possibly the POI), should have the capability to meet or exceed the performance specified in [Table 2.2](#) and [Table 2.3](#).⁵⁴ TOs may consider using or adapting these specifications based on a technical basis. To permit the full range of dynamic reactive power response, supplemental capacitors should be operated to offset collector system reactive losses as the resource output increases. There are also cases where the dynamic reactive power systems are used to supplement the reactive power range or serve as the primary source of dynamic reactive power response.⁵⁵ Regarding large disturbance behavior, the following concepts should be addressed during the FAC-002-2 interconnection studies and as part of the FAC-001-3 interconnection requirements:

- The response of each generating resource over its full operating range, and for all expected BPS grid conditions, should be stable. The dynamic performance should be tuned to provide stable response. The performance specifications in [Table 2.3](#) may need to be modified during the study process to ensure a stable response. While actual settings may be tuned during the interconnection studies and commissioning tests,

⁵² https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Inverter-Based_Resource_Performance_Guideline.pdf.

⁵³ Federal Energy Regulatory Commission, Order No. 827, 16 June 2016: <http://www.ferc.gov/whats-new/comm-meet/2016/061616/E-1.pdf>

⁵⁴ Refer to NERC *Reliability Guideline on BPS-Connected Inverter-Based Resource Performance*, Appendix A, Item 3.3: https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Inverter-Based_Resource_Performance_Guideline.pdf.

⁵⁵ In some cases, the dynamic reactive device (DVAR) controller regulates POM voltage and is used as the master controller capable of dispatching external devices such as wind turbines and shunt capacitors.

Chapter 2: Detailed Description of Requirements Improvements

the inverters should have the capability to meet the performance specifications shown in [Table 2.3](#), and TOs may consider using or adapting these specifications.

- Large disturbance behavior, where local inverter controls take priority, should operate with significantly faster response times compared to the outer loop plant-level controls. Local inverter controls use their terminal voltage measurement to take very fast actions during transient events, such as faults, and can be programmed to act quickly as a result.
- The dynamic response of inverter-based resources should be programmable by the GO in coordination with the inverter manufacturer to enable changes based on changing grid conditions once installed in the field.
- Large changes in terminal voltage will likely cause the inverter to reach a current limit. This is to be expected for inverter-based resources, and current limiters should be coordinated with inverter protection to ensure that the resource is able to respond very quickly while staying within its continuous or short-term overload limits.

During grid fault events, the type of current injected to the grid is critical for reliable operation of transmission protection systems and grid dynamics. Response during and immediately⁵⁶ following fault events is discussed in the next section.

Table 2.2: Small Disturbance Reactive Power-Voltage Performance

Parameter	Description	Performance Target
For a step change in voltage at the POM of the inverter-based resource...		
Reaction Time	Time between the step change in voltage and when the resource reactive power output begins responding to the change ⁵⁷	< 500 ms*
Rise Time	Time between a step change in control signal input (reference voltage or POM voltage) and when the reactive power output changes by 90% of its final value****	< 1-30 sec**
Overshoot	Percentage of rated reactive power output that the resource can exceed while reaching the settling band	< 5%***

* Reactive power response to change in POM voltage should occur with no intentional time delay.

** Depends on whether local inverter terminal voltage control is enabled, any local requirements, and system strength (response should be stable for the lowest possible grid strength). Response time may be modified based on studied system characteristics.

*** Any overshoot in reactive power response should not cause BPS voltages to exceed acceptable voltage limits.

**** See Appendix F of NERC *Reliability Guideline: BPS-Connected Inverter-Based Resource Performance*.⁵⁸ Final value is the final settled (steady-state) value of reactive power following the change in voltage set point value.

⁵⁶ In this case, the time frame being referred to is within cycles after fault clearance.

⁵⁷ Time between the step change in voltage and reaching 10% of new steady-state value can be used as a proxy for determining this time.

⁵⁸ https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Inverter-Based_Resource_Performance_Guideline.pdf.

Table 2.3: Large Disturbance Reactive Current-Voltage Performance

Parameter	Description	Performance Target
For a large disturbance step change in voltage, measured at the inverter terminals, where voltage falls outside the continuous operating range, the positive sequence component of the inverter reactive current response should meet the following performance specifications...		
Reaction Time	Time between the step change in voltage and when the resource reactive current output begins responding to the change ⁵⁹	< 16 ms*
Rise Time	Time between a step change in control signal input (reference voltage or POM voltage) and when the reactive current output changes by 90% of its final value	< 100 ms**
Overshoot	Percentage of rated reactive current output that the resource can exceed while reaching the settling band	Determined by the TP/PC***

* For very low voltages (e.g., less than around 0.2 pu), the inverter PLL may lose its lock and be unable to track the voltage waveform. In this case, rather than trip or inject a large unknown amount of active and reactive current, the output current of the inverter(s) may be limited or reduced to avoid or mitigate any potentially unstable conditions.

** Varying grid conditions (i.e., grid strength) should be considered, and behavior should be stable for the range of plausible driving point impedances. Stable behavior and response should be prioritized over speed of response.

*** Any overshoot in reactive power response should not cause BPS voltages to exceed acceptable voltage limits. The magnitude of the dynamic response may be requested to be reduced by the TP or PC based on stability studies.

Reactive Power at No Active Power Output

Inverters can be designed to provide reactive power when operating at zero⁶⁰ active power output (i.e., solar PV inverters at night or wind turbines with no wind). However, there is additional cost to the GO associated with operations and maintenance, dc link capacitor lifespan, and inverter component lifespans. Reactive capability in this mode is also dependent on ambient temperature. This should be taken into consideration. This capability can be used by the TP as a highly effective solution option to improve BPS voltage profiles, minimize voltage variability, and support voltage stability by providing dynamic reactive power during all operating modes. If configured accordingly, inverter-based resources can be a valuable asset to provide this ERS when dispatched at zero or slightly negative active power.

The TP and PC may coordinate with the GO to ensure this capability is available to provide grid voltage support services. This will be based on TP and PC reliability assessments or during the interconnection study process. However, ensuring this capability is built into the inverters needs to be addressed up front.

Inverter Current Injection during Fault Conditions

Inverter-based resources and synchronous machines have different current injection characteristics. Synchronous machines inject fault current based on the physical characteristics of the machine, and short-circuit current from a synchronous machine is well understood since it can be represented as a voltage source behind a reactance.⁶¹ However, the response of an inverter to grid disturbances is a function of the controls programmed into the inverter and the rated capability of the inverter. Therefore, interconnection requirements need to clearly articulate how the inverter should behave during fault events to ensure the correct current is provided during and immediately following

⁵⁹ Time between the step change in voltage and reaching 10% of new steady-state value can be used as a proxy for determining this time.

⁶⁰ Some active power is consumed by the inverter to generate reactive power.

⁶¹ The current injection is therefore a defined value with a decaying dc component. The machine provides negative sequence current during unbalanced fault conditions as well.

fault conditions. The fault current contribution should be coordinated with any other relevant inverter active and reactive current controls, as described in other sections of this guideline. This includes both the magnitude of the current as well as the phase relationship of current with respect to voltage. TOs may consider, based on detailed system studies (likely EMT studies), establishing fault current requirements for newly interconnecting inverter-based resources. As the penetration of inverter-based resources continues to grow, pockets of the BPS may require unconventional relaying techniques to ensure secure protection schemes. Based on initial conversations between inverter manufacturers and relay manufacturers, future equipment and performance requirements should incorporate the following:^{62, 63, 64}

- Magnitude, phase angle relationship, timing (e.g., rise time, settling time), and current priority for positive and negative sequence current injection, coordinated with I_p and I_q priorities
- A minimum threshold (i.e., minimum negative sequence measurement) where negative sequence current would be injected; however, this may be system-specific in most cases
- Magnitude of positive and negative sequence currents; phase angle relationship between these currents and voltages; and the rise time, reaction time, settling time, and overshoot of response
- Consideration of upward response (injection during fault inception) and downward response (injection withdrawal upon fault clearing)

The IEEE P2800 effort should consider standardizing fault current injection for inverter-based resources, after further deliberation by inverter manufacturers, relay manufacturers, and protection and stability engineers.

Fault Ride-Through Capability

FRT is the capability of a plant to remain connected to the BPS, continue injecting some form of active and reactive current, and meet a set of performance requirements during and following a BPS fault event. Since NERC PRC-024 focuses only on the voltage and frequency protective relaying aspects of generator protection, and is not a comprehensive FRT standard, interconnection requirements may include more stringent requirements on meeting FRT specifications for a predefined set of contingency events. These requirements apply to both synchronous and nonsynchronous generating resources.

FRT capabilities can be discussed in terms of qualitative as well as quantitative requirements:

- Qualitative requirements focus on the overall ride-through for expected BPS grid disturbances. For example, generating resources may be required to have FRT capability for all expected single contingency events (e.g., NERC TPL-001 standard P1 and P2 events) unless the plant is consequentially isolated due to the fault, the plant is part of a remedial action scheme, or the plant is allowed to trip by exception from the TP based on system studies. These types of requirements are applied during the FAC-002 interconnection studies process, where the TP would perform stability analyses for the set of expected contingencies and identify any situations where the generating facility is unable to meet the FRT or performance requirements. From a transmission perspective, having assurance that generating resources will remain connected and supporting BPS reliability during grid disturbances is critical. However, these qualitative requirements do not provide the GO (and inverter manufacturer) with information that they can use to design the facility during the interconnection process and use to setup controls necessary for reliable performance. For this reason, a set of quantitative FRT requirements should also be considered by the TO.
- Quantitative requirements ensure that resources behave in a manner that supports BPS reliability and also assists the GOs and inverter manufacturers in specifying equipment to meet these requirements. These

⁶² https://www.nerc.com/comm/PC/IRPTF%20Workshops/Key_Takeaways_April_2019_Inverter_Relay_Manufacturer_Meeting.pdf

⁶³ <https://www.vde.com/en/fnn/topics/european-network-codes/rfg>

⁶⁴ https://resourcecenter.ieee-pes.org/technical-publications/technical-reports/PES_TR_7-18_0068.html

requirements may involve a performance envelope (FRT capability) that must be met by the resource, typically derived based on interconnection studies, grid codes, Reliability Standards, and other factors deemed necessary by the TO. Having these requirements ensures that the resources, particularly inverter-based resources, are unlikely to operate in a mode that has not been previously studied. Examples of these quantitative performance requirements include, but are not limited to, the following:

- Pre- and post-fault short-circuit strength (equivalent impedance or short-circuit ratio (SCR)-based metric)) for worst case contingency conditions
- RMS low voltage ride-through and high voltage ride-through
- Instantaneous transient overvoltage
- Instantaneous change in phase angle
- Low frequency ride-through and high frequency ride-through
- No use of momentary cessation, by exception only

TOs should define requirements for FRT capability, including both qualitative and quantitative requirements. In many cases, the qualitative requirements for FRT capability during expected grid disturbances is one aspect of the interconnection studies process. Quantitative requirements should also be used to ensure consistent performance from all generating resources, and may demand more capability than would be required by meeting the quantitative requirements alone in some cases. These requirements should be clear as to what voltage measurement is used (e.g., highest phase value, lowest phase value, positive sequence value, or some other specified voltage value).

Grid Forming Capabilities

Grid forming inverter capability can be generally described as the capability of an inverter to support BPS operation under normal and emergency conditions without relying on the characteristics of synchronous machines. This includes operation as a current independent ac voltage source during normal and transient conditions as long as no limits are reached within the inverter and the ability to synchronize to other voltage sources or operate autonomously if a grid reference is unavailable. A more explicit definition of grid forming inverter capability, and the unique services it can then provide to support BPS reliability under increasing penetrations of inverter-based resources, are still being discussed and developed by the industry. The extent of these definitions and applicable services can also vary from one system to another.

Before specifying or requiring the use of any grid forming performance in any interconnection requirement, TOs should first define grid forming capability and ascertain when and where such capability may be needed on the BPS. Example scenarios where research work has shown its use includes systems with a high penetration of inverter-based resources (localized or widespread)⁶⁵ or systems that may be utilizing inverter-based resources for blackstart purposes. Additionally, and equally important, TOs should simultaneously also evaluate the viability of other available options. Based on the understanding and capability of grid forming inverters today, its use is likely more effective as a solution option in some cases rather than a requirement for all inverter-based resources.

System Restoration and Blackstart Capability

Ensuring sufficient plans, facilities, personnel, and coordination are in place to enable effective system restoration from blackstart resources is the responsibility of each TOP, GOP, RC, and TO and Distribution Provider identified in the TOP restoration plans. These activities are covered in the requirements of NERC EOP-005-3 and EOP-006-3 Reliability Standards. The following aspects should be considered by TOPs and BAs as part of the restoration process

⁶⁵ Grid forming inverter capability can improve BPS operation as inverter-based resource penetration increase, and its sole purpose is not only for 100% inverter-based systems.

and are worth highlighting here, yet may not be directly related to interconnection requirements (i.e., FAC-001-3) for inverter-based resources:

- During a blackstart emergency condition, units are generally not allowed to return without explicit instruction from the BA. Further, plant protection (typically undervoltage) will trip the main substation circuit breaker(s), precluding the automatic reconnection of inverter-based resources. Regardless, automatic reconnection and explicit statement of the expected performance of inverter-based resources during system restoration should be considered by the TOP and BA. This is required as part of NERC EOP-005-2.
- Generating resources are generally not required to have blackstart capability. However, if they do have this capability, they are typically required to provide that information to the TOP and TO as part of the interconnection process. This concept holds for both synchronous and nonsynchronous generating resources.

Return to Service following Tripping

Most inverters have an ac circuit breaker electrically located between the inverter ac terminals and the pad-mounted transformer that interfaces the inverter to the collector system and can electrically isolate the inverter from the grid. Some inverter protection functions may trip this ac circuit breaker, depending on the nature of the fault initiating the trip (e.g., ac overvoltage above a threshold value, dc reverse current above a threshold value). Inverter-based resources may or may not automatically initiate a reconnect sequence to synchronize the inverter to the grid and resume current injection after a trip. There may be a programmed wait time before this reconnect sequence begins; this typically includes a specified time for the inverter controls and then a delay⁶⁶ setting. These resources likely also have plant-level protection settings that may trip the entire resource by tripping the ac circuit breaker connected to the plant GSU(s). Any BPS-connected resource that trips off-line should reconnect based on the reconnection requirements specified by their TO. TOs should consider the current and future penetration of inverter-based resources, and determine if automatic reconnection is acceptable to maintain reliable performance and generation-load balance.

Note that the return to service following an inverter (or entire inverter-based resource) trip may be different from the return to service following complete loss of a BPS grid (localized or large-scale outage). During system restoration, grid operators use blackstart procedures to build the grid back in a sequenced and effective manner. Following “system black” conditions, inverter-based resources should not attempt to automatically reconnect to the grid (unless directed by the grid operator) so as to not interfere with these blackstart procedures. Note that grid following inverters are not able to generate their own ac voltage waveform and therefore are not able to resynchronize to the grid if there is no ac voltage for the PLL to identify grid phase angle. Thus, complete loss of the ac grid will preclude the inverter from resynchronizing. The situation to avoid during blackstart restoration is reconnecting inverters without explicit permission from the BA when the TOP energizes the transmission system feeding the inverter-based resource.

Balancing

As the penetration of variable energy resources (i.e., inverter-based resources) continues to increase, BAs may be faced with rapidly changing generation output levels from a significant amount of generating resources. To account for these rapid changes, BAs may consider requiring active power ramp rate limits to mitigate any significantly large power deviations over a short period of time. Note that this ramp rate limit applies to balancing the variable nature of these resources.⁶⁷ However, these ramp rate limits should not be misinterpreted as a ramp rate limit on active power recovery during or immediately following large disturbances where the individual inverters assume primary

⁶⁶ It has been observed that many inverters use a five-minute wait time, which is defined in IEEE Std. 1547 and is not relevant for BPS-connected inverter-based resources.

⁶⁷ While CAISO does not have a formal requirement for active power ramp rate limits at the moment, they request inverter-based resources participating in the market to limit changes in output to 10% per minute of nameplate capacity.

control for large disturbances. Depending on the market situation or agreements between the GO and BA, some inverter-based resources may be required to receive AGC dispatch signals. In many cases, this is a prerequisite to participate in certain markets.

Monitoring

While working with industry stakeholders, the ERO Enterprise has identified in multiple disturbance analyses that many existing inverter-based resources have minimal data monitoring or diagnostic equipment. This problem is exacerbated by the fact that some plants had diagnostic equipment installed but did not record information from this equipment. Often, the data was recorded in volatile memory and overwritten before NERC, the Regional Entity, or the transmission entities were able to request the data after identifying that a disturbance involving inverter-based resources had occurred.

To address this issue and ensure sufficient monitoring data is available from all generating resources to perform event analysis, data recording requirements should be specified. Refer to the NERC *Reliability Guideline: BPS-Connected Inverter-Based Resource Performance*⁶⁸ for more information regarding data time synchronization, data retention and retrieval, inverter- and plant-level event triggers, and recommended measurement points from the facility. Data should be available from multiple sources to provide sufficient clarity as to any abnormal response or behavior within the plant. This includes plant control settings and static values, plant supervisory control and data acquisition data, sequence of events recording data, dynamic disturbance recorder data, and inverter fault codes and inverter-level dynamic recordings.

Additional data points⁶⁹ for inverter-based resources that may be useful to collect for engineering analysis and exchange of operational data with the TO include, but are not limited to, the following:⁷⁰

- **Wind Power Plants:** turbine output (MW), available power (MW), wind speed, wind direction, number of turbines generating, number of turbines available, total number of turbines, air pressure, air density, high-wind cutoff threshold, slew rate (MW/second)
- **Solar PV Plants:** panel output (MW), solar concentration (irradiance), number of panels generating, number of panels available, total number of panels
- **Both:** ambient temperature, breaker status, voltage set point,⁷¹ AGC control (on/off), regulation (up/down), ramp rate (up/down)

Operation in Low Short-Circuit Strength Networks

The occurrence of areas of the BPS with low short-circuit strength is becoming increasingly common as the penetration of inverter-based resources increases. Refer to NERC *Reliability Guideline: Integrating Inverter-Based Resources into Low Short Circuit Strength Systems*.⁷² TOs should ensure they have an understanding of areas of potential low short-circuit strength and that sufficient requirements are in place to reliably study and integrate inverter-based resources to the BPS. This chapter describes a recommended process for identifying these areas and defining the data and performance requirements for inverter-based resource integrating with these systems. The process involves the following:

⁶⁸ https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Inverter-Based_Resource_Performance_Guideline.pdf.

⁶⁹ Note that these additional data points may have different sampling rate requirements, and the TO should clearly specify those, as applicable.

⁷⁰ Many of these are similar to synchronous generation and would also apply to battery energy storage. The goal here is to have sufficient information available to TOs (and applicable grid operators) from all generating resources. This guideline focuses solely on the inverter-based resource aspects.

⁷¹ Or possibly reactive power set point or power factor set point for some legacy resources.

⁷² https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Item_4a_Integrating%20Inverter-Based_Resources_into_Low_Short_Circuit_Strength_Systems_-_2017-11-08-FINAL.pdf

Chapter 2: Detailed Description of Requirements Improvements

1. The TO should use an appropriate⁷³ SCR-based measure (or other comparable measure) to identify areas of relatively low short-circuit strength. The TO should have the tools and capabilities to identify low short-circuit strength systems accurately and effectively during the interconnection process.
 - a. The TO should have an established process for selecting which normal and contingency conditions to be studied. It is recommended that since SCR-based metrics are used solely as a screening method, that multiple-contingency conditions be considered, including maintenance outages (e.g., N-2 up to N-4 or higher), when practical.
 - b. The TO should understand that a low SCR (or relevant SCR-based metric) alone is not necessarily a cause for concern but can be indicative of potential system conditions where inverter controls-related issues may occur. A large ratio of maximum to minimum SCR (using whichever metric selected) can be an indicator of potential controls tuning issues and the need for a supervisory gain control or other “weak grid stabilization” option.
2. The TO should provide this information to the interconnecting GO, with some qualitative description of technical issues related to interconnecting the inverter-based resource at the proposed location.
3. If the TO considers the interconnection area to be “weak,”⁷⁴ then the TO should require that the interconnecting GO provide this information to the inverter manufacturer(s) and that the GO submit documentation demonstrating that the interconnecting inverter-based resource can reliably and stably operate under similar low short-circuit strength conditions for expected contingency events. The TO should provide either the necessary EMT models around the interconnecting resource or a mutually agreed upon localized system or equivalent⁷⁵ impedance. Alternatively, the TO may elect to perform these studies as part of the interconnection process.
 - a. The documentation submitted by the GO should include EMT studies showing stable and correct operation which meets and performance requirements established by the TO used in the studies process for expected grid conditions, including outage conditions.
 - b. Any identified instability conditions or issues meeting performance requirements should be addressed by the interconnecting GO in cooperation with the TO. This may include, but is not limited to the following:
 - i. Controls modifications to ensure reliable operation under low short-circuit strength conditions.
 - ii. Adding equipment or network enhancements to improve short-circuit strength (e.g., synchronous condensers or transmission reinforcements).
 - iii. Reduction of proposed maximum generating capacity, where applicable.
4. If the concern relating to the interconnection relates to the presence of other system elements (such as nearby inverter-based resources) or system conditions, TO may elect to require more detailed EMT studies using models supplied by the GO.

⁷³ This may include, but is not limited to, SCR, weighted SCR, composite SCR, and other measures being developed. Note that the standard SCR metric does not apply nor work in areas with multiple inverter-based resources. All short-circuit MVA-based metrics have limitations. No single metric is necessarily suitable for all networks.

⁷⁴ Defining strict threshold values for short-circuit strength (using any method) that must be adhered to at all times may not be the best approach. Low short-circuit strength issues are typically site-specific. As such, the TO should use judgment when applying thresholds to each location. Thresholds applied on a wide-area basis should be avoided.

⁷⁵ The TO should establish a methodology for determining the boundary beyond which a short-circuit equivalent can be used.

5. Once a mutually agreed upon solution has been identified, the TO should require that an updated positive sequence stability model⁷⁶ and EMT model⁷⁷ be submitted based on the proposed solution.
6. The TO should require that the positive sequence stability model be benchmarked against the EMT model using final (expected) settings and configuration to ensure an accurate positive sequence stability model. Any discrepancies between models should have a justification that is based on engineering judgment.
7. It is expected that the most severe low short-circuit strength conditions cannot be set up for staged testing during commissioning. If instability occurs during actual operation, the GO should coordinate with the inverter manufacturer and TO to understand mitigation options.

Studies analyzing system strength are performed for interconnecting generating resources, and typically include a determination of an SCR-based metric. SCR-based analysis does not model inverter-based resources as on-line since lower short-circuit capacity results in a lower SCR value.⁷⁸ Fault analysis is performed under expected outage conditions with the inverter-based resources off-line to determine the short-circuit MVA capacity for these conditions. Because short-circuit programs are typically tuned to maximum fault duty for the purposes of circuit breaker rating and relay setting, it may be worth considering reduced synchronous generation operating conditions in addition to system outages. Then the appropriate SCR-based metric is applied based on the expected capacity of the interconnecting resource(s). Therefore, for SCR-based metric analysis, short-circuit modeling is not needed.

Power Quality

BPS-connected inverter-based resources should limit power quality disturbance emissions in compliance with applicable grid codes, the interconnection requirements of each TO, and any applicable power quality standards for BPS-connected generating resources. Two common power quality concerns include voltage fluctuations (flicker/rapid voltage changes) and harmonics. Refer to [Appendix B](#) for more background and actual events related to power quality issues pertaining to inverter-based resources.

Voltage Fluctuation

BPS-connected inverter-based resources may cause less voltage fluctuation (flicker) concerns than low voltage connected distributed energy resources due to a higher reactance-to-resistance (X/R) ratio in HV/EHV systems, and the capability of BPS-connected inverter-based resources to automatically control voltage. However, BPS-connected inverter-based resources may become a source for flicker under abnormal system configurations (i.e., major outage conditions) when its controls interacting with the modified grid characteristics could lead to voltage fluctuations that may have been overlooked during interconnection studies.

IEEE Std. 1453 related to flicker does not explicitly cover variable energy resources (i.e., inverter-based resources).⁷⁹ Until such a guideline for BPS-connected resources is available, utility planners should exercise engineering judgment to identify system strength for all expected outage conditions. If minimum system strength is significantly lower than during normal operation (e.g., less than 15%), detailed studies should be conducted to assess if the inverter-based resource could cause flicker issues (can be performed in conjunction with low short-circuit strength studies). Flicker mitigation options may include inverter-based resource curtailment, coordinated outage planning, or enhanced inverter-based resource controls more suited for a wide range of system strengths.

⁷⁶ The TO should be explicit in describing the positive sequence dynamic model expected (e.g., generic library model, detailed user-defined model, or both).

⁷⁷ The TO should develop clear guidelines regarding the appropriate process for developing/acquiring an EMT model and submitting that model to the TO, TP, and PC. The EMT models should be real code models specific to each individual site, not generic models.

⁷⁸ SCR is defined as $SCR = S_{SCMVA} / P_{RMW}$, where S_{SCMVA} is the short-circuit MVA capacity at the high side of the main transformer interconnecting resource's Project's high side of the main transformer

PRMW is the rated MW value of the inverter-based resource

⁷⁹ Note that IEC 61000-3-17 is being developed to address voltage fluctuation and flicker for generators connected to low voltage networks.

Harmonics

Harmonic injection into the BPS is another power quality concern during the inverter-based resource interconnection process. IEEE Std. 519-2014 included generation as harmonic sources and could be used as a reference for interconnection studies. GOs may consider requesting TOs to provide frequency-dependent system (source) impedances, including the effects of nearby reactive compensation facilities (e.g., switching shunt capacitor banks on-line and off-line), so that information can be provided to the inverter manufacturer during the studies process. Normal and contingency system operating conditions should be considered in the studies. GOs are responsible for restricting harmonic current injection to below established limits. TOs should ensure voltage harmonics are below limits before and after inverter-based resource connection.

It is good utility practice to monitor background power quality levels before and after interconnection of the resource so that issues are identified correctly and addressed in a timely manner. Permanent power quality monitoring requirements should be considered for performance testing, troubleshooting, post-event analysis, and determining the responsibility for mitigating power quality issues.

Protection Settings

The key findings from grid disturbance analyses involving inverter-based resources have led to recommendations for inverter-based resource protection and controls. These recommendations may be incorporated into interconnection requirements, such as the following:

- The area outside of the “No Trip Zone” of the voltage and frequency ride-through curves of the currently effective PRC-024 should not be interpreted as a “Must Trip Zone,” and should be considered a “May Trip Zone.” Tripping should be based on physical equipment limitations and protection should be set to the widest range of voltage and frequency deviations possible while still ensuring equipment safety and reliability.
- Any instantaneous tripping without filtering or time delay⁸⁰ for protection functions should be avoided, unless necessary for the safety and integrity of the inverter-based resource facility.
- Any tripping on calculated frequency should be based on an accurately calculated and filtered frequency measurement over a time window (e.g., six cycles), and should not use an instantaneously calculated value.
- Inverter overvoltage protection should be set as wide as possible, within equipment limitations. The PRC-024 curve uses a filtered RMS voltage measurement, and should not be applied for transient, sub-cycle overvoltages. Refer to [Figure A.1](#) and [Table A.1](#) in *NERC Reliability Guideline on BPS-Connected Inverter-Based Resource Performance*. The table refers to any individual phase voltage quantities.
- The TO may consider specifying performance during successive fault events within a predefined time period.
- Any dc reverse current protection should be coordinated with the PV module ratings, set to operate for short-circuits on the dc side, and should not operate for transient ac overvoltages or for ac-side faults.
- Inverter-based resources connected to the BPS should not use rate-of-change-of-frequency (ROCOF) protection, unless an equipment limitation exists that requires the inverter to trip on high ROCOF. However, in most instances, ROCOF protection should not be used for BPS-connected resources.
- Inverter PLL loss of synchronism should not cause the inverter to trip or enter momentary cessation within the voltage and frequency ride-through curves of PRC-024. Inverters should be capable of continuing to inject current to the BPS within the PRC-024 curves. If the PLL loses synchronism, the inverter-based resource should be able to regain synchronism and resume stable current injection without causing a trip or using momentary cessation.⁸¹

⁸⁰ Filtering inherently adds a time delay to any protective functions since the filter uses a time window.

⁸¹ Any limitations regarding the need to use momentary cessation within the “No Trip Zone” of the currently effective version of PRC-024 should be identified by the GO and provided to the PC and TP per Requirement R3 of PRC-024-2.

Chapter 3: Detailed Description of Modeling Improvements

This chapter provides the technical basis and additional discussion related to the modeling requirements improvements for interconnecting inverter-based resources that were introduced in [Chapter 1](#). Modeling requirements are a component of the overall interconnection requirements. However, due to their complexity and integration with the study process, these recommended modeling improvements are often in a standalone requirements document in the planning or generation interconnection process. For this reason, the recommended modeling requirements improvements have been separated into this chapter for clarity.

Disturbance analyses conducted by the ERO Enterprise and industry stakeholders involving solar PV resources have identified numerous modeling issues that appear to be systemic in interconnection-wide planning models. To address these issues for newly interconnecting inverter-based resources, the interconnection requirements should be explicit in clearly articulating the modeling needs and requirements to ensure accurate models are provided and verified.

For all types of modeling, it is critical that the most up-to-date and accurate representation of the resource is provided for reliability study purposes. The TO should have explicit requirements that the expected dynamic model be provided during the interconnection study process and that any modifications or changes to the plant upon commissioning be reflected in an updated dynamic model that is provided immediately upon plant commissioning. These changes should be studied by the TP and PC to ensure that any deviation from the previously studied controls and performance do not adversely impact reliability of the BPS.

Timing of Modeling Data Submittals

A systemic modeling issue was uncovered regarding the accuracy of the inverter-based resource dynamic models submitted in the interconnection-wide base cases following the issuance of the NERC Alert related to the Canyon 2 Fire disturbance. Namely, a significant number of BPS-connected solar PV facilities had provided dynamic models to their TO, TP, and PC for inclusion in the interconnection-wide base cases that did not accurately capture momentary cessation. Industry is currently addressing this modeling issue; however, it is important to highlight that these types of modeling issues should be addressed during the interconnection process with clear and concise modeling requirements adhered to be the interconnecting GO prior to and after commercial operation.

The data initially submitted during the feasibility study and into the system impact study should be the most accurate and reasonable modeling information available to the GO at the time.⁸² This data should be screened for basic correctness as prescribed by the TP and PC. This data is used for steady-state powerflow, transient stability, short-circuit, and EMT simulations. Once the study is approved, the data should become final, and any changes to the data should become subject to material modification determinations.

Prior to commercial operation of the facility, the GO should be required to submit the most up-to-date modeling data that reflects the equipment and topology being installed in the field. The GO should highlight any differences from the originally studied data (i.e., between the precommercial operation and during the studies phases). Any changes to control system settings (e.g., parameter changes, hardware and software changes, control mode changes), increases in output, facility topology changes, and any other change that modifies the electrical characteristics or response of the plant should trigger the need for a material modification determination.

After the plant has been commissioned and is in-service, most TOs have a requirement to provide an updated model (if applicable) that captures any change between the precommercial operation data and the data after commissioning testing. Any discrepancies should be addressed within a prescribed time frame (e.g., 120 days after the in-service

⁸² The data should always be a reasonable representation of the plans for interconnection; any deviation from these plans should be submitted for review and study by the TP. The GO should also work closely with the inverter manufacturer and other equipment manufacturers to ensure appropriate modeling data is provided for each specific generating facility.

date) to ensure accurate as-built data has been provided to the TO, TP, PC, RC, and other affected entities. This final step to ensure modeling data matches as-built specification sheets, oneline diagrams, and inverter and plant-level control settings is critical, and TOs should ensure they are enforcing this final check and verifying accurate finalized data that then enters the interconnection-wide planning cases.

The material modification determinations should apply during the entire time of in-service operation and is not only applicable to the interconnection process. As stated in the supplemental material for NERC FAC-001-3, “[TOs] should have documentation to support the technical rationale for determining whether an existing interconnection was ‘materially modified.’ Recognizing that what constitutes a ‘material modification’ will vary from entity to entity, the intent is for this determination to be based on engineering judgment.” It is critical for TOs to have clear specifications for what constitutes a “material modification” as this has led to significant confusion in the industry and possible modeling gaps. Changes to control system settings or control modes should be considered material modifications.

Commissioning Procedures

For inverter-based resources, as with any generating resource, it is important that commissioning procedures lead to all parties understanding the as-built settings for the facility. Commissioning procedures are critical for developing a consistent baseline understanding and model of the generating resource. If commissioning is performed either incorrectly or insufficiently, then the remaining interconnection process and in-service operation may face challenges. For example, it is important for an accurate model to be provided as early in the process as possible with periodic updates being made as necessary (particularly during the commissioning process). This may include, particularly, the following:

- The GO (developer) and equipment manufacturers⁸³ have agreed to performance specifications that meet the applicable interconnection requirements. These specifications should be documented and provided to the TO.
- GOs should submit the desired control system settings to the TO for review and comment prior to implementing them. The submission should include a side-by-side comparison with the modeling data. This gives the TOs an opportunity to capture and remediate any performance deficiency while the commissioning team is still on-site. The control settings that the TOs are particularly interested in include, but are not limited to, the following:
 - Plant controller settings (droop, gains, time constants, dead bands, primary frequency response, etc.)
 - Inverter FRT mode and associated settings (threshold and gains)
 - Other control features that impact the FRT capability of inverters
 - Active and reactive power limit settings at the inverter and plant controller level
 - Inverter built-in voltage and frequency protection settings
- GOs may consider involving engineering staff from the TO for regular commissioning progress meetings. This allows increased coordination with TOs, giving an opportunity for the TO to help address any performance issues at the earliest possible stage. This often results in the lowest remediation cost.
- Verification by the GO should occur during commissioning to demonstrate that the as-built settings match the documentation provided. TOs should clearly specify the acceptable forms of verification (e.g., screenshots of settings, retrieval of parameters from inverter and plant-level controls, oneline diagrams).
 - The GO may consider requiring this information from the equipment manufacturers as part of the commissioning process.

⁸³ Such as the inverter and plant-level controller manufacturer and electrical equipment manufacturers.

- All plant models (i.e., steady-state, transient stability, EMT, short-circuit, and any others) should match the documentation provided as well as the verification reporting as applicable. Note that the purpose of this verification process is to capture any deviation from the expected or modelled performance, and it should not be confused with model verification testing for NERC MOD-026-1 or MOD-027-1 that often occurs after the plant is commissioned.
- The models and verification documentation should be submitted by the GO to the TO for further reference.

Steady-State Power Flow Modeling

TOs should have clear and explicit modeling requirements to ensure that the necessary data is being collected to accurately represent inverter-based resources. This modeling starts with a steady-state power flow representation to enter into the base case.

In most cases, dispersed power-producing resources (i.e., wind and solar PV) should be represented in the power flow base case by using an equivalent representation as shown in [Figure 3.1](#).⁸⁴ This includes a single equivalent generator, equivalent pad-mounted transformer, equivalent collector system, and explicit representation of the plant-level shunt compensation, substation transformer(s) (i.e., plant transformer), and interconnecting transmission line. A number of references exist for deriving the equivalent generator, equivalent pad-mounted transformer, and equivalent collector system quantities.^{85,86} In cases where the plant has multiple inverter manufacturers, different power flow representations may be required to account for these differences in the steady-state and dynamic simulations. In these cases, the GO should consult with the TO. A single-line diagram of the plant should be provided to the TO with the accompanying model for additional verification of the model submittal.

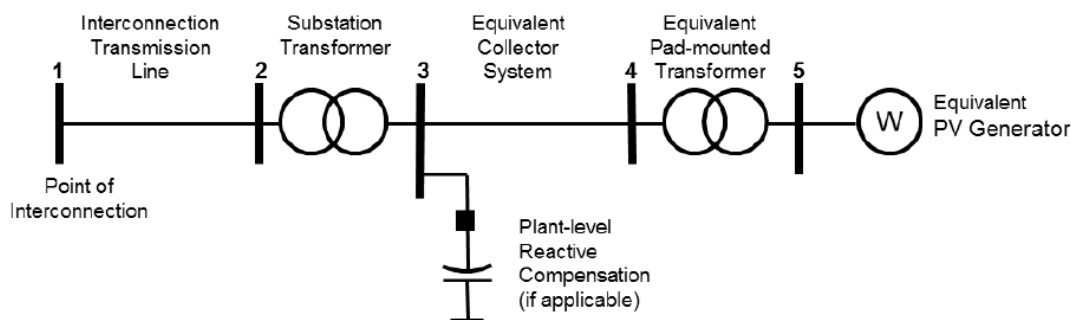


Figure 3.1: Example Equivalent Power Flow Representation for a Solar PV Plant
[Source: WECC]

The modeling requirements specified by the TO should also include all necessary control settings such that the correct capabilities, flags, and settings can be represented in base case. This includes, but is not limited to, the following:

- **Plant Type:** A description of the resource type (e.g., solar PV or wind power resource) used as a flag to ensure that the inverter-based resource is accurately represented in the base case, where applicable.
- **Active and Reactive Capability:** The overall plant “composite capability curve” should be provided for performance purposes. That same curve should be used for accurately modeling the P-Q capability in power flow studies. All simulation software platforms have the capability to represent the P-Q capability curve by

⁸⁴ WECC Guide for Representation of Photovoltaic Systems in Large-Scale Load Flow Simulations, WECC Renewable Energy Modeling Task Force, Approved January 2011: <https://www.wecc.org/Reliability/WECCPVPlantPowerFlowModelingGuide.pdf>.

⁸⁵ WECC Guide for Representation of Photovoltaic Systems in Large-Scale Load Flow Simulations, WECC Renewable Energy Modeling Task Force, Approved January 2011: <https://www.wecc.org/Reliability/WECCPVPlantPowerFlowModelingGuide.pdf>.

⁸⁶ Wind Plant Power Flow Modeling Guide, Energy Systems Integration Group, Accessed February 2019: <https://www.esig.energy/wiki-main-page/wind-plant-power-flow-modeling-guide/>.

entering a set of data points to represent this curve. This data should be required by the TO, and used by the TP and PC to represent these resources in studies.

- **Plant-Level Voltage Control Settings:** The plant will operate in a form of voltage control mode,⁸⁷ and this information needs to be provided to ensure correct voltage control flags and set points are set accordingly in the software tools. In many cases, the voltage control set point at the POI (or POM) is provided by the TOP and can be set by the TP and PC. Some description of the coordination of any plant-level shunt compensation (static or dynamic) should be required to ensure it can be accurately represented in the power flow base case.

The model should accurately reflect any contractual limitations or requirements that may be established for the resource. The TO should ensure that these limitations and requirements, if different than the model provided, are accounted for and described sufficiently such that the plant can be accurately modeled.

Positive Sequence Stability Modeling

In addition to an accurate representation of the BPS-connected inverter-based resource for power flow studies, a positive sequence stability model representation is needed to ensure reliable operation of the BPS by TPs and PCs in system reliability studies. TOs have different requirements based on their local modeling and studies practices. The TO may only allow “generic”⁸⁸ simulation software library models, may require detailed user-defined models, or may require both a detailed user-defined model and a generic model in some cases.⁸⁹ Detailed models are often used for local interconnection reliability studies (localized studies as well as interconnection study process studies) while generic models are typically used in the interconnection-wide base cases per MOD-032-1. In any case, the TO should be clear in the types of models that are expected to be provided for the interconnection process. Those models should, at a minimum, align with the list of acceptable models used for interconnection-wide modeling developed by NERC⁹⁰ and the MOD-032 Designees.⁹¹

Regarding the generic library models, there are multiple industry references that provide guidance regarding dynamic modeling for BPS-connected solar PV⁹² and wind⁹³ plants. The GO should consult with their inverter manufacturer and overall plant architect(s) to ensure that the final dynamic model provided to the TO represents the overall inverter-based resource (not an individual inverter or turbine) while following the guidelines and requirements set by the TO. The TO should ensure that the most up-to-date version of the dynamic models is required and used appropriately. For example, a modern solar PV resource is typically modeled with the following:⁹⁴

- **Inverter-Level Controller Model:** represents the overall control of the inverter as a generating resource (*regc_a*)
- **Electrical Control Model:** represents the detailed electrical controls of the inverter-based resource, including large disturbance behavior (*reec_a*)

⁸⁷ This could also include fixed power factor or fixed reactive power mode. However, this is unlikely and not recommended for newly interconnecting resources.

⁸⁸ The model parameters should represent, to the best possible extent, the actual performance, settings, and controls of the actual inverter-based resource. When the “generic” models are used, these models should never be parameterized with generic values.

⁸⁹ Possibly with some documentation of benchmarking between these models. Generic models are used for interconnection-wide modeling purposes and more detailed user-defined models are used for local reliability studies and interconnection studies. Both are needed in many cases.

⁹⁰ NERC List of Acceptable Models: [https://www.nerc.com/comm/PC/Pages/System-Analysis-and-Modeling-Subcommittee-\(SAMS\)-2013.aspx](https://www.nerc.com/comm/PC/Pages/System-Analysis-and-Modeling-Subcommittee-(SAMS)-2013.aspx).

⁹¹ For example, the WECC Approved Dynamic Model Library:

<https://www.wecc.org/Reliability/WECC%20Approved%20Dynamic%20Models%20Library%20May%202018.pdf>.

⁹² WECC Solar Plant Dynamic Modeling Guidelines, Western Electricity Coordinating Council, Approved May 2014:

<https://www.wecc.org/Reliability/WECC%20Solar%20Plant%20Dynamic%20Modeling%20Guidelines.pdf>.

⁹³ WECC Wind Plant Dynamic Modeling Guidelines, Western Electricity Coordinating Council, Approved May 2014:

<https://www.wecc.org/Reliability/WECC%20Wind%20Plant%20Dynamic%20Modeling%20Guidelines.pdf>.

⁹⁴ EPRI, “Model User Guide for Generic Renewable Energy System Models,” Product ID: 3002014083, July 2018:

<https://www.epri.com/#/pages/product/000000003002014083/?lang=en-US>.

- **Plant-Level Controller Model:** represents control of multiple individual inverters within the plant (e.g., *repc_b*)

The NERC MOD-032-1 standard focuses on the TP and PC jointly establishing model data requirements and reporting procedures that must be adhered to by equipment owners to aid in the development of interconnection-wide base case development. The NERC MOD-026-1 and MOD-027-1 standards focus on model verification of the positive sequence stability models after the plant has been commissioned.⁹⁵

Short-Circuit Modeling

Short-circuit studies are typically performed to compute currents and voltages under fault conditions for relay setting and coordination studies and for circuit breaker duty studies. These studies rely on models of elements of the transmission network (lines, transformers, etc.) and generating resources by using positive, negative, and zero sequence representations. It is important that TOs clearly state the requirements for short-circuit model representation (including inverter-based resources) to ensure appropriate and accurate models are provided by the GO of the interconnecting generating resource. Elements of these requirements pertaining to inverter-based resources include, but are not limited to, the following:

- Any transmission line(s) connecting the inverter-based resource from the substation transformer to the POI should be modeled to the same level of accuracy that is used by the TO for other similar BPS elements. The TO should specify the necessary data for use in available line constant calculation tools. Necessary data may include, but is not limited to, the following: transmission plan and profile documents showing transmission tower configuration with conductor spacings relative to each conductor and ground, insulator string length (for calculation of flash-over arc impedance), and conductor type (including static) and line length (in feet). If the conductor is a special type, the complete electrical specifications for the conductor should be provided (i.e., ac resistance, conductor radius, conductor GMR, etc.). At a minimum, the lumped positive and zero sequence impedance for the generator tie line is needed.
- The substation transformer of the interconnecting inverter-based resource should also be modeled to the same level of accuracy used by the TO. Necessary data includes, but is not limited to, transformer nameplate data, transformer type, winding configuration, and test report data from the transformer manufacturer. Data for this transformer should include zero sequence information for three-phase core type.
- The collector system is typically represented in the short-circuit program as an equivalent impedance; however, more detailed studies may be performed by the TO that require more detailed collector system information.⁹⁶ The TO should explicitly state the level of detail needed for short-circuit modeling. In many cases, the TO may request the following information: collector system oneline diagram showing the full topology (with cable/line lengths) between turbines/inverters and other elements, and sequence resistance and reactance values. The information should also include any shunt compensation within the plant, including nameplate information for those devices. Equivalent representations may be allowable by the TO, and details should be provided on where equivalencing can be used.
- Depending on the level of detail of the collector system, the generator model can represent the overall facility, groups of inverters, or individual inverters. The generator model (equivalent or individual) should be represented by a model provided by the supplier that is supported by commonly used short-circuit programs (e.g., voltage-controlled current source or other suitable model). Data may need to be aggregated from each inverter type or may be specified per inverter type, depending on TO requirements.

⁹⁵ NERC, "Reliability Guideline: Power Plant Model Verification for Inverter-Based Resources," September 2018: https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/PPMV_for_Inverter-Based_Resources.pdf.

⁹⁶ For example, if multiple inverter types (or a wind plant with mixed Type III and Type IV turbines) are used within the facility, then more detailed representations may be required by the TO. The TO should provide this level of guidance in their modeling requirements.

Chapter 3: Detailed Description of Modeling Improvements

- The inverters, unlike synchronous machines, are a controlled current source and provide a fault current based on the logic and controls built into the inverter.⁹⁷ A recommended approach for gathering necessary information for the purposes of short-circuit modeling is to complete **Table 3.1** for the inverter-based resource for specified time periods. The table specifies the positive and negative current magnitude and power factor angle for varying levels of voltage magnitude at the inverter terminal.⁹⁸ This information is needed at different time frames (e.g., one cycle, three cycles, and five cycles) since the inverter will respond with different types of current over these time frames.⁹⁹ These tables will need to be provided for different fault types (i.e., three-phase (3L), three-phase-ground (3LG), line-line (L-L), line-line-ground (L-L-G), and single-line-to-ground (SLG)).¹⁰⁰ The software programs use this information (either loaded into the program in tabular format or via a script) iteratively to compute fault currents.¹⁰¹

The development of accurate inverter-based resource models for the purpose of short-circuit analyses is an ongoing effort under the IEEE Power System Relaying and Control Committee C24 Working Group¹⁰² in coordination with EPRI and software vendors.^{103,104,105} In addition, the IEEE P2800 effort may bring some standardization to inverter-based resource fault behavior that may help with standardization of these models.¹⁰⁶ Once any detailed models become available, they may be more suitable for representing some inverter-based resources in short-circuit studies. However, it is important that sufficient information be gathered by the TO from the GO such that the inverter-based resource can be accurately modeled as the tools develop and improve. For example, while present models may not reflect negative sequence current injection, this information should be provided by inverter-based resources that do inject negative sequence current so that when these models do become available then the TO can update the data accordingly.

Table 3.1: Short-Circuit Performance Tables				
Positive Sequence Voltage (pu)	Positive Sequence Current (pu)	Negative Sequence Current (pu)	Positive Sequence Power Factor Angle (deg)	Negative Sequence Power Factor Angle (deg)
One-Cycle Time Frame				
0.9				
0.8				
0.7				
0.6				
0.5				
0.4				

⁹⁷ The inverter manufacturer can often set the current response to different settings, so clear requirements or coordination between the manufacturer, GO, and TP/PC are needed to ensure a suitable response for the local BPS needs within the inverter capabilities.

⁹⁸ Note that if the inverter-based resource has limited ride-through capability (i.e., employs momentary cessation), then the table should be filled out with zeros throughout, or this information should somehow otherwise be specified by the GO to the TO.

⁹⁹ This concept is similar to how synchronous reactance (X_d), transient reactance (X'_d), and subtransient reactance (X''_d) are specified for a synchronous machine.

¹⁰⁰ If the inverters are configured to only provide positive sequence current, then the table should reflect that with zeros in the negative sequence current column. Otherwise, if this capability is available, this information is critical for correctly representing the inverter-based resource response in short-circuit programs.

¹⁰¹ This is the approach being taken by commonly used short-circuit software programs since inverter-based resources have a nonlinear fault response.

¹⁰² <http://www.pes-psrc.org/sub/C.html>.

¹⁰³ "EPRI Wind/Solar Phasor Domain Short-Circuit Models and Implementation Status in Commercial Tools", EPRI, Palo Alto, CA, 3002010940

¹⁰⁴ PSS@CAPE Manual "Type 4 Wind/Solar Generator Models"

¹⁰⁵ ASPEN Technical Bulletin "Modeling Type-4 Wind Plants and Solar Plants With ASPEN OneLiner's Voltage Controlled Current Source Model"

¹⁰⁶ <https://standards.ieee.org/project/2800.html>.

Table 3.1: Short-Circuit Performance Tables				
Positive Sequence Voltage (pu)	Positive Sequence Current (pu)	Negative Sequence Current (pu)	Positive Sequence Power Factor Angle (deg)	Negative Sequence Power Factor Angle (deg)
0.3				
0.2				
0.1				
Three-Cycle Time Frame				
0.9				
0.8				
0.7				
0.6				
0.5				
0.4				
0.3				
0.2				
0.1				
Five-Cycle Time Frame				
0.9				
0.8				
0.7				
0.6				
0.5				
0.4				
0.3				
0.2				
0.1				

Electromagnetic Transient Modeling

Along with positive sequence stability models, EMT models are needed to study certain reliability issues that involve inverter-based resources that cannot be observed in positive sequence stability programs. These types of studies are particularly useful in areas where inverter-based resources may interact with other power electronic controls, such as existing high-voltage dc circuits, STATCOMs, SVCs, or other inverter-based resources. They are also useful where inverter-based resources are connected in low short-circuit strength networks or in close proximity to series capacitors. Therefore, TOs should specify requirements for inverter-based resources to provide EMT models in situations where an EMT-type study may be needed now or in the foreseeable future. As the grid evolves, having these accurate models is critical for detailed system studies and solving complex issues that involve inverter-based resources.

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TOs may either require EMT models for all newly interconnecting inverter-based resources or may require these models on a case-by-case basis. Situations where these models should be required may include, but are not limited to, the following:

- Areas of low (or decreasing) short-circuit strength¹⁰⁷
- Areas near existing (or potentially future) series compensated transmission circuits, presenting a risk of subsynchronous oscillations (SSO), subsynchronous control interactions (SSCI), supersynchronous oscillations as well as other resonance issues and a risk of high transient overvoltages
- The addition of new inverter-based resources in areas with existing or planned high concentration of inverter-based resources where situations of control interactions, control mode cycling, or other control instabilities may occur
- Interconnections of inverter-based resources near high-voltage dc circuits and other large transmission-connected reactive devices that are interfaced through power electronics (e.g., Flexible AC Transmission System (FACTS) devices)

Detailed EMT modeling requirements may be developed by the TO to ensure consistent EMT models are provided based on the type of study being performed and the specific EMT simulation tools being used. In general, the EMT model should adhere to the following requirements specified by the TO:

- **Model Accuracy Features:** The EMT model should have sufficient detail to represent the following:
 - **The fully detailed inner control loops of the power electronics as implemented in the actual equipment that will be installed:** Most inverter manufacturers can provide models that embed the actual firmware code (relevant to EMT simulations) into the EMT model, and this is the recommended type of model to be supplied for EMT studies.¹⁰⁸
 - **All pertinent control features (e.g., external voltage controllers, plant-level controllers, PLLs):** These include the actual (or expected) operating modes and settings required for system-specific installations, tuned to the expected or as-built controls settings. Inverter-level and plant-level¹⁰⁹ controls should be modeled appropriately with actual hardware code preferred.
 - **All pertinent electrical and mechanical configurations:** These may include, but are not limited to, filters, specialized transformers, and other mechanical systems that could impact electrical performance, such as drivetrain controls and pitch controls. The model should have both detailed (with Insulated Gate Bipolar Transistor (IGBTs)) and average-value (with controlled sources) representation options for its converters.
 - **All pertinent inverter-based resource protection systems relevant to BPS performance that are modeled in detail for both balanced and unbalanced fault conditions:** Typically this includes, but is not limited to, ac over- and under-voltage protection (instantaneous phase and RMS), over- and under-frequency protection, dc bus over- and under-voltage protection, and inverter overcurrent protection. Actual firmware code is recommended to be implemented in the model for these features.

¹⁰⁷ https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Item_4a_Integrating%20Inverter-Based_Resources_into_Low_Short_Circuit_Strength_Systems_-_2017-11-08-FINAL.pdf.

¹⁰⁸ This refers to “black box models” of the exact controls code (e.g., C code) used in the actual controls firmware. The controller source code for all relevant controls is typically compiled into binary DLLs to protect the intellectual property of the manufacturer. If real code models are not used, or if key control features are approximated using generic representations, additional validation may be required. A three-phase sinusoidal source representation should not be used. Models should not be manually translated block-by-block from control block diagrams due to inaccuracies that may be introduced during this translation (e.g., in the electrical network and interface to the controls, or portions of the controls such as PLL circuits or protection circuits)

¹⁰⁹ Often, the plant-level controls also include the control of other reactive devices, such as shunt capacitor banks and STATCOMs, within the plant. The plant-level controls modeling may include the control and coordination of other devices as well, if those devices would operate in the time frame of the study.

- **Model Usability Features:** The EMT model should meet usability criteria to ensure study engineers have a functional model, including the following:
 - The model should have control or hardware options accessible to the user that are pertinent to the study (e.g., active current/power ramp rates). Diagnostic flags (e.g., control mode or protection system activation) should also be accessible.¹¹⁰
 - If the simulation time step is very small, or if a very specific time-step is required by the model, this can lead to very slow simulation times and incompatibilities with other models. The model should not be restricted to operating at a single time step but should be able to operate within a range (e.g., 10 μ s – 20 μ s).¹¹¹ Higher time steps can be used with average-value modeling of converters.
 - The model should include a user manual or guide and a sample implementation test case. Access to technical support engineers is desirable.
 - The model documentation should provide a clear way to identify the specific settings and equipment configuration that will be used in any study such that during commissioning the settings used in the studies can be checked. This may be control revision codes, settings files, or a combination of these and other identification measures.
 - The model should accept external reference variables. Examples include active and reactive power ordered values for reactive control modes, and voltage reference and droop values as applicable for voltage control modes. Model should accept these reference variables for initialization, and be capable of changing these reference variables mid-simulation (i.e., dynamic signal references).
 - The model must be capable of initializing itself. Once provided with initial condition variables, the model must initialize and ramp to the ordered output without external input from simulation engineers. Any slower control functions that are included (such as switched shunt controllers) should also accept initial condition variables if required. The model should accept an initialization procedure to eliminate internal delays.
 - The model should have the ability to scale plant capacity. The plant active power capacity of the model should be scalable in some way, either internally or through an external scaling transformer. This is distinct from a dispatchable power order and is used for modeling different capacities of the plant or breaking a lumped equivalent plant into smaller composite models.
 - The model should have the ability to dispatch its output to values less than nameplate. This is distinct from scaling a plant from one unit to more than one, and is used for testing plant behavior at various operating points.
- **Model Efficiency Features:** The EMT model should also meet the following requirements to ensure studies can be completed effectively:
 - The model should initialize as quickly as possible (e.g., less than five seconds) to user-supplied terminal conditions.
 - The model needs to support multiple instances of itself in the same simulation.

¹¹⁰ Care should be taken to ensure that any user-settable options are not changed in a way that is not implementable in the real hardware and that any selectable options are actually available at the specific site being considered. Discussion with the manufacturer is recommended prior to any changes being made in model configuration.

¹¹¹ Most of the time, requiring a smaller time step means that an inappropriate interfacing between the model and the larger network is used. For switching converter models, it is important to replicate the switching frequency of the power electronic device and this is the primary limit in selecting the maximum time step used (typically 10–20 μ s). The time step should not be limited by internal control system implementation issues.

Benchmarking Positive Sequence Stability Models with EMT Models

Verification efforts for meeting NERC MOD-026-1 and MOD-027-1 requirements (particularly Requirement R2 of each standard) focus on the small disturbance performance and do not excite the model enough to verify the majority of model parameters in the dynamic model that would influence the performance for large disturbances. These parameters dominate the model response during any simulated fault event. Therefore, the interconnection requirements need to provide sufficient clarity and detail to ensure that the models match the installed equipment during the study process (based on the best information available) and after the resource has been commissioned.

The EMT models are typically the most detailed representation of the actual controls inside an inverter-based resource. These models are expected to provide an equivalent (often more accurate) representation of the resource. In comparison, a positive sequence dynamic model is designed to provide an accurate representation of the RMS trend of response of the resource. To ensure that the positive sequence model accurately represents the installed behavior, without the need for performing any field tests, the positive sequence dynamic model(s) can be benchmarked against the EMT model. This benchmarking activity ensures a reasonable match between the two models, and a degree of certainty that the model matches actual behavior.

TOs, in coordination with their TP, are recommended to require model benchmarking between EMT and positive sequence stability models by GOs, which will also identify and recognize system conditions where the positive sequence stability model may prove ineffective for performing reliability studies. This consideration should look at the existing system as well as future system conditions. Experience demonstrates that obtaining accurate models prior to project commissioning is significantly easier than trying to get accurate models after the plant is operational. Possible situations where the benchmarking should be required may include, but are not limited to, the following:¹¹²

- Controls interactions or controls cycling within the inverter-based resource or with other neighboring inverter-based resources (possibly identified during the EMT studies process)
- Areas of relatively low short-circuit strength, which generally includes pockets of high penetration of inverter-based resources or long ac transmission lines
- SSO, SSCI, and other interaction with nearby series compensated transmission networks

Regarding model benchmarking activities, the following recommendations are provided:

- TOs should require that interconnecting inverter-based resources provide EMT models during the study process (based on the EMT modeling requirements established above)¹¹³ and an updated EMT model after the plant has been commissioned. Any changes made to the plant-level or inverter-level controls or configuration should also instigate that an updated set of EMT and dynamic models be provided by the GO and an evaluation of the material nature of the change. These models are in addition to the updated positive sequence stability models required for interconnection-wide modeling purposes.
- TOs should verify that the EMT model provided by the GO represents the specific plant or facility under consideration and does not include default or generic parameter values. The parameters values, controls, settings, etc. should represent (to the best possible extent) the actual or expected controls and settings of the specific plant being studied. Default model parameters provided by the GO from an equipment

¹¹² Note that, in some of these cases, a full EMT study will also be required in addition to the benchmarking activities. For example, SSCI, SSO issues, and low short-circuit strength networks will likely require both a full EMT study to ensure reliability as well as a benchmarking report to show a reasonable match (or identified limitations) between the types of models.

¹¹³ The interconnecting GO may change inverter models during the study process, posing a unique modeling challenge for EMT studies. It may not be possible to provide an EMT model for a 2022 study year model for a specific manufacturer since the exact inverter model (and associated model) will change over this time frame. CAISO, for example, currently requires EMT models be supplied six months prior to commercial operation. Then, an updated as-built model is requested within 120 days after commercial operation.

Chapter 3: Detailed Description of Modeling Improvements

manufacturer is currently a systemic modeling issue; specific TO requirements to address this issue are recommended.¹¹⁴

- The interconnecting GO should provide the TO with evidence that the expected and commissioned¹¹⁵ positive sequence dynamic models reasonably match the EMT models provided. This should include some type of benchmarking report provided by the interconnecting GO (this may involve the inverter manufacturer).¹¹⁶ The benchmarking analysis should, at a minimum, exhibit the following:
 - The analysis should have the unit dispatched at full active power output.
 - The analysis should be performed over a range of expected equivalent network impedances, including impedances experienced during normal system conditions as well as during line outage conditions. If the GO is to provide a report, the TP should provide this equivalent impedance range (or corresponding models indicating these system conditions) to be tested to the GO during the interconnection process.
 - The analysis should be performed for any specific operating modes or control settings that may be utilized once the plant is commissioned and operational. For example, any switches or changes in settings or controls for low short-circuit strength conditions (if applicable) should be tested explicitly.
 - The analysis should include trace-over-trace comparison of a range of expected disturbance events, including at least a bolted three-phase fault at the POI. Unbalanced faults, such as single line to ground faults with delayed clearing, are expected to have benchmarking results that do not necessarily match. However, the positive sequence response should show a general trend match with EMT, and any tripping or instability in one type of model that does not show up in the other should be documented and explained.
 - The analysis should include trace-over-trace comparison of a step change in voltage reference or power order if applicable.
 - The analysis should provide simulation results with sufficient data channels to illustrate the benchmarking between positive sequence stability models and EMT models is satisfactory. This includes, but is not limited to, bus voltages at the POM, low-side of the plant transformer, and inverter (generator) level; line and transformer active and reactive power flows, active power and reactive power output at the POM, and ride-through status and protection signals.
 - The analysis should provide results with sufficient resolution such that a comparison of the dynamic response of the two models can be compared. This is typically at least five seconds of simulation time following the fault inception, but it may be longer. The TP should specify the expected simulation length to the GO if they are performing the studies.
 - The analysis should identify and discuss any differences between benchmarking simulation results. The plots should show similar results between the positive sequence stability program and the EMT program. Any significant differences between the traces should have a sufficient technical basis, and should be included in the benchmarking report. The TP and PC should, in consultation with the GO, determine whether the benchmarking results are satisfactory.
 - The analysis should document the specific control parameters and modeling files used for both positive sequence models and EMT models in the production of the report.

¹¹⁴ This could include requiring screenshots of inverter settings (upon commissioning) or verification with the inverter and plant controls manufacturers that the models are coordinated and are not using standard default parameter values.

¹¹⁵ The TO should ensure some type of verification, upon commissioning, that the actual installed equipment matches the models submitted. This may include benchmarking the positive sequence dynamic models with the EMT models using the as-built settings.

¹¹⁶ The inverter manufacturer will typically use an identical test system and simulation the same set of contingencies to demonstrate benchmarking, and will provide this information to the GO as part of model delivery up front.

Appendix A: Interconnection Requirements Documentation

Table A.1 provides a list of interconnection requirements documentation from various TOs, TPs, and PCs. It is intended to serve as a reference for TOs in the development of their local requirements pertaining to inverter-based resources. The references below may or may not include the recommendations in the guideline and are simply provided here as a list for future reference.

Table A.1: Interconnection Requirements References	
Avista:	http://www.oasis.oati.com/woa/docs/AVAT/AVATdocs/Avista_Corporation_Facility_Connection_Requirements_-_Ver_8.pdf
BC Hydro:	https://app.bchydro.com/content/dam/BCHydro/customer-portal/documents/transmission/tgi/technical-interconnection-requirements-for-power-generators-r14-2014-06.pdf
BPA:	https://www.bpa.gov/transmission/Doing%20Business/Interconnection/Pages/default.aspx
CAISO:	http://www.caiso.com/Documents/InverterTariffRevisions-InterconnectionProcessEnhancements2018.docx
Duke Energy Progress:	http://www.oasis.oati.com/woa/docs/CPL/CPLdocs http://www.oasis.oati.com/woa/docs/CPL/CPLdocs/Duke_Energy_Progress_Facility_Interconnection_Requirements_R1.pdf
Duke Energy Carolinas:	http://www.oasis.oati.com/woa/docs/DUK/DUKdocs http://www.oasis.oati.com/woa/docs/DUK/DUKdocs/Duke_Energy_Carolinas_Facilities_Connection_Requirements_Rev_8.docx
Duke Energy Florida:	http://www.oasis.oati.com/woa/docs/FPC/FPCdocs/ http://www.oasis.oati.com/woa/docs/FPC/FPCdocs/TECP-EGR-TRM-00053_-_Rev._003.pdf
ENTSO-E:	https://www.entsoe.eu/network_codes/rfg/ https://consultations.entsoe.eu/system-development/entso-e-connection-codes-implementation-guidance-d/consult_view/ https://consultations.entsoe.eu/system-development/entso-e-connection-codes-implementation-guidance-d-3/user_uploads/igd-high-penetration-of-power-electronic-interfaced-power-sources.pdf
ERCOT:	http://www.ercot.com/content/wcm/lists/168307/ERCOT_PSCAD_Model_Submittal_Guideline_Draft_20180507_3_.docx

Appendix A: Interconnection Requirements Documentation

FPL:
• https://www.oasis.oati.com/woa/docs/FPL/FPLdocs/November_2018_REVISED_FIR_12072018.pdf
ISO-NE:
• https://www.iso-ne.com/participate/applications-status-changes/new-modified-interconnections/ • https://www.iso-ne.com/static-assets/documents/rules_proceeds/isonet_plan/pp05_6/pp5_6.pdf • https://www.iso-ne.com/static-assets/documents/rules_proceeds/operating/isonet/op14/op14_rto_final.pdf • https://www.iso-ne.com/static-assets/documents/regulatory/tariff/sect_2/sch22/sch_22_lgip.pdf • https://www.iso-ne.com/static-assets/documents/regulatory/tariff/sect_2/sch23/sch_23_sgip.pdf
ITC Holdings:
• https://www.itc-holdings.com/docs/default-source/stakeholder-documents-and-request-forms/shared/itc-holdings-planning-criteria-100-kv-and-above--2019.pdf?sfvrsn=d36ecaf6_2 • https://www.itc-holdings.com/docs/default-source/itc-fact-sheets/itc-holdings-facility-connection-requirements-04-27-18.pdf?sfvrsn=1da1cff6_2
Southern Company:
• http://www.oasis.oati.com/woa/docs/SOCO/SOCOdocs/Interconnection-Reg_Inverter-Gen_Effective-2018-12-26.pdf
Southern California Edison:
• https://www.sce.com/business/generating-your-own-power/grid-interconnections/transmission-owner-tariff
VDE:
• https://www.vde.com/en/fnn/topics/european-network-codes/rfg • https://www.vde-verlag.de/standards/0100494/vde-ar-n-4130-anwendungsregel-2018-11.html

Appendix B: Background on Power Quality Issues

As the penetration of BPS-connected inverter-based resources continues to increase in many parts of North America, the need for power quality monitoring and analysis continues to grow. This is particularly due to the nonsinusoidal nature of inverter-based technology. As a result, power quality analysis during the interconnection process for BPS-connected inverter-based resources is recommended for the following reasons:

- Reduced short-circuit strength, driving “weak grid” conditions, increases the likelihood of power quality issues.
- Reduced short-circuit strength can modify network resonant frequencies, potentially impacting the tuning of BPS-connected harmonic filters.
- Reduced short-circuit strength can impact flicker transfer coefficients.
- BPS outage scenarios are increasingly more complicated due to increased variability.
- Widespread use of BPS-connected shunt compensation creates low-order harmonic resonances that amplify harmonics injected by inverter-based resources and background harmonic voltage distortion levels.

These issues should be identified during the interconnection process such that effective mitigation strategies can be developed and implemented.

Voltage Fluctuation

Voltage fluctuation (i.e., “flicker”) refers to the cyclic variation of voltage magnitude. Flicker is quantified by using short-term (Pst) and long-term (Plt) flicker severity.¹¹⁷ IEEE Std. 1453/1453.1 and IEC 61000-4-15/61000-3-7 acceptable flicker levels. Flicker was conventionally an issue caused by loads (e.g., electric arc furnaces and other industrial loads) rather than generation. IEEE Std. 1547-2018 adopted flicker limits for distributed energy resources, and flicker is predominantly a focus for distribution engineers. One could postulate that the inherent variability of BPS-connected wind, solar PV, and other inverter-based resources could cause flicker concerns on the BPS. However, modern inverter-based resources are equipped with controls and capability to control voltage and help mitigate any potential flicker issues (note the relatively slower time frames for flicker as compared with harmonics or other resonances).

However, studies should identify any conditions where grid strength may fall below acceptable levels, and where BPS-connected inverter-based resources could cause large voltage fluctuations. [Figure B.1](#) (left) shows voltage measurements of a Type 4 wind power plant connected at 230 kV under a bus outage at a substation with high SCR. The outage reduced SCR at the wind plant connection point by more than 85%. As a result, sustained oscillations near 3.5 Hz occurred when wind speed ramped up at night. These oscillations lasted for several hours without being detected by protection or supervisory control and data acquisition. [Figure B.1](#) (right) shows the corresponding Pst trend in that day. It can be observed that, during the night, the flicker index jumped higher more than tenfold. Such risk could be managed by earlier review of outage scenarios during the interconnection process. Outages causing a large change in SCR may need more detailed studies to develop mitigating plans (e.g., curtailment, enhanced outage planning, different inverter controls options).

¹¹⁷ Short-term flicker severity (Pst): evaluation time of 10 minutes; long-term flicker severity (Plt): evaluation time of 2 hours.

Appendix B: Background on Power Quality Issues

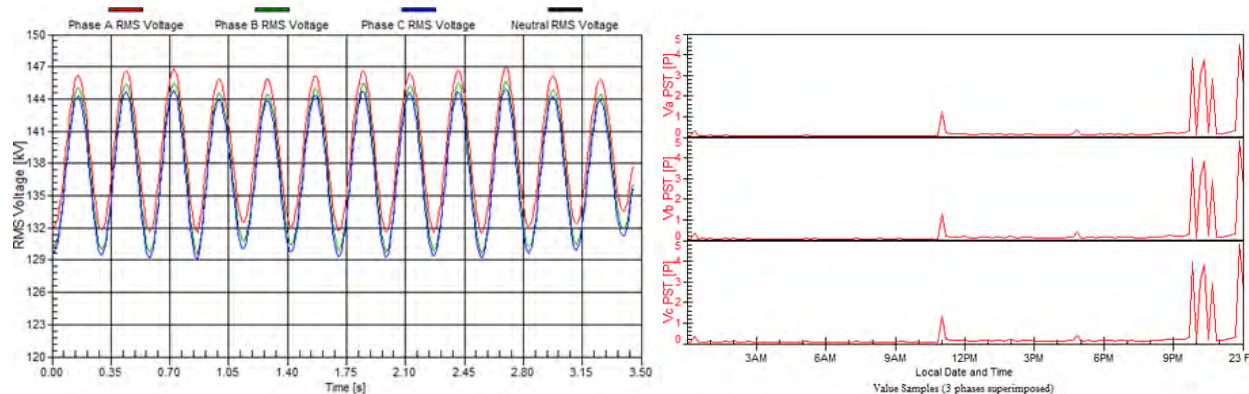


Figure B.1: Sustained Oscillation and Flicker Pst at 230 kV Type 4 Wind Plant
[Source: Hydro One]

As with wind generation, the interconnection of solar PV generation can potentially create undesired flicker. To illustrate this issue, Figure B.2 shows voltage and Pst field measurements at the POI of a 30 MW solar PV plant interconnected to the 46 kV sub-transmission system. As shown in Figure B.2, the Pst on Day 3 was over 7.5, which is well beyond industry limits. One key takeaway from the flicker experienced at this facility is the importance of short SCR. If SCR is too low (in this case less than five), then the plant has more ability to impact voltage in the area. In this case, the solar PV site was able to impact the area voltage significantly, resulting in numerous customer complaints of lights flickering. Another key takeaway is the importance of having a permanent power quality monitor installed at the POI to assist with the analysis.

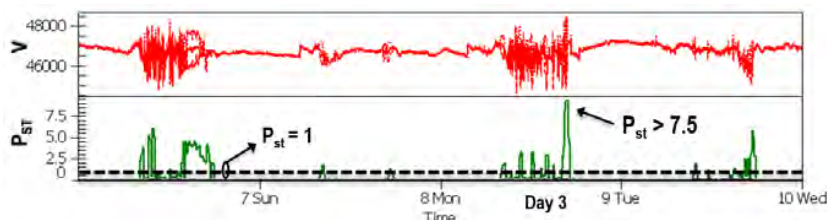


Figure B.2: Flicker Experienced at PV Plant POI
[Source: Southern Company]

Another type of voltage fluctuation is nonperiodic and called rapid voltage changes (RVCs). RVC is typically an infrequent one-step voltage variation caused by facility switching or start-up. Pst and Plt readings by power quality meters are not suitable for assessing these infrequent voltage changes. IEEE Std. 1453 and IEC-61000-3-7 recommend indicative RVC planning levels, such as 3–5% voltage changes for less than four times per day. Grid codes may have similar requirements; however, consistent definition and measurement methodology of RVC has not been established across the board. BPS-connected inverter-based resource planning should inspect the magnitude of abrupt rapid voltage changes under facility energization, start-up, or sudden trip at full output with sufficient consideration of outages.

An example of RVC during energization of a 46 kV PV plant main transformer with a conventional switching device is illustrated in Figure B.3. Bus voltage on phase c experienced a rapid change of approximately 14%. Transformer energization RVC events can be examined using EMT simulations to screen for potential concerns before plant energization. CIGRE Technical Brochure-568 *Transformer Energisation in Power Systems*¹¹⁸ provides guidance on transformer energization studies as well as mitigation strategies.

¹¹⁸ http://cigre.org.uk/web-cont1001/uploads/TI_568_Transformer_Energisation.pdf.

Appendix B: Background on Power Quality Issues

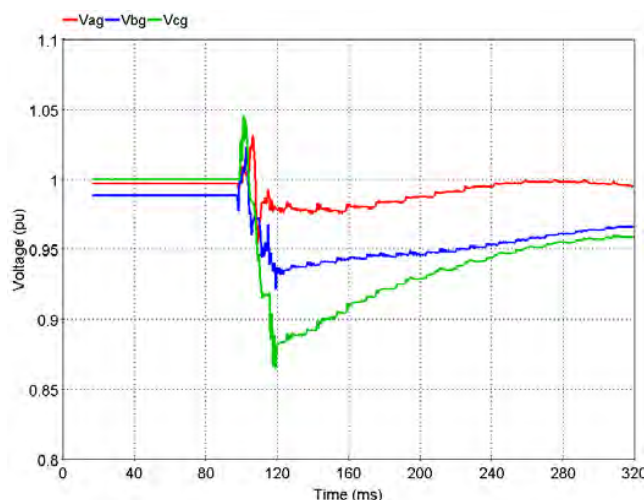


Figure B.3: Windowed RMS Phase-to-Ground Voltage during Transformer Energization
[Source: Southern Company]

Harmonics: Total Harmonic Distortion

As mentioned above, another concern in inverter-based resource operation is the injection of harmonic currents into the BPS. These harmonics should be managed and mitigated because of the potential they have to cause problems to major power system components, such as transformers, synchronous generators, capacitor banks, protection systems, and end-user equipment.

Industry standards, such as IEEE Std. 519-2014, have been developed with the intent of limiting the level of harmonic injection into the BPS. Usually the utility is responsible for maintaining harmonic voltage distortion levels below the applicable limits whereas the interconnecting GO is responsible for limiting harmonic current injection. Specifications of modern inverters often guarantee very low harmonic injections at rated output. Typically, inverter manufacturers will provide test data for the harmonic current spectrum data measured at the terminals of the inverter (e.g., at 550 V level) at various dc bus voltages or ac output levels (e.g., 100%, 66%, and 33% of rated output).

Commercial operation and performance testing records typically do not suggest inverter-based resources have caused unacceptable harmonic distortion to transmission system unless severe resonance conditions apply. Frequency scan analyses can be performed to identify harmonic resonances during the interconnection study process. The scans could be particularly useful if the inverter-based resource has shunt reactive compensation on the medium-voltage side (e.g., 34.5 kV collector system). If the inverter-based resource MV-connected shunt capacitor banks and the upstream substation inductance create a parallel resonance at a harmonic frequency that is excited by the inverter-based resource, then harmonic current injection into the BPS can be very large as illustrated in [Figure B.4](#). This figure shows a plot of the 5th and 7th harmonic currents (measured at the POI) versus time for a PV facility that is rated 54 MW and has two shunt capacitor banks installed at the 34.5 kV bus, each rated 5.4 Mvar. To demonstrate the impact of MV capacitor banks on individual harmonic distortion levels at the POI (115 kV), phase c harmonic currents have been overlaid with the capacitor bank switching times (on-line and off-line). Note that on Day 1, both capacitor banks were switched on-line at approximately 8:00 a.m. and then switched off-line at approximately 6:00 p.m. whereas on Day 2 (see [Figure B.5](#)), the capacitor banks were randomly switched

Appendix B: Background on Power Quality Issues

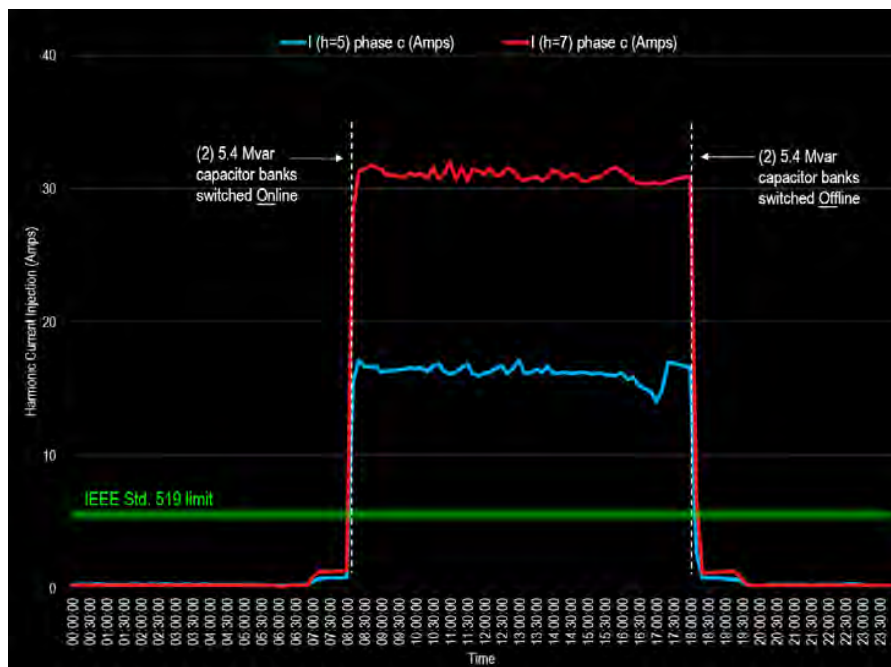


Figure B.4: Measured 5th and 7th Harmonic Currents at POI on Day 1
[Source: Southern Company]

Figure B.4 demonstrates a strong correlation between MV shunt capacitor bank status (on-line vs. off-line) and the high harmonic current magnitudes measured at the POI. Note that, when both capacitor banks were switched on-line (10.8 Mvar total), the 7th harmonic current is significantly amplified (over 20X) when compared to baseline (capacitor bank off-line) harmonic current measurements. Furthermore, 5th harmonic current measurements exhibited a similar behavior. **Figure B.5** further demonstrates this issue.

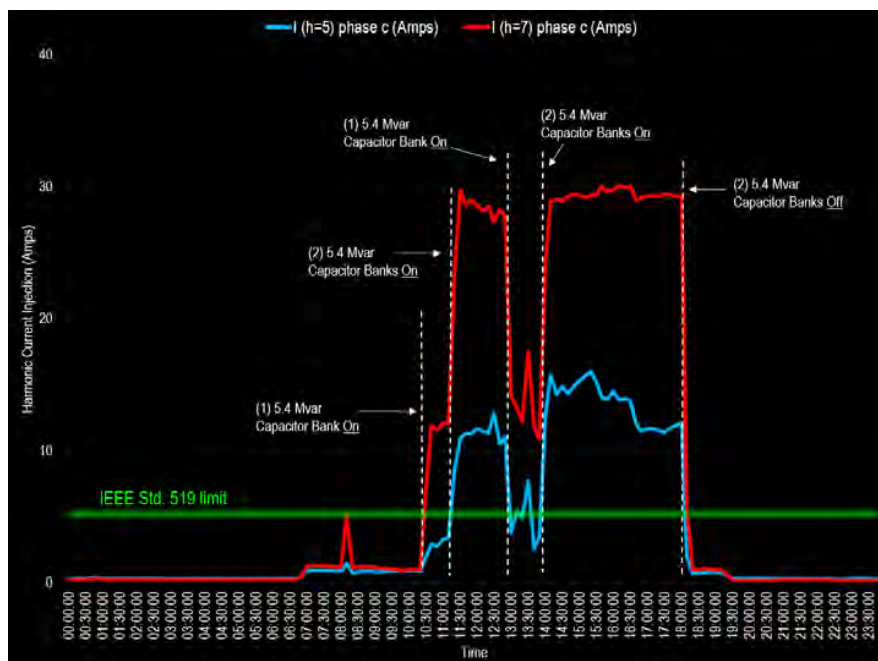


Figure B.5: Measured 5th and 7th Harmonic Currents at POI on Day 2
[Source: Southern Company]

Appendix B: Background on Power Quality Issues

A simple method to help screen for harmonic resonance conditions is illustrated in [Figure B.6](#). The harmonic resonance frequency (Hz) while looking towards the BPS from the MV bus can be calculated as shown below. The system short-circuit MVA at the MV bus, MVA_{Sys_MV} , can be obtained from the short-circuit database and is generally provided by TOs or TPs. MVA_{Shunt} represents the shunt capacitor bank Mvar rating. It is important to consider recognized outages in such screening. If this calculation results in low order resonances (e.g., less than 9th harmonic) there is a high potential for harmonic currents in excess of IEEE Std. 519-2014 limits as observed in [Figures B.4](#) and [B.5](#).

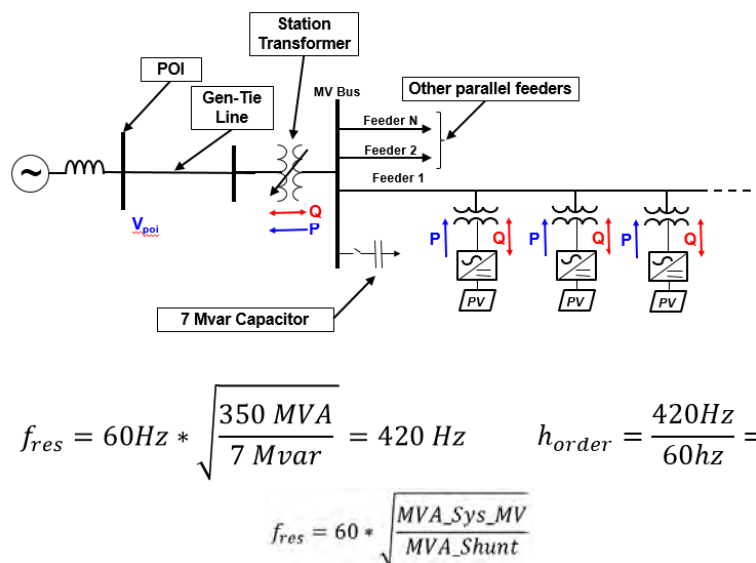


Figure B.6: Illustrative Circuit and Example for Calculating Harmonic Resonance
[Source: MEPP1]

Another practical risk associated with such resonance in inverter-based resource operations is from the grid into the inverter-based resource facility (i.e., secondary voltage magnification). If an oscillatory transient generated by the TO's switching operation contains a component close to the inverter-based resource resonant frequency, augmented transient overvoltage could be excited inside the inverter-based resource facility. [Figure B.7](#) provides an illustration of the circuit configuration/conditions that can lead to secondary voltage magnification events of concern. The secondary voltage magnification phenomenon is a function of the relative impedances of the system impedance (L_1) and switched EHV/HV capacitor bank (C_1) and the inverter-based resource plant main transformer impedance (L_2) and the medium voltage capacitor (C_2) within the plant. If these relative impedances are roughly equal then there is a potential for secondary voltage magnification leading to large transient overvoltages within the inverter-based resource to occur during routine switching of the extra high voltage/high voltage capacitor bank (C_1).

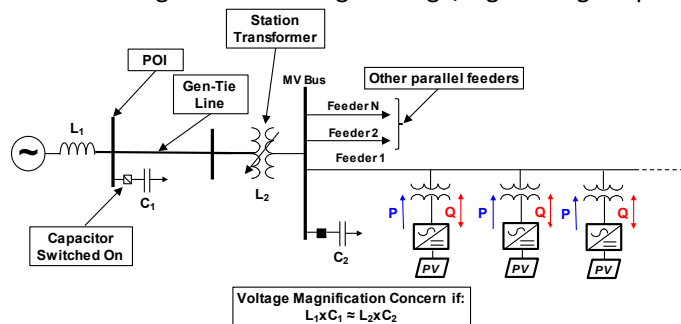


Figure B.7: Illustrative Circuit and Example for Secondary Voltage Magnification

Appendix B: Background on Power Quality Issues

Figure B.8 shows an example of voltage waveforms captured at a 230 kV Type 4 wind plant when a 230 kV shunt capacitor was routinely switched in by TO. The waveforms show moderate transient peaks below 1.2 pu. However, the wind turbines were tripped off-line by over-voltage protection coincident with the capacitor switching. Investigations found that the wind farm's shunt capacitors at its 34.5 kV bus created in-yard resonance near the 7th harmonic; this was coincidentally the major component from the incoming 230 kV transients. As a result, the transient peak was magnified to 1.7 pu at the 34.5 kV bus and the turbines were tripped by (transient) over-voltage protection. **Figure B.9** shows the corresponding voltage waveforms measured at the 34.5 kV bus. To manage such risks, inverter-based resources may request TOs to provide impedance characteristics of the HV grid, including the effects of switching nearby reactive compensation facilities such as capacitor banks). For example, the TO may provide the expected transient overvoltage at the high voltage bus upon capacitor switching in this case, and GOs may use this information in their MV compensation design.

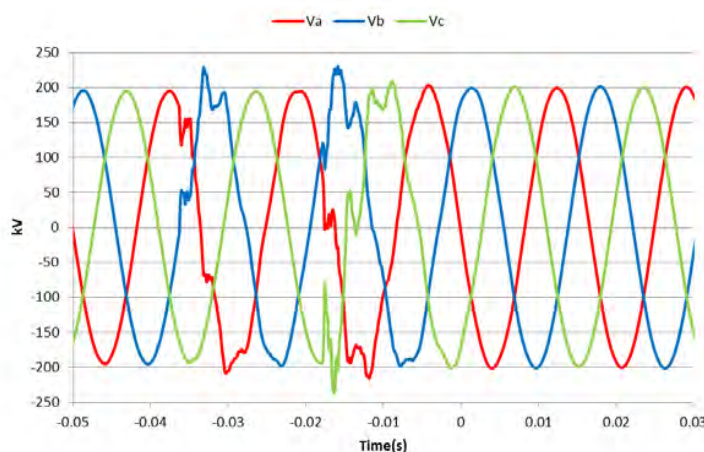


Figure B.8: Transient Voltage Waveforms of a 230 kV Type 4 Wind Plant
[Source: Hydro One]

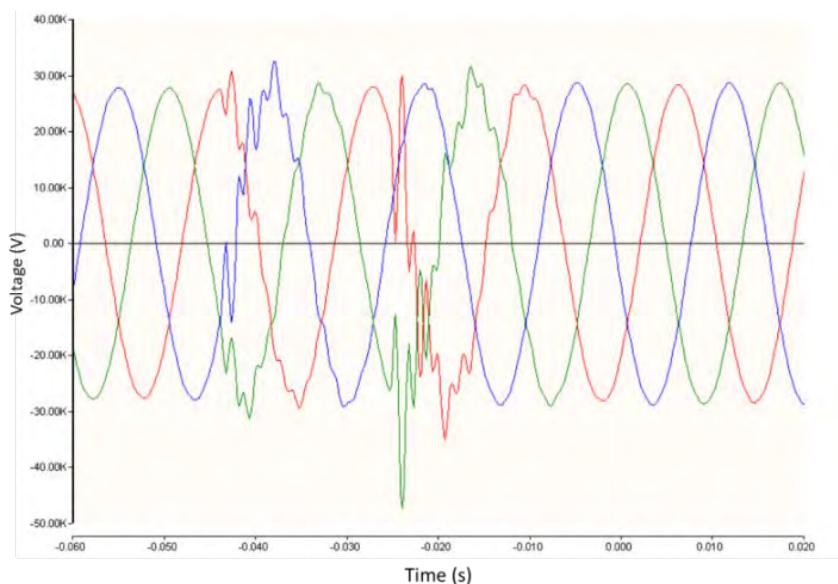


Figure B.9: Voltage Waveforms at 34.5 kV Bus for 230 kV Transients in Figure B.8
[Source: Hydro One]

Appendix B: Background on Power Quality Issues

Though harmonic planning studies could identify potential harmonic resonance risks, there is no guarantee that harmonic distortion issues could be predicted with high confidence due to the following reasons:

- The inverter-based resource harmonic emission levels may vary greatly with operating points of inverters.
- Combination of outages and reactive switching may produce a large amount of resonance scenarios.
- Inside the inverter-based resource, multiple paralleled inverters may interact and result in harmonic instability. Such an issue could not be captured by passive frequency scan.

However, it is prudent for GOs of BPS-connected inverter-based resources, TOs, and TPs to discuss power quality issues early during the interconnection study process. This creates an opportunity for proactive discussions and education on the subject. TPs should also consider asking for the maximum expected harmonic current spectrum at the POI, which can be compared with the recommended limits provided in IEEE Std. 519-2014.

Power Quality Monitoring

Permanent power quality monitoring equipment should be installed for field verification of inverter-based resource performance and troubleshooting during system events. The following factors should be considered in practical power quality monitoring:

- Unless equipped with an add-on harmonic measurement feature, a capacitively coupled voltage transformer is not suitable for measuring harmonic voltages. Inverter-based resource planning should consider this factor when selecting instrument transformers.
- IEEE Std. 519-2014 *IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems*¹¹⁹ and IEC 61000-3-6 “Assessment of emission limits for the connection of distorting installations to MV, HV and EHV power systems” have different total voltage harmonic limits for transmission system. For voltage above 161 kV, the weekly 95th percentile voltage total harmonic distortion is 1.5% in IEEE Std. 519 and 3% in IEC 61000-3-6. TOs may consider if higher voltage total harmonic distortion limit is justifiable. There is discussion on whether IEEE 519 should be harmonized with IEC 61000-3-6 in this matter and the future IEEE Std. 2800 might address this issue.
- TOs should measure the difference in harmonic voltage before and after energization of inverter-based resources to identify any power quality issues exacerbated by the inverter-based resource.
- When collecting power quality data, particular attention should be given to data acquisition rates as faster data acquisition rates are conducive to improved accuracy

¹¹⁹ <https://standards.ieee.org/standard/519-2014.html>.

Appendix C: Contributors

NERC gratefully acknowledges the invaluable contributions and assistance of the following industry experts in the preparation of this guideline. NERC also would like to acknowledge all the technical discussions and contributions of the NERC IRPTF.

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Min Lwin	General Electric
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JP Skeath	North American Electric Reliability Corporation

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Reliability Guideline

BPS-Connected Inverter-Based Resource
Performance

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Preface

The vision for the Electric Reliability Organization (ERO) Enterprise, which is comprised of the North American Electric Reliability Corporation (NERC) and the seven Regional Entities (REs), is a highly reliable and secure North American bulk power system (BPS). Our mission is to assure the effective and efficient reduction of risks to the reliability and security of the grid.

The North American BPS is divided into seven RE boundaries as shown in the map and corresponding table below. The multicolored area denotes overlap as some load-serving entities participate in one Region while associated Transmission Owners/Operators participate in another.



FRCC	Florida Reliability Coordinating Council
MRO	Midwest Reliability Organization
NPCC	Northeast Power Coordinating Council
RF	ReliabilityFirst
SERC	SERC Reliability Corporation
Texas RE	Texas Reliability Entity
WECC	Western Electricity Coordinating Council

Preamble

NERC, as the FERC-certified ERO,¹ is responsible for the reliability of the Bulk Electric System (BES) and has a suite of tools to accomplish this responsibility, including but not limited to the following: lessons learned, reliability and security guidelines, assessments and reports, the Event Analysis program, the Compliance Monitoring and Enforcement Program, and Reliability Standards. Each entity, as registered in the NERC compliance registry, is responsible and accountable for maintaining reliability and compliance with the Reliability Standards to maintain the reliability of their portions of the BES.

It is in the public interest for NERC to develop guidelines that are useful for maintaining or enhancing the reliability of the BES. The NERC Technical Committees—the Operating Committee (OC), the Planning Committee (PC), and the Critical Infrastructure Protection Committee (CIPC)—are authorized by the NERC Board of Trustees (Board) to develop Reliability (OC and PC) and Security (CIPC) Guidelines per their charters.² These guidelines establish voluntary recommendations, considerations, and industry best practices on particular topics for use by users, owners, and operators of the BES to help assess and ensure BES reliability. These guidelines are prepared in coordination between NERC Staff and the NERC Technical Committees. As a result, these guidelines represent the collective experience, expertise, and judgment of the industry.

The objective of each reliability guideline is to distribute key practices and information on specific issues to support high levels of BES reliability. Reliability guidelines do not provide binding norms and are not subject to compliance and enforcement (unlike Reliability Standards that are monitored and subject to enforcement). Guidelines are strictly voluntary and are designed to assist in reviewing, revising, or developing individual entity practices to support reliability for the BES. Further, guidelines are not intended to take precedence over Reliability Standards, regional procedures, or regional requirements. Entities should review this guideline in conjunction with Reliability Standards and periodic review of their internal processes and procedures and make any needed changes based on their system design, configuration, and business practices.

¹ <http://www.ferc.gov/whats-new/comm-meet/072006/E-5.pdf>

² [http://www.nerc.com/comm/OC/Related%20Files%20DL/OC%20Charter%2020131011%20\(Clean\).pdf](http://www.nerc.com/comm/OC/Related%20Files%20DL/OC%20Charter%2020131011%20(Clean).pdf)

[http://www.nerc.com/comm/CIPC/Related%20Files%20DL/CIPC%20Charter%20\(2\)%20with%20BOT%20approval%20footer.pdf](http://www.nerc.com/comm/CIPC/Related%20Files%20DL/CIPC%20Charter%20(2)%20with%20BOT%20approval%20footer.pdf)

<http://www.nerc.com/comm/PC/Related%20Files%202013/PC%20Charter%20-%20Board%20Approved%20November%202013.pdf>

Executive Summary

The North American BPS and electric grids around the world are undergoing rapid changes in generation resource mix with increasing amounts of renewable generation such as wind and solar photovoltaic (PV) power plants. These resources are asynchronously connected to the grid and are either completely or partially interfaced with the BPS through power electronics, hence referred to as *inverter-based resources*. The power electronics aspects of these generating resources present new opportunities in terms of grid control and response to abnormal grid conditions. Regardless of the type of resource, it is paramount that all BPS-connected resources are capable of providing ERSs³ and operate in a manner that supports BPS reliability. NERC, as the ERO of North America, is tasked with assuring reliability of the North American BPS and is continually assessing the impacts of the changing resource mix. A critical component to these assessments is developing guidance and recommended practices for the performance of resources when connected to the BPS. This Reliability Guideline provides a set of recommended performance specifications for inverter-based resources.

Disturbance analyses of BPS-connected solar PV tripping have identified a number of areas where the performance of inverter-based resources can be improved. In addition, reliability organizations around the world have devised grid code requirements to solve reliability issues with nonsynchronous resources. With this information, and working closely with the electric industry, NERC has captured a set of recommended performance specifications for inverter-based resources in this Reliability Guideline (guideline). The specifications are designed to be independent of specific technology and relate to all types of inverter-based resources, such as wind, solar PV, and battery energy storage systems (BESSs). This guideline uses examples of each interchangeably. It is understood, and noted in the guideline, that some of the recommended performance aspects may need modification based on local interconnection studies, grid strength, etc., and those modifications should be coordinated between the Generator Owner (GO), Generator Operator (GOP), inverter manufacturer, plant designer, Planning Coordinator (PC), Transmission Planner (TP), Reliability Coordinator (RC), and Transmission Service Provider (TSP).

This guideline provides recommended steady-state and dynamic performance characteristics for inverter-based resources and also covers a wide range of related aspects from protective functions to monitoring capability. The material presented throughout the guideline is based on extensive research and discussions with industry experts and members of the NERC Inverter-Based Resource Performance Task Force (IRPTF). The NERC IRPTF consists of industry representatives from multiple sectors of the electric industry: inverter manufacturers, GOs, GOPs, PCs, TPs, RCs, Balancing Authorities (BAs), Transmission Owners and Operators (TOs/TOPs), independent system operator (ISO), national laboratories, research organizations, and simulation and modeling experts. This collaborative industry effort has led to a vetted set of recommendations for inverter-based resources, and the types of technical discussions in the NERC IRPTF around these topics should continue as the BPS continues to evolve.

The body of the guideline provides detailed reference materials. The recommended performance specifications are also provided more concisely in [Appendix A](#).

³ See the *Essential Reliability Services Task Force Measures Framework Report*. Available: <https://www.nerc.com/comm/Other/essntlrbltysrvscstskfrcl/ERSTF%20Framework%20Report%20-%20Final.pdf>.

Introduction

As a result of the ongoing analyses of large BPS disturbances in the Western Interconnection involving inverter-based resources, particularly solar photovoltaic (PV) resource, NERC formed the NERC IRPTF to develop recommended performance specifications for BPS-connected inverter-based resources during steady-state and dynamic system conditions. The Blue Cut Fire and Canyon 2 Fire events in the Southern California area led to key disturbance reports⁴ and NERC Alerts⁵ to identify the extent of conditions and develop recommended mitigating actions. This guideline subsequently builds on these efforts to more comprehensively provide technical guidance for the recommended behavior of inverter-based resources when connected to the BPS.

One of the major goals of the IRPTF is to bring GOs, GOPs, TPs, TOs, TSPs, TOPs, RCs, and BAs together to engage with the inverter manufacturing community, inverter-based resource performance experts, and other applicable standards bodies to cooperatively develop recommended practices moving forward. The IRPTF is cognizant of existing equipment capabilities and limitations. However, the IRPTF is also considering the growing penetration of inverter-based resources and resulting future operating conditions.

Applicability of Guideline

This guideline focuses on inverter-based resources directly connected to the BPS. While NERC Reliability Standards only apply to BES resources, this guideline is also relevant to smaller inverter-based resources that are still connected to the BPS. This includes resources connected to the transmission and sub-transmission system voltage levels that do not meet the BES inclusion criteria (e.g., also including resources less than 75 MVA). The guideline does not cover resources connected to the distribution system (distributed energy resources (DERs)), and instead recommends the use of the new IEEE Std. 1547-2018 for these resources.

The electric industry has decades of experience with synchronous machines, but experience with significant amounts of nonsynchronous resources is limited and the technology of inverter-based resources is evolving rapidly. Inverter-based resources present new characteristics for stability and control with power electronics, which are high-power switching devices (transistors) controlled by high-speed digital controls. These resources also present new challenges that will be faced as the penetration continues to grow. Many of the performance characteristics presented in this guideline for inverter-based resources are an innate feature of the characteristics of a synchronous machine. On the other hand, one should not expect that an inverter-based resource perform exactly like a synchronous machine. This would disregard many of the fast controls and features of inverter-based resources that have the ability to improve the dynamic performance and stability of the BPS. Therefore, it is important to clearly articulate those aspects that are different (from a power electronics standpoint) and those that are similar to synchronous machine technology. This guideline presents these similarities and differences such that these resources can be integrated reliably.

This guideline also provides technical details and clarifications for inverter-based resources related to relevant NERC Reliability Standards and other interconnection requirements. The NERC Reliability Standards are independent of technology and performance-based to the most possible extent. The goal of this guideline is to ensure that the technological attributes of inverter-based resources (e.g., the power electronic aspects, opportunities, and challenges) are clear and consistent.

The material in many sections of this guideline is highly technical and specific as this is unavoidable given the subject matter and the intended purpose. This guideline provides guidance and technical reference material to GOs and GOPs with inverter-based resources connected to the BPS, inverter manufacturers, and transmission entities including TPs, TSPs, PCs, RCs, BAs, TOPs, and TOs. Lastly, the guideline was developed in close coordination

⁴ NERC Disturbance Reports: <https://www.nerc.com/pa/rrm/ea/Pages/Major-Event-Reports.aspx>.

⁵ NERC Alerts: <https://www.nerc.com/pa/rrm/bpsa/Pages/Alerts.aspx>.

with liaisons to IEEE Std. 1547 to ensure alignment in performance across transmission, sub-transmission, and distribution-connected resources.

Key Findings from the Disturbance Analyses

The key findings from the Blue Cut Fire and Canyon 2 Fire disturbance analyses are briefly described here for reference. More information can be obtained in the relevant disturbance analysis reports and NERC Alerts.⁶

Blue Cut Fire Disturbance

On August 16, 2016, the Blue Cut Fire caused a 500 kV line fault that cleared normally (less than 3 cycles) that resulted in the widespread loss of 1,178 MW of solar PV generation. This event was the primary focus of the NERC/WECC joint task force, which was formed prior to the NERC IRPTF. The task force published a disturbance report⁷ that identified the following key findings:

- Inverters were tripping erroneously on instantaneous frequency measurements
- The majority of inverters are configured to momentarily cease injection of current for voltages outside the continuous operating range around 0.9–1.1 pu

Canyon 2 Fire Disturbance

On October 9, 2017, the Canyon 2 Fire caused two transmission system faults east of Los Angeles. The first fault was a normally cleared phase-to-phase fault on a 220 kV transmission line that occurred at 12:12:16 PST, and the second fault was a normally cleared phase-to-phase fault on a 500 kV transmission line that occurred at 12:14:30 PST. Both faults resulted in the reduction of solar PV generation across a wide region of the SCE footprint. NERC and WECC published a disturbance report that identified the following key findings:⁸

- The erroneous tripping on calculated frequency issues appeared to be mitigated
- Inverters continued to use momentary cessation as a form of ride-through
- Plant-level controller ramp rates were interacting with the recovery from momentary cessation
- Many inverter protective controls were set solely based on the PRC-024-2 voltage curve, rather than actual equipment limitations
- Many inverter protective controls were set to trip for instantaneous voltage over 1.2 pu, using an unfiltered measurement
- One inverter manufacturer reported phase lock loop (PLL) synchronization issues
- One inverter manufacturer reported tripping on dc reverse current that required a manual reset at the inverter

⁶ NERC Industry Recommendation: Loss of Solar Resources during Transmission Disturbances due to Inverter Settings:

<https://www.nerc.com/pa/rrm/bpsa/Alerts%20DL/NERC%20Alert%20Loss%20of%20Solar%20Resources%20during%20Transmission%20Disturbance.pdf>.

NERC Industry Recommendation: Loss of Solar Resources during Transmission Disturbances due to Inverter Settings – II:

[https://www.nerc.com/pa/rrm/bpsa/Alerts%20DL/NERC Alert Loss of Solar Resources during Transmission Disturbance-II 2018.pdf](https://www.nerc.com/pa/rrm/bpsa/Alerts%20DL/NERC%20Alert%20Loss%20of%20Solar%20Resources%20during%20Transmission%20Disturbance-II%202018.pdf).

⁷ Blue Cut Fire Disturbance Report:

[http://www.nerc.com/pa/rrm/ea/1200 MW Fault Induced Solar Photovoltaic Resource /1200 MW Fault Induced Solar Photovoltaic Resource Interruption Final.pdf](http://www.nerc.com/pa/rrm/ea/1200%20MW%20Fault%20Induced%20Solar%20Photovoltaic%20Resource%20Interruption%20Final.pdf).

⁸ Canyon 2 Fire Disturbance Report:

[http://www.nerc.com/pa/rrm/ea/October%209%202017%20Canyon%202%20Fire%20Disturbance%20Report/900 MW Solar Photovoltaic Resource Interruption Disturbance Report.pdf](http://www.nerc.com/pa/rrm/ea/October%209%202017%20Canyon%202%20Fire%20Disturbance%20Report/900%20MW%20Solar%20Photovoltaic%20Resource%20Interruption%20Disturbance%20Report.pdf).

Introduction

- There appears to be transient interactions between momentary cessation, transient overvoltage, and in-plant shunt compensation that warrants further investigation

As noted, these recommendations are the drivers for this guideline document. Considerable time was invested by all sectors of the industry, including the inverter manufacturers, GOs, and GOPs, to ensure each subject is thoroughly vetted with each sector.

Chapter 1: Momentary Cessation

This chapter describes the concept of momentary cessation and provides recommendations for existing and new inverter-based resources on the use of momentary cessation and recovery from momentary cessation.

Introduction to Momentary Cessation

Momentary cessation, also referred to as “blocking,” is when no current is injected into the grid by the inverter during low or high voltage conditions outside the continuous operating range. This occurs because the power electronic firing commands are blocked, and the inverter does not produce active or reactive current (and therefore no active or reactive power). The use of momentary cessation for relatively shallow voltage dips has unintentionally propagated from distribution-connected resources to BPS-connected resources, especially for solar PV inverters. Inverter manufacturers have stated that momentary cessation has been implemented for a couple of reasons, including the following:

- **Distribution-Connected Inverter-Based Resource Standard Requirements:** Inverters connected to the distribution system have historically been required to use momentary cessation during abnormal (both high and low) voltage and frequency conditions. However, inverter manufacturers have stated that these requirements were driven by distribution operating entities for safe and reliable operation of the distribution system, not limitations within the inverter.
- **Design Philosophies:** Existing inverters have been designed with distribution requirements in mind and rely on momentary cessation as a control strategy. Existing inverter designs have historically used momentary cessation in conditions where accurately measuring the voltage waveform⁹ is challenging.

BPS-connected inverter-based resources are expected to continue current injection inside the “No Trip” zone of the frequency and voltage ride through curves of PRC-024-2. Existing and newly interconnecting inverter-based resources should eliminate the use of momentary cessation to the possible extent.¹⁰ Recommendations on the type of current to be injected during low voltage conditions is described in Chapter 3.¹¹

Key Takeaway:

BPS-connected inverter-based resources are expected to continue current injection inside the “No Trip” zone of the frequency and voltage ride through curves of PRC-024-2. Existing and newly interconnecting inverter-based resources should eliminate the use of momentary cessation to the greatest possible extent.

Newly interconnecting inverter-based resources should be designed and operated to eliminate the use of momentary cessation. Existing resources may have hardware and/or software limitations based on a design philosophy using momentary cessation, and it may not be feasible to eliminate its use. For equipment limitations that cannot be addressed, PRC-024-2 Requirement R3.1 states that “[t]he [GO] shall communicate the documented regulatory or equipment limitation, or the removal of a previously documented regulatory or equipment limitation, to its Planning Coordinator and Transmission Planner within 30 calendar days...” **Table 1.1** shows some examples of equipment limitations that necessitate momentary cessation for some existing generating resources.

⁹ The derived phase angle from that voltage waveform is used to synchronize to the grid, and that angle is used to determine the active and reactive current injected into the grid.

¹⁰ The voltage and frequency ride-through curves of PRC-024-2 apply to the Point of Interconnection (POI) and not the inverter terminals themselves. The GO, in coordination with their plant designer and inverter manufacturer, should reflect the frequency and voltage protection ride-through requirements at the POI to the inverter terminals to ensure expected conditions at the inverters can also ride through and continue current injection during the disturbance.

¹¹ ERCOT Operating Guide requires generators to provide real and reactive power and does not allow momentary cessation during voltage ride through conditions. Available: http://www.ercot.com/content/wcm/current_guides/53525/02-050117.doc

Chapter 1: Momentary Cessation

Table 1.1: Examples of Equipment Limitations for Momentary Cessation	
Hardware Limitations	Software Limitations
- Line voltage sensing circuits for synchronization are not able to operate correctly at low voltages - Control power supplies are not able to operate at low input voltages while providing the power to switch the power electronic devices during current injection - Auxiliary devices have a limited operating voltage range (e.g., contactors drop out, variable speed drives for fans may not provide the required airflow, building air conditioning may trip)	- Voltage synchronization (e.g., PLL) is inoperable at low input voltages - New software is required to provide current injection - Additional designs are needed for hardware limitations - Program cycle time or loop time limitations do not allow software upgrades without compromising performance

In addition to equipment limitations, interconnection studies may identify specific situations where it may be advantageous for resources to use momentary cessation in some form. For example, there may be systems where current injection during the fault period results in unacceptable overvoltages during fault clearing. Other systems may be connected in extremely weak regions, and struggle to maintain tight control over real and reactive currents in periods immediately following fault clearing, resulting in the need to actively limit or even eliminate current injection until control can be restored. In most of these cases, momentary cessation would only be needed for very low voltages (e.g., less than 0.3–0.4 pu), resulting in the momentary cessation being restricted to a relatively small electrical region. Additionally, any momentary cessation used for special purposes such as these should not be extended (current injection delayed) further than necessary for grid recovery.

The TP and PC should approve the use of momentary cessation on a case-by-case basis based on local system reliability needs. Electromagnetic transient (EMT) studies should be used to confirm that momentary cessation is necessary and that any instability cannot be mitigated by controls tuning, determined by the TP and PC. This can be confirmed during the interconnection process. When momentary cessation needs to be used because of equipment limitations, momentary cessation settings should be set by performing the following:

- Reducing the momentary cessation low voltage threshold to the lowest feasible value
- Increasing the momentary cessation high voltage threshold to at least the PRC-024-2 voltage ride-through curve levels
- Reducing the recovery delay (time between voltage recovery and start of current injection) to the smallest value possible (e.g., on the order of one to three electrical cycles)
- Increasing the active power ramp rate upon return from momentary cessation to at least 100 percent per second (e.g., return to predisturbance active current injection within one second). The exception to this is if the generation interconnection studies, or direction from the TP or PC, specify a slower ramp rate (i.e., low short circuit strength areas).

The TP and PC should specify, as part of the interconnection agreement data requirements, that the following information is provided if momentary cessation is used:

- Low voltage magnitude threshold (pu voltage)

Chapter 1: Momentary Cessation

- Time delay before recovery begins after voltage recovers (sec)
- Active current ramp rate back to precontingency current after voltage recovers (pu/sec)

The dynamic models (positive sequence stability models and EMT models as applicable) provided to the TP and PC by the GO should accurately represent the response of the inverter-based resource, including any use of momentary cessation. Refer to the NERC Modeling Notification¹² published by the NERC System Analysis and Modeling Subcommittee (SAMS), in coordination with the NERC IRPTF, which provides clear guidance on modeling momentary cessation.

Key Takeaway:

When momentary cessation is used as an equipment limitation for existing resources, GOs should consider improving inverter-based resource performance by performing the following:

- Reducing the momentary cessation low voltage threshold to the lowest value possible.
- Increasing the momentary cessation high voltage threshold to as close to, or higher than, the PRC-024-2 voltage ride-through curve levels.
- Reducing the recovery delay (time between voltage recovery and start of current injection) to the smallest value possible (e.g., on the order of one to three electrical cycles).
- Increasing the active power ramp rate upon return from momentary cessation to at least 100 percent per second (e.g., return to predisturbance active current injection within one second). The exception to this is if the generation interconnection studies, or direction from the TP or PC, specify a slower ramp rate (i.e., low short circuit strength areas).

Considerations for Type 3 and Type 4 Wind Turbine Generators

Type 3 and 4 wind turbine generators (WTGs) use current-limiting mechanisms to protect the power electronic components from damage during high voltage or high current conditions during faults. [Figures 1.1](#) and [1.2](#) show typical responses of Type 3 and Type 4 WTGs during fault conditions, respectively. In both cases, the Type 3 and Type 4 WTGs are providing fault current to the grid and are not entering into momentary cessation (no current injection).¹³ This is the expected behavior from these types of inverter-based resources. They use the following controls during ride-through for short-circuit conditions:

- **Type 3 WTG Response:** During a fault, a Type 3 WTG may short circuit the rotor-side windings (active-crowbar¹⁴) for a short period of time (zero to several cycles) to protect the rotor-side converter and dc link. This may or may not be used in conjunction with a “dc bus chopper” or dynamic brake (see [Figure 1.3](#)).¹⁵
- **Type 4 WTG Response:** During a fault, a Type 4 WTG dissipates energy stored in the rotating electric machine using a dc bus chopper circuit within the ac–dc–ac converter (see [Figure 1.4](#)).¹⁶ This chopper circuit may also operate postfault to dissipate energy and mitigate drivetrain oscillations.

¹² http://www.nerc.com/comm/PC/NERCModelingNotifications/Modeling_Notification_-_Modeling_Momentary_Cessation_-_2018-02-27.pdf

¹³ That is, these resources should not momentarily cease injection of current to the BPS.

¹⁴ The active-crowbar circuit shorts the windings completely; however, ac output current of the WTG does not immediately go to zero.

¹⁵ The dc bus chopper (also referred to as a “dynamic brake”) is part of the ac–dc–ac converter system, and limits dc bus voltage by using a braking resistor switched by a thyristor. The dc bus chopper provides better control of fault response than the simple shorting crowbar.

¹⁶ Since this energy is a function of the magnetic field and speed of rotation of the electric machine.

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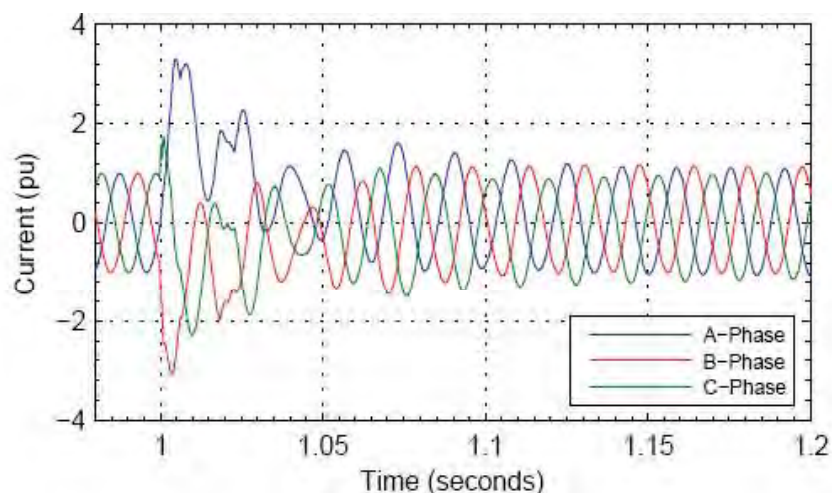


Figure 1.1: Typical Response of Type 3 WTG Short Circuit Current

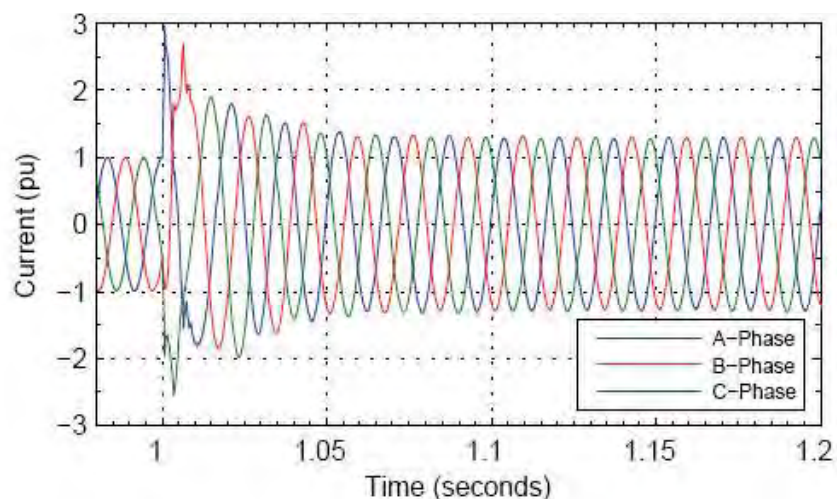


Figure 1.2: Typical Response of Type 4 WTG Short Circuit Current

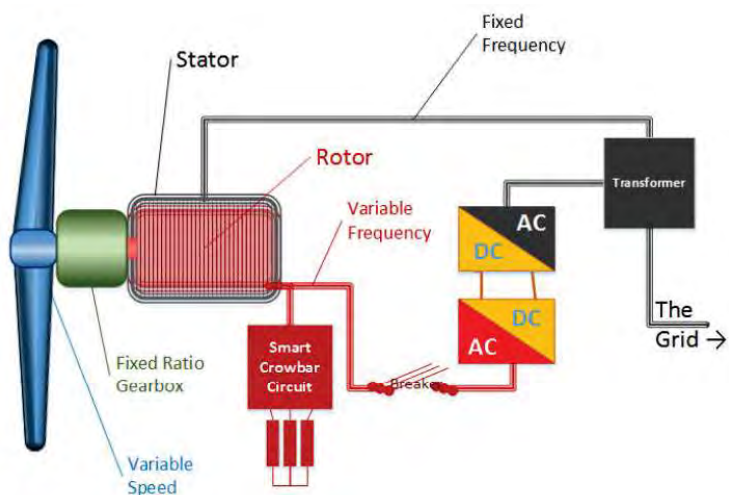


Figure 1.3: Type 3 Wind Turbine Generator Simplified One-line Diagram

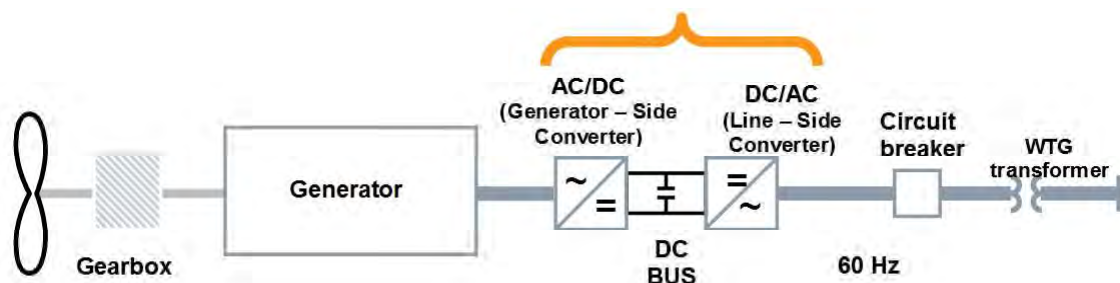


Figure 1.4: Type 4 Wind Turbine Generator Simplified One-line Diagram
[Source: Siemens]

Mitigating Ramp Rate Interactions

Ramp rate limits¹⁷ that are typically set by the BA to ensure reliable balance of generation and load during normal operation should not be imposed during recovery of current injection unless explicitly required by interconnection agreements. Existing inverter-based resources that are unable to eliminate the use of momentary cessation should restore current injection to precontingency levels as quickly as possible¹⁸ following momentary cessation. Active current injection upon restoration from momentary cessation should not be restricted by a plant-level controller.

When voltage at the plant-level controller falls below the continuous operating range (e.g., 0.9 pu), control logic freezes sending commands to individual inverters to avoid controller windup. The inverters either enter momentary cessation or a ride-through mode where the individual inverters take over control rather than the plant-level controller. Once voltage recovers to within the continuous operating range, the inverters start responding to the centralized plant-level controller commands once again, and the ramp rate is then determined by the plant controller. If the inverter has not yet returned to its predisturbance current injection, then the plant-level controller may impede the response of the inverters. Generating facilities with this interaction should remediate it in coordination with their BA and inverter manufacturer(s). One solution is to add a time delay before the plant-level controller resumes its control of individual inverters. That delay should be coordinated with the inverter time constants such that the inverter has sufficient time to fully restore output.

Key Takeaway

Ramp rate limits that are typically set by the BA to ensure reliable balance of generation and load during normal operation should not be imposed by the plant-level controller or any other inverter controls during recovery of current injection following momentary cessation (if used as an equipment limitation).

Maximum power point tracking (MPPT) controls should also not impede recovery of predisturbance active current injection following momentary cessation. Potential interaction depends on whether the MPPT controls freeze output of the MPPT function to the precontingency value or reset it to a default value. If the inverter uses a default value far from the operating value, control software changes are most likely needed to mitigate interactions.

Figure 1.5 shows the response of six large power plants during the Canyon 2 Fire disturbance and shows that plant-level controllers impeded the recovery of active power by the inverters. This is not the desired operation of

¹⁷ Ramp rates are used by BAs to aid in the balance of generation and demand to control grid frequency and BA area control error (ACE). BAs may specify ramp rate limits for generating resources to ensure the plant does not change power output too quickly during normal operation (not during transient events). Ramp rate limits are typically implemented at the plant-level controller, although may be implemented at the inverter-level, to ensure overall plant active power output meets BA ramping requirements. This controller is relatively slow, operating around 10 times per second or slower.

¹⁸ As mentioned above, the recovery of active current injection may be altered by the TP or PC based on reliability studies. However, there should be no unintended interaction between plant-level controller and inverter controls regardless.

Chapter 1: Momentary Cessation

BPS-connected inverter-based resources after fault conditions and should be mitigated to support BPS stability. TPs, PCs, TOPs, and RCs should be monitoring SCADA data for this type of response from inverter-based resources and work with those identified GOs to correct this interaction.

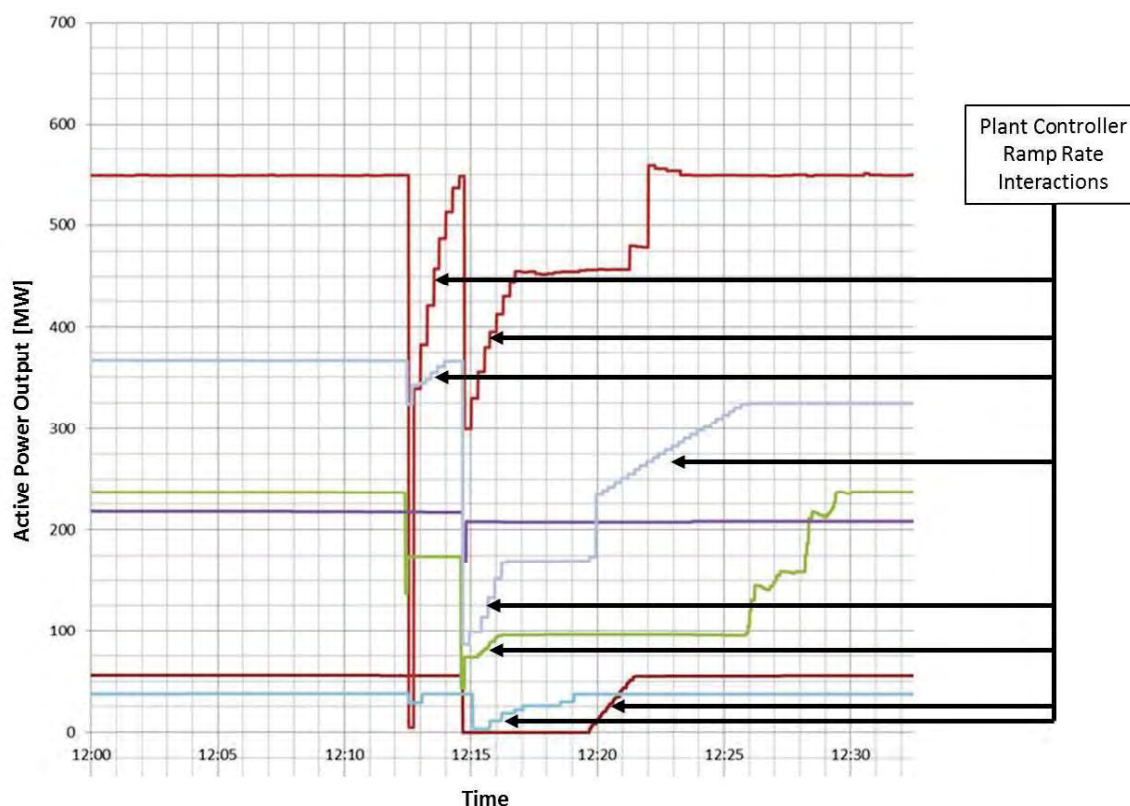


Figure 1.5: Plant Controller Ramp Rate Interactions during Canyon 2 Fire Disturbance

Chapter 2: Active Power-Frequency Control

This chapter describes aspects related to the calculation of frequency and also recommends steady-state and dynamic performance characteristics for active power-frequency control of inverter-based resources. As the Blue Cut Fire event illustrated, how an inverter-based resource calculates and acts upon measured frequency is directly related to its ability to support BPS reliability. In addition, ensuring that the capability for active power-frequency control is installed in all generating resources connected to the BPS will ensure continued frequency stability across the North American Interconnections. This chapter describes aspects related to frequency calculation and protection and recommends steady-state and dynamic performance characteristics for active power-frequency control of inverter-based resources.

Ensuring Robust Frequency Measurement and Protection

Correct sensing of grid frequency during grid disturbances is essential for meeting the requirements of PRC-024-2. GOs with inverter-based resources connected to the BPS should ensure that the frequency measurement and protection settings are set such that these resources are able to ride through and not trip for phase jumps or other grid disturbances when calculated frequency is affected but grid frequency is within the ride through curves of PRC-024-2. Manufacturers should test¹⁹ the inverter's capability to ride through these types of disturbances even though such testing is not part of performance-based standards used by NERC. There are multiple options to ensure that frequency sensing and frequency protection functions operate robustly:

- **Frequency Measurement Duration:** Frequency is calculated over a window of time. Instantaneous calculated frequency should not be used for protection. While the PRC-024-2 frequency ride-through curve includes the option to trip instantaneously for frequencies outside the specified range, this calculation should occur over a time window. Typical window/filtering lengths are three to six cycles (50–100 ms).
- **Time Duration before Frequency Tripping:** As stated in the Blue Cut Fire disturbance report, adding a time duration (time in which frequency must be below the threshold) prior to action for frequency protection is a reasonable solution for inverter-based resources connected to the BPS.
- **Frequency Ride-through Settings to within Equipment Specifications:** Any frequency-based protection settings should be based on the equipment specifications of the facility, including inverters and associated controls. Expanding the frequency trip limits to the extent reliably and safely possible will generally help avoid any nuisance trips.
- **Low Voltage Inhibit for Frequency Protection:** Synchronous machines also include under-/over-frequency protection functions (relay 81) that typically have a voltage cut-off. The relay will typically become disabled if the voltage falls below the cut-off level. This is a settable value and can be as high as 80 percent of nominal voltage. The intent of this cut-off is to avoid the problem of accurately calculating frequency during fault conditions or large voltage dips. During fault conditions, there are other issues more critical than accurate speed detection for a synchronous machine. One option for inverter-based resources to ensure robust trip operation and frequency ride-through is to inhibit frequency tripping during and immediately after low voltage conditions. Most modern relays are digital and use this type of approach on synchronous machines; the same concept could be used for inverter-based resources.

¹⁹ IEEE Std. P1547.1 is using the UL 1741(SA) test specifications for voltage and frequency ride-through and further developing them to account for voltage phase angle jumps commonly caused by fault conditions as well as rate-of-change-of-frequency (ROCOF) ride-through test procedures. "Smart inverters" being installed in California under CA Rule 21 will be utilizing UL1741(SA) for certification.

Key Takeaway:

Inverter-based resources should ensure that the frequency measurement and protection settings are set such that these resources are able to ride through and not trip for phase jumps or other grid disturbances where calculated frequency is affected but grid frequency is within the ride-through curves of PRC-024-2.

While inverters can tolerate large frequency fluctuations, the inverter ac filtering may be affected and the ac transformer may be susceptible to saturation if the frequency deviates from the designed nominal value. Other transformers supplying power to the internal inverter loads and external auxiliary loads, as well as other control components at the facility, may also be a limiting design specification for frequency ride-through. Inverter manufacturers have stated that existing resources have been designed to existing standards and equipment specifications. Therefore, there may be equipment limitations based on design criteria²⁰ that require under- or over-frequency tripping. Moving

forward for new inverter-based resources, inverter manufacturers have stated that the frequency ride-through ranges can be widened (e.g., to 57-63 Hz or wider for North America).

FERC Order No. 842

FERC Order No. 842²¹ amended the Commission's pro forma *Large Generator and Small Generator Interconnection Agreements* to require that all newly interconnecting resources within its jurisdiction install, maintain, and operate a functioning governor or equivalent controls as a precondition of interconnection effective May 15, 2018. FERC Order No. 842 requires new generation units to have functioning primary frequency response capability, and also requires resources to respond to frequency excursion events when plant point of measurement (POM)²² frequency falls at least outside of a ± 0.036 Hz deadband, and adjust its output in accordance to a five percent droop. This response must be timely and sustained rather than injected for a short period and then withdrawn. In other words, new generation is expected to adjust its output to follow its droop of five percent whenever the frequency is at least outside of ± 0.036 Hz. Reserving generation headroom to provide frequency response to underfrequency events is not required. However, resources should respond to overfrequency excursion events at least outside a deadband by reducing active power output in accordance with the five percent droop specification. The TP or PC may require more responsive droop settings; however, those should be based on engineering studies demonstrating that more responsive frequency control is needed.

Steady-State Active Power-Frequency Control

Inverter-based resources should have active power/frequency controls that adhere to FERC Order No. 842 and regional requirements, where applicable, and should have similar performance characteristics to those documented in the NERC Reliability Guideline on Frequency Control.²³ Regional requirements or standards should also be adhered to when determining appropriate settings for active power-frequency controls. For example, the regional standard on primary frequency response in the ERCOT footprint, BAL-001-TRE-1,²⁴ sets forth requirements for each applicable generating resource, including droop and deadband settings. These controls should be active any time the resource is connected to the BPS. This section describes these performance characteristics as related to inverter-based resources.

²⁰ For example, existing inverters may be designed and constructed to the specifications of PRC-024-2. Since they may be designed to these requirements, they may not be able to reliably operate outside the "No Trip Zone" frequency ranges.

²¹ Available here:

<https://elibrary.ferc.gov/IDMWS/common/downloadOpen.asp?downloadfile=20180215%2D3099%2832695275%29%2Epdf&folder=15219837&fileid=14823757&trial=1>.

²² This is the "high-side of the generator substation" transformer according to FERC Order No. 827. This guideline aligns with FERC on the use of Point of Measurement rather than Point of Interconnection, unless referencing a specific NERC Reliability Standard that uses Point of Interconnection.

²³ Available: http://www.nerc.com/comm/OC_Reliability_Guidelines_DL/Primary_Frequency_Control_final.pdf.

²⁴ http://www.nerc.com/_layouts/PrintStandard.aspx?standardnumber=BAL-001-TRE-1&title=Primary_Frequency_Response_in_the_ERCOT_Region&jurisdiction=United%20States

While inverter-based resources may not have a turbine-governor, they should have an active power-frequency control system with the capability to provide primary frequency control when dispatched to an operating conditions that would allow for them to respond. Ensuring that the capability to provide this response is available and functional will prompt the BA (either in a market or nonmarket environment) to procure sufficient levels of frequency responsive reserves. Having the capability to respond is not the same as a requirement or recommendation to actually respond. For example, most inverter-based resources operate at maximum power tracking (e.g., maximum output based on solar irradiance or available wind speed) and therefore do not have the ability to generate additional active power. If the unit is dispatched at some level less than its maximum available output for any reason (e.g., curtailed or market signal), it should be configured to have the capability to respond in the upward direction for an underfrequency event. Similarly, all on-line generating units should be configured to respond to an overfrequency event by reducing output based on their control settings.

Key Takeaway:

Inverter-based resources should have the capability to provide primary frequency response (active power-frequency control) and deliver that primary frequency response to the grid when in an operating condition that would allow for a response. The active power-frequency control should use a proportional droop characteristic and a nonstep type of deadband setting, as outlined in FERC Order No. 842, where applicable.

For BPS-connected resources, active power-frequency control can be implemented at either the inverter-level²⁵ or at the plant-level. This is based on the design of the plant and the selection and coordination of inverters. Either philosophy should provide adequate active power-frequency control at the POM that meets the needs of the BPS. The primary frequency response control algorithm of the inverter-based resource (plant) should meet the following performance aspects. **Figure 2.1** illustrates a droop characteristic with nonstep deadband.

- **Droop:** The active power-frequency control system should have an adjustable proportional droop²⁶ characteristic with a default value of five percent. The droop response should include the capability to respond in both the upward (underfrequency) and downward (overfrequency) directions. Frequency droop should be based on the difference between maximum nameplate active power output ($P_{\max}$) and zero output ($P_{\min}$) such that the droop line is always constant for a resource. The reference set point value for power output is based on the current generating level of the unit prior to any disturbance (P_{gen}). When the unit is operating at maximum available power output (P_{avail}), then P_{gen} is equal to P_{avail} . If, for example, the unit is curtailed, then P_{gen} may be less than P_{avail} .
- **Deadband:** If the active power-frequency control system has a deadband, it should be a nonstep²⁷ deadband²⁸ that is adjustable between 0 Hz and the full frequency range of the droop characteristic with a default value not to exceed ± 0.036 Hz.
- **Hysteresis:** Inverter-based resources may consider a small hysteresis characteristic where linear droop meets any deadband to reduce dithering of inverter output when operating near the edges of the deadband. The hysteresis range should not exceed ± 0.005 Hz on either side of the deadband. If measurement resolution is not sufficient to measure this frequency, then hysteresis should not be used.

²⁵ For DER applications, these requirements (e.g., CA Rule 21, IEEE Std. 1547-2018) are set at the inverter-level.

²⁶ The droop should be a permanent value based on $P_{\max}$ (maximum nominal active power output of the plant) and $P_{\min}$ (typically 0 for an inverter based resource). This keeps the proportional droop constant across the full range of operation.

²⁷ Outside a nonstep deadband, the change in active power output starts from zero deviation away from either side of the deadband. Sometimes referred to as a Type 2 deadband (see Appendix B of the IEEE Technical Report, *Dynamic Models for Turbine-Governors in Power System Studies*. Available: http://sites.ieee.org/fw-pes/files/2013/01/PES_TR1.pdf.

²⁸ Frequency deadband is the range of frequencies in which the unit does not change active power output.

Chapter 2: Active Power-Frequency Control

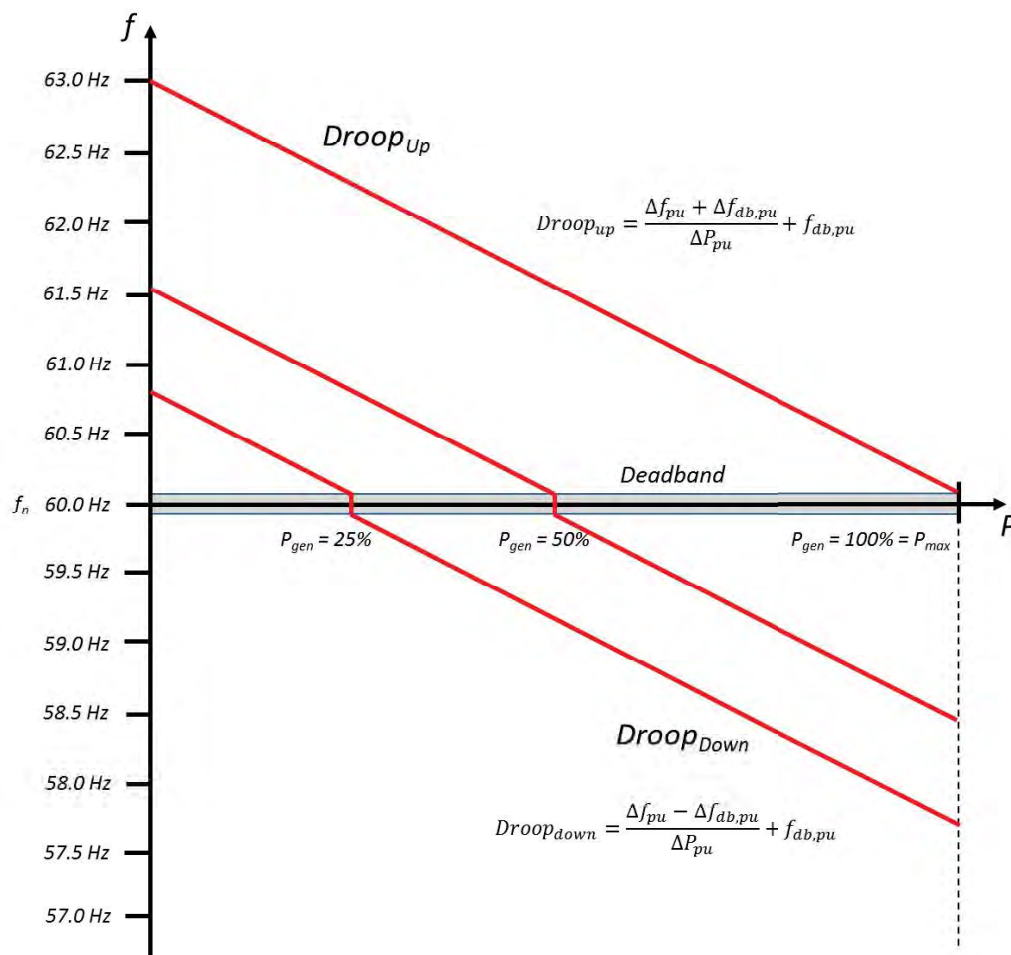


Figure 2.1: Recommended Active Power-Frequency Control Characteristic

Dynamic Active Power-Frequency Control

For a step change²⁹ in frequency at the POM, inverter-based resources should have the capability to meet or exceed the dynamic characteristics shown in [Table 2.1](#). Refer to [Figure F.1](#) in [Appendix F](#) for an illustration of these recommendations. These recommended performance characteristics apply to the closed-loop response of the entire inverter-based resource as measured at the POM (or possibly the POI). While resources should have the capability to meet or exceed these specifications, requirements set forth by regional standards or the Balancing Authority (BA) should take precedence.³⁰ The active power-frequency response should be sustained by the resource until such time that control signals (e.g., BA automatic generation control (AGC)) return generation to a new set point value.

Table 2.1: Dynamic Active Power-Frequency Performance		
Parameter	Description	Performance Target
For a step change in frequency at the POM of the inverter-based resource...		
Reaction Time	Time between the step change in frequency and the time when the resource active power output begins responding to the change ³¹	< 500 ms
Rise Time	Time in which the resource has reached 90 percent of the new steady-state (target) active power output command	< 4 seconds
Settling Time	Time in which the resource has entered into, and remains within, the settling band of the new steady-state active power output command	< 10 seconds
Overshoot	Percentage of rated active power output that the resource can exceed while reaching the settling band	< 5 percent**
Settling Band	Percentage of rated active power output that the resource should settle to within the settling time	< 2.5 percent**

** Percentage based on final (expected) settling value

Actual performance of variable energy resources (operating at maximum available input power) is highly variable. Therefore, it is challenging to test this performance characteristic with on-line measurement data. However, this can be tested during commissioning at reduced (curtailed) power output prior to commercial operation. It can also be verified and tested using simulation techniques, which assume a constant input power (i.e., constant wind speed or solar irradiance). Both methods are viable in terms of verification of this performance characteristic.

²⁹ While frequency cannot step instantaneously, this is a common means of defining the desired control action. A typical step size is 0.2 percent, or 0.120 Hz, from nominal on a 60 Hz system.

³⁰ As the generation mix continues to evolve on the BPS, with lower inertia resources, faster response times may be needed by the BA to arrest decline in frequency following large generation-load imbalances. Therefore, the response times shown in the table may need to be tuned faster at a later time based on grid needs.

³¹ Time between step change in frequency and the time to 10 percent of new steady-state value can be used as a proxy for determining this time.

Chapter 3: Reactive Power-Voltage Control

This section describes the recommended steady-state and dynamic reactive current (or power)-voltage performance characteristics.

Inverter Regulation Controls

Inverter controls are highly complex and include many control loops and functions. The inner control loops are the fastest while the outer loops (i.e., the plant-level controller) are the slowest. Some inner inverter controls are proprietary and generally not openly shared. However, basic inverter controls (for a solar PV inverter) are captured in [Figure 3.1](#). The diagram shows the hierarchy of the multi-loop controls; however, it does not show the more detailed controls such as the PLL, feed-forward and cross coupling terms, active-reactive current priority, and other details that would be in an actual controller. At a high level, the following control loops typically impact regulation, particularly voltage regulation, for inverter-based resources:

- **Current Regulation Loops:** The current regulation loops (often referred to as the inner current control loops) control the ac current³² injected by the inverter into the grid. Most three-phase inverters control current in the dq reference frame. Active current is controlled by controlling the d-axis component of the ac current, and local inverter voltage and reactive current control is implemented by controlling the q-axis component of the ac current. These control loops typically operate in the kilohertz range. These loops use the phasor determined by the PLL, or equivalent, as a reference for the dq transformation, so the dynamics of the local voltage and current controllers, as well as the PLL, are important to the operation of the current regulation loops.
- **DC Bus Voltage (V_{dc}) Regulation Loop:** In a general control configuration, this loop controls the magnitude of the real axis component of the ac output current (i.e., the value of the current reference) of the grid side inverter to maintain voltage on the dc bus capacitor. It is usually slower than the current regulation loop (the output of the dc voltage regulation loop is an input to the current regulation loop), acting within one to six cycles. When inverter terminal voltage changes due to a large event in the system, the dc bus voltage changes thereby causing the dc bus voltage regulator to react and regulate the dc bus voltage by adjusting the real axis ac current reference of the inverter. For example, if a sudden large drop in inverter terminal voltage occurs, accompanied by an increase in phase angle (characteristic of a large load increase or fault), the PLL will track the increased angle causing a decrease in real axis current output from the inverter. This can cause the dc voltage to increase as the current input into the dc bus does not change. The magnitude of increase in dc voltage depends upon, among other factors, the size of the dc bus capacitor and the magnitude of decrease in current. The dynamics of the complete regulation of this voltage is controlled by the following:
 - **The Current Regulation Loop:** By controlling the output voltage of the inverter, the value of current can be brought back to the predisturbance value thereby bringing the dc voltage back to its predisturbance value.
 - **The DC Bus Voltage Regulation Loop:** By controlling the reference value provided to the current regulation loop, the current can be controlled and the dc voltage can be brought back to its predisturbance value. An increase in dc voltage can result in an increase in real axis current reference value thereby instructing the current regulation loop to increase the current output of the inverter.
 - **The Source Side Control Loop:** The dc bus serves as a load to the source/rectifier. Thus, an increase in dc voltage can result in a decrease in current input into the dc bus, and thus, bring the dc voltage down to its predisturbance value.

³² Both active and reactive current injection

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- The dominance of a particular control loop depends on its speed of response, duration of the forcing event, and the particular control topology implemented. Also, the PQ priority mode of the grid side inverter influences the extent to which the current regulation loop can help in maintenance of the dc voltage level. Additionally, the size of the dc bus dictates the speed and complexity of the required control. If the dc bus capacitor is small, then the energy on the dc bus is low and it would be more susceptible to voltage variations for smaller network events. In such cases, complex and fast controls are required in order to maintain the dc bus voltage.
- **Maximum Power Point Tracking (MPPT) Loop:**³³ The MPPT loop maximizes the utilization of input energy (solar irradiance) by locating and maintaining operation at the point where the dc-side power source produces its maximum power. This applies primarily to PV inverters,³⁴ where the loop adjusts the voltage reference for the dc bus voltage regulation loop. This is the slowest of the inverter control loops, and its operation rate varies from a half-second to around 10 seconds depending on characteristics of the dc-side source.
- **Plant-Level Voltage Controller:** The generating facility is required to maintain scheduled voltage (or power factor) per NERC Standard VAR-002-4.1. Often, the plant-level controller maintains this scheduled voltage at the POM. The controller coordinates individual inverter reactive power (or voltage reference) set points. The inverters respond to these commands by modifying their reactive current injection to the grid. The plant-level controller also optimizes losses, coordinates with dynamic or static reactive devices, manages inverter and collector system voltages, maintains specified POM voltage ranges or reactive power outputs, and manages other external factors. Control times of the plant-level controller are coordinated with the individual inverter controls and are typically site- or owner/operator-specific. For example, if the inverters have fast voltage control at their terminals, then the plant-level controller should be at least one order of magnitude slower to avoid control instability. The overall response of the plant-level voltage regulation is typically slower, primarily due to communication latency and measurement delays between the measurement meters to the plant-level controller to the individual inverters.

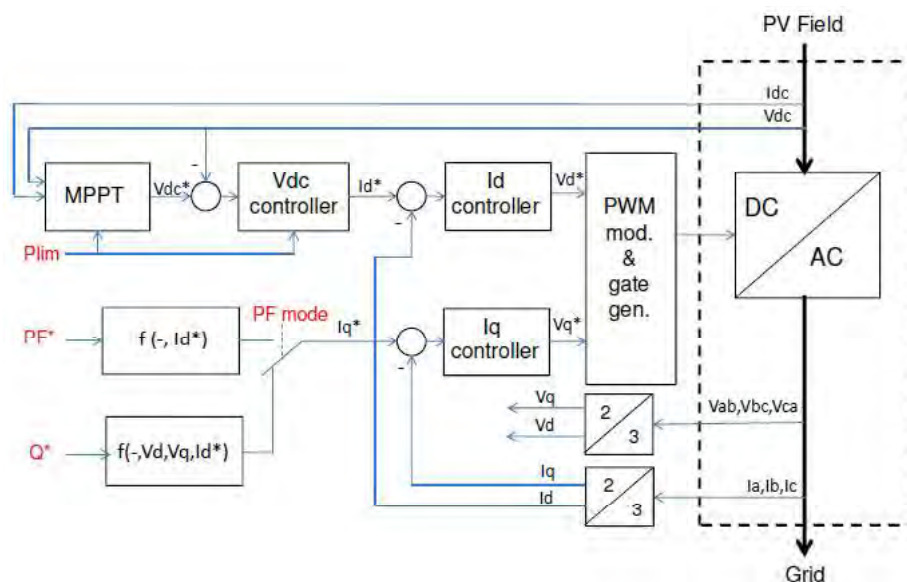


Figure 3.1. Basic Diagram of Solar Inverter Controls [Source: GE]

³³ This is applicable to solar PV. For wind, the torque controller maintains optimal turbine speed to maintain the tip-speed ratio at the peak of the efficiency (C_p) curve.

³⁴ For variable-speed wind turbines, the torque controller (a slow control loop) maintains the tip-speed ratio at its optimal point. In that case, this is not typically referred to as MPPT, it is simply part of the torque/speed control system.

The following subsections describe the recommended performance characteristics of these various control loops working together to provide the overall plant's response to change in BPS grid conditions. Large disturbances are dominated by the faster controls of the inverters while small disturbances are driven by the plant-level controller response.

Reactive Power-Voltage Control and FERC Order No. 827

FERC issued Order No. 827³⁵ on June 16, 2016, eliminating exemptions for newly interconnecting wind generators under its jurisdiction from the requirement to provide reactive power by revising the pro forma Large Generator Interconnection Agreement (LGIA), Appendix G of the LGIA, and the pro forma Small Generator Interconnection Agreement (SGIA). FERC found that, due to technological advancements, the cost of providing reactive power no longer creates an obstacle to wind power development, and this decline in cost resulted in the exemptions being "unjust, unreasonable, and unduly discriminatory and preferential." FERC addressed the following items in its Order:³⁶

- **Power Factor Range:** All newly interconnecting nonsynchronous generators must "maintain a composite power delivery at continuous rated power output at the high-side of the generator substation... [and]... must provide dynamic reactive power within the power factor range of 0.95 leading to 0.95 lagging, unless the transmission provider has established a different power factor range that applies to all nonsynchronous generators in the transmission provider's control area on a comparable basis."
- **Point of Measurement (POM):** All newly interconnecting nonsynchronous generators are required to provide reactive power within the power factor range at the point of Measurement (POM), or "high-side of the generator substation."³⁷ See [Figure 3.2](#) for an illustration of the POM.
- **Dynamic Reactive Power Capability:** Dynamic reactive power can be achieved by "systems using a combination of dynamic capability from the inverters plus static reactive power devices to make up for losses." The static reactive power devices should only be used to make up for losses that occur between the inverters and the POM that would otherwise cause the overall nonsynchronous resource to not meet the 0.95 leading to 0.95 lagging power factor requirement. However, the dynamic reactive capability of the inverters should be utilized to the greatest possible extent.
- **Real Power Output Threshold:** All newly interconnecting nonsynchronous generators should be able to maintain the 0.95 leading to 0.95 lagging power factor requirement at all active power outputs down to 0 MW. FERC provided an example of a 100 MW generator required to provide 33 MVAR at 100 MW output and 3.3 MVAR at 10 MW output. This essentially is a triangle-shaped capability curve. However, this guideline recommends broader use of the inherent inverter capability beyond the triangular shape, as discussed in the following subsection.
- **Compensation:** The FERC Order covers compensation for reactive capability; however, this is outside the scope of this guideline.

³⁵ Federal Energy Regulatory Commission, Order No. 827, 16 June 2016. Available: <http://www.ferc.gov/whats-new/comm-meet/2016/061616/E-1.pdf>

³⁶ NERC provided comments on the Notice of Proposed Rulemaking (NOPR) preceding this Final Rule.

³⁷ The Point of Measurement (POM) concept is carried over into this document, to align with FERC Order No. 827.

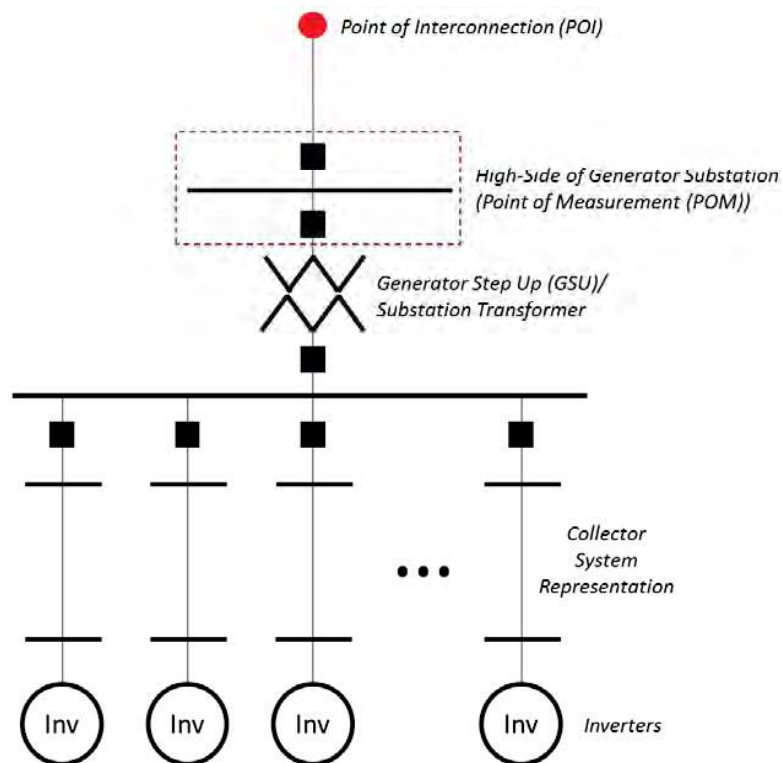


Figure 3.2. Wind Power Plant One-line Diagram Example

Inverter-Based Resource Reactive Capability

Inverters are current source devices that provide a specified amount of active and reactive current, and the active and reactive power is dependent on the amount of current and inverter terminal voltage. At nominal voltage, the inverter-based resource can supply 1.0 pu apparent power continuously to the grid.³⁸ Each inverter has a capability curve similar to a synchronous machine, which is affected by terminal voltage of the inverter. At higher and lower voltage, the reactive capability is restricted at leading and lagging output, respectively. [Figure 3.3](#) shows an inverter capability curve with near semi-circle capability while [Figure 3.4](#) shows an inverter capability curve with fixed reactive capability at lower active power output levels. Both figures show reactive capability for nominal voltage, similar to a synchronous generator capability curve.

The overall plant also has a reactive capability, which depends on the individual inverter capabilities as well as the in-plant dynamic and static reactive resources. [Figures 3.5](#) and [3.6](#) show two examples of overall plant capability. The power factor requirements from FERC Order No. 827 are also shown. Both figures show the reactive capability of the inverters and how that capability is modified at the POM using static reactive devices (shunt compensation) to meet the power factor requirements at maximum active power output.³⁹ The reactive capability outside the triangular-shaped requirement, yet within the reactive capability of the plant, should be utilized to the greatest possible extent to support BPS voltages. Inverters should not have artificial settings imposed to limit reactive power output to the triangular boundary (other than the maximum power operating point, and other plant-level

³⁸ At nominal voltage, the capability curve can be drawn in terms of active and reactive power. At off-nominal voltage, typically active and reactive current are specified since inverter-based resources are current-limited devices.

³⁹ Note that FERC Order No. 827 states that, “the pro forma LGIA and pro forma SGIA do not specify a voltage range for the reactive power requirement.” It also states that the “power factor range standard shall be dynamic and can be met using, for example, power electronics designed to supply this level of reactive capability (taking into account any limitations due to voltage level, real power output, etc.) or fixed and switched capacitors, or a combination of the two.”

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limits, or voltage limits at the terminals of the inverter). The ability to provide additional reactive power while not operating at maximum active power capability is part of automatic voltage control and an ERS. If the inverter-based resource can provide more reactive current within its limitations to maintain scheduled voltage pre- or postcontingency, the inverter should be programmed to do so. Similar to a synchronous machine, the full capability of the inverter should be utilized to maintain steady-state voltage without degrading active power output.⁴⁰ Capability curves are typically specified at nominal voltage, so specific performance at off-nominal voltage values may vary slightly.

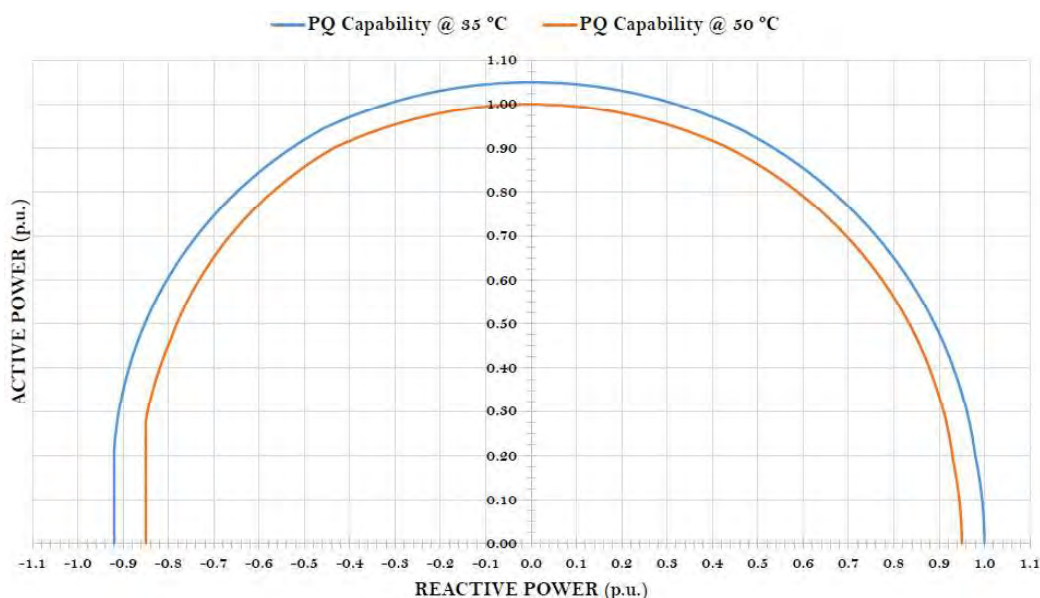


Figure 3.3: Inverter P-Q Capability—Vendor 1 [Source: First Solar]

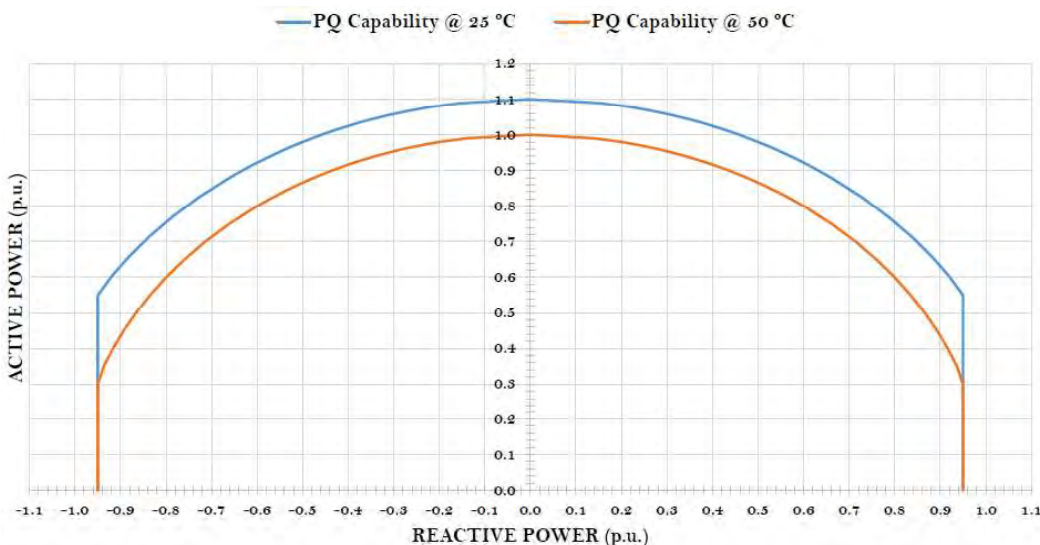


Figure 3.4: Inverter P-Q Capability—Vendor 2 [Source: First Solar]

⁴⁰ These concepts apply to battery energy storage as well, however, these resources can operate with negative active power. It is recommended that batteries also provide automatic voltage control within their reactive capability while acting as a load (charging, negative active power generation). The automatic voltage control aspects of a battery should be seamless across the transition from acting as a generating resource to acting as a load.

Chapter 3: Reactive Power-Voltage Control

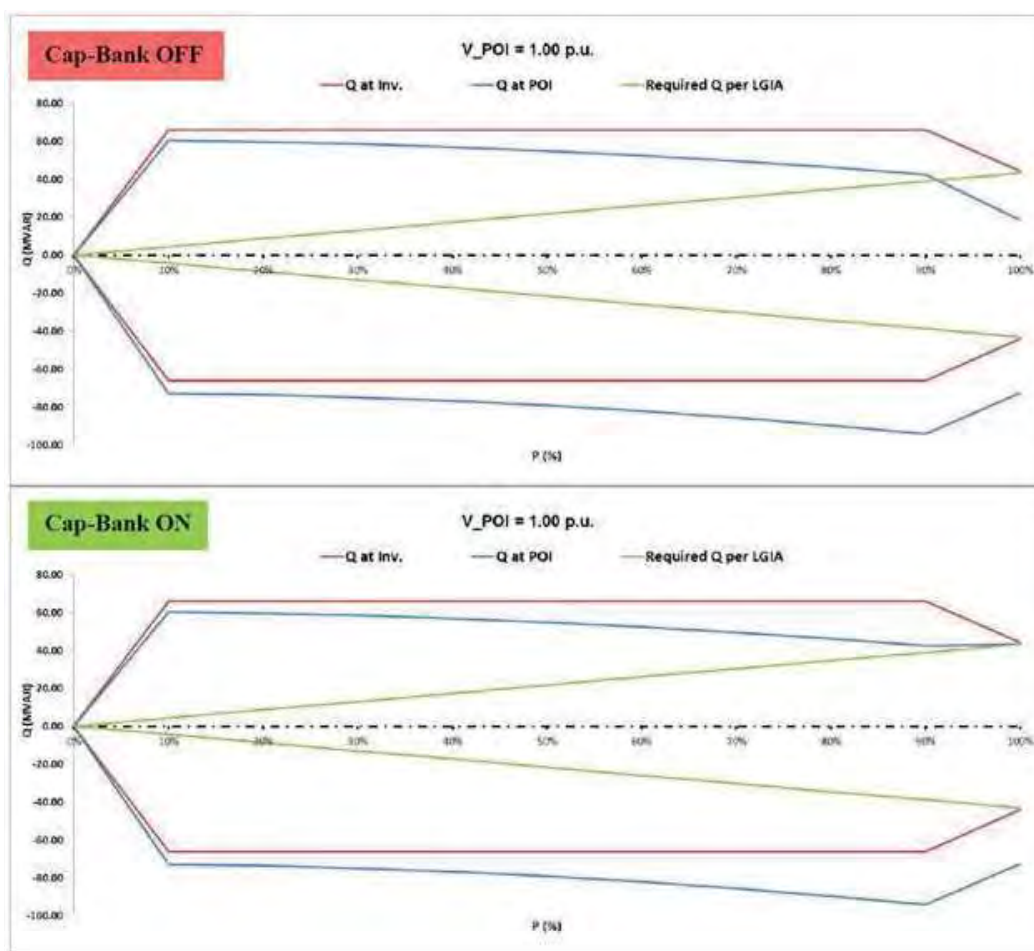


Figure 3.5: Plant Capability Curve—Example 1 [Source: First Solar]

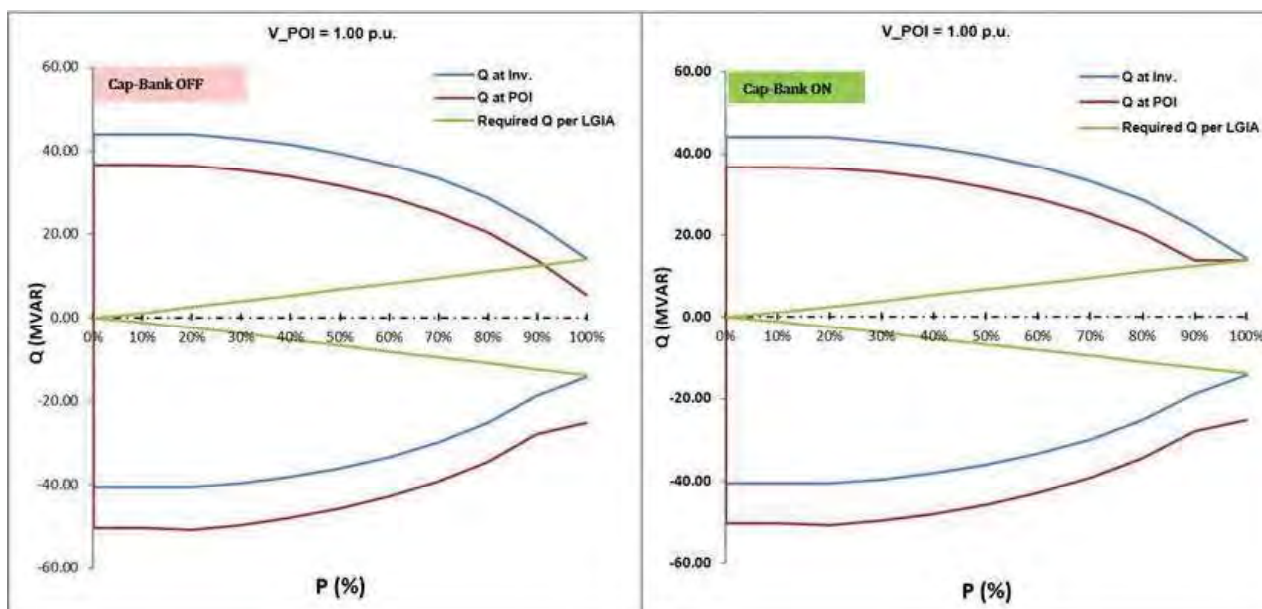


Figure 3.6: Plant Capability Curve Example 2 [Source: First Solar]

Steady-State Reactive Power Control and Droop

All GOPs with applicable resources are required to “operate each generator connected to the interconnected transmission system in the automatic voltage control mode (with its automatic voltage regulator (AVR) in service and controlling voltage) or in a different control mode as instructed by the Transmission Operator,” per NERC Reliability Standard VAR-002-4.1. While an AVR generally applies to synchronous machines, this concept also applies to inverter-based resources that control voltage with inverter-level or plant-level controls, or both. Inverter-based resources, similar to synchronous machines, should operate in a closed-loop, automatic voltage control mode to maintain the scheduled voltage provided by the TOP. The voltage range or set point will determine the commanded reactive current to be exchanged with the grid.⁴¹ For inverter-based resources, similar to synchronous generating resources, the following considerations should be accounted for:

- For a single plant connected to a bus, the plant may operate in an automatic voltage control mode without reactive-droop (explained below). However, even in these cases, if there are other voltage controlling devices in close electrical proximity (i.e., not on the same bus, but electrically close), some level of reactive-droop may still be appropriate.
- For multiple plants or generators regulating the same bus, reactive droop should typically be used to ensure stable and coordinated voltage control among resources. This control should be coordinated with the TP, PC, and TOP. Reactive droop provides a set point value at off-nominal reactive power based on the given voltage deviation from nominal operating voltage so that each resource shares in the allocation of reactive control. [Figure 3.7](#) shows an example of reactive droop, and is described by the following equation:⁴²

$$Droop = \frac{\Delta V / V_n}{\Delta Q / Q_n}$$

The reactive droop is based on the scheduled voltage set point and the high and low schedule limits. For example, if the scheduled operating voltage is 1.0 pu and the acceptable range is 0.95–1.05 pu, then a 10 percent change in voltage should move the resource from full leading to full lagging reactive power output (2.0 pu change in current), which equates to a 5% droop. Note some standards or entities may refer to this as 10% droop (1.0 pu change in current).⁴³ The equation here shows a simple example equation (not accounting for deadband):

$$5\% \text{ Droop} = \frac{\frac{1.05 - 0.95 \text{ pu}}{1.0 \text{ pu}}}{\frac{I_{q+} - I_{q-}}{I_n}} = \frac{0.10 \text{ pu}}{2.00 \text{ pu}} = 5\%$$

⁴¹ Scheduled voltage is typically a set point with a specified voltage tolerance (or range). Controls may include deadband and/or droop to ensure stable performance.

⁴² Note that this is a conceptual equation of droop. The equation in the figure includes deadband.

⁴³ This concept may be applied for voltage schedules that are off nominal voltage (e.g., 525 kV for 500 kV base system).

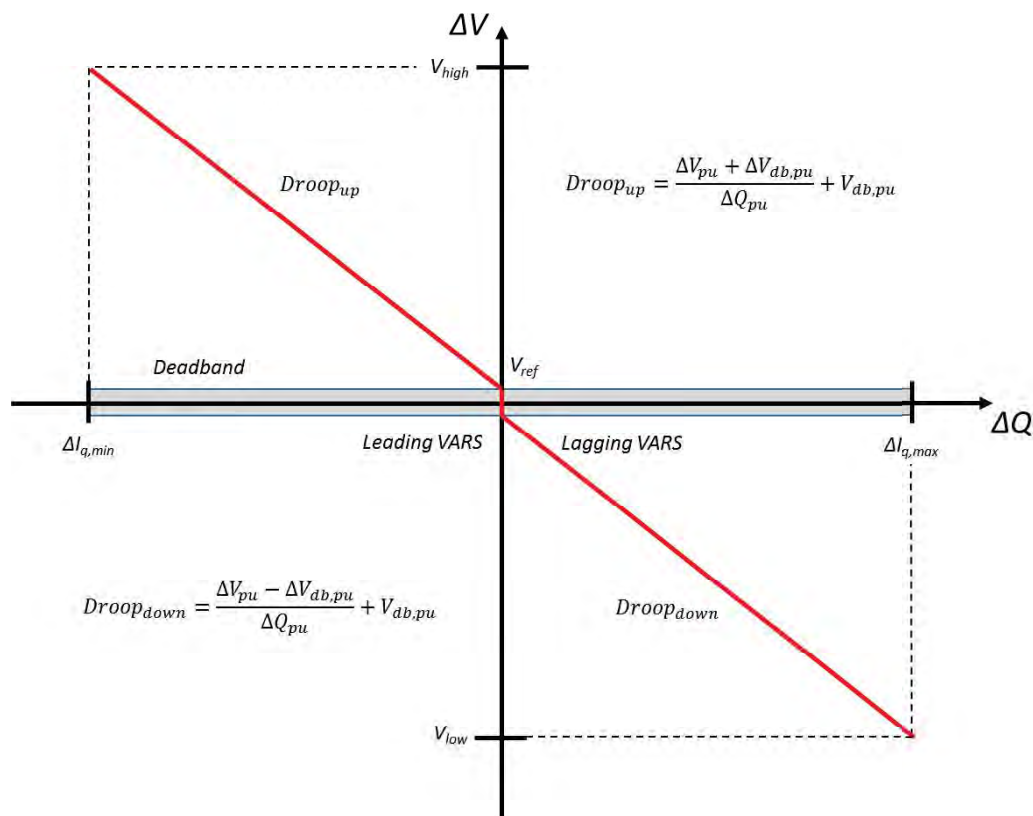


Figure 3.7: Reactive Power-Voltage Control Characteristic

Large and Small Disturbance Performance Characteristics

This guideline differentiates between large disturbance (e.g., fault-type events) and small disturbance (e.g., normal switching-type events, changes in generation and load) performance characteristics for inverter-based resources since different controls within the plant dominate the response depending on the severity of the disturbance. These types of responses are differentiated by the following:

- **Small Disturbance:** Voltage stays within the continuous operating range of the plant
- **Large Disturbance:** Voltage falls outside the continuous operating range of the plant (i.e., “ride-through mode”)

The transition between large and small disturbance behavior is coordinated between the plant-level controller and the individual inverter controls.⁴⁴ This is typically based on the boundary of the continuous operating range, which is typically ± 10 percent around nominal operating voltage. When voltage remains within the continuous operating range, the plant-level controls drive the overall plant response. Faster local inverter controls take over when voltage falls outside this range during severe transient events that result in large variations in voltage at the POM and at the inverters.

Each generating resource should have a continuously acting automatic control system that controls reactive power and reactive current injection. These controls should operate without instability over the entire expected operating range of the resource. The steady-state and dynamic performance of the resource should be studied

⁴⁴ If there is no plant-level controller, then the inverters still have a point where they enter “ride-through mode” and this would be the distinguishing point between large and small disturbances.

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during the interconnection process leading up to commissioning and energization. These controls should ensure BPS stability and reliability and should be agreed upon between the GO and the TOP. This is particularly an issue in areas with low short circuit strength relative to the size of the inverter-based resource(s) in the area.

Large disturbance performance criteria is difficult to test in the field due to the severe transient voltages and currents. This is often type-tested in the factory during inverter design. Small disturbance performance criteria can be tested by using testing techniques similar to those used for MOD-026-1. The following sub-sections describe the recommended small and large disturbance performance characteristics for inverter-based resources. Note that the small disturbance characteristics are specified in terms of reactive power since they are driven by the plant-level controller while the large disturbance characteristics are specified in terms of reactive current since they are driven by the inverter controls.

Small Disturbance Reactive Power-Voltage Performance

Small disturbances regularly occur on the BPS, ranging from switching events to continuous load and generation changes throughout the day. Voltage typically remains within the continuous operating range and the plant-level controller maintains reactive power/voltage control. The control characteristic should follow the guidance provided in the “Steady-State Reactive Power Control and Droop” section above. The overall response of the plant should have response times and characteristics to support BPS voltage schedules, postcontingency voltage recovery,⁴⁵ and voltage stability. Inverter-based resource should be flexible and have the capability to adjust control settings and tuning based on changing grid conditions. As the generating resource mix becomes more dominated by inverter-based resources, resources will need to provide fast automatic voltage control to support voltage even for small disturbances. Inverter-based resources should have the capability to meet or exceed the performance characteristics shown in [Table 3.1](#).⁴⁶ These characteristics are specified for the response of reactive power of the overall closed-loop response of the inverter-based resource (plant). Refer to [Figure F.1](#) in [Appendix F](#) for an illustration of these recommendations.

Table 3.1: Small Disturbance Reactive Power-Voltage Performance		
Parameter	Description	Performance Target
For a step change in voltage at the POM of the inverter-based resource...		
Reaction Time	Time between the step change in voltage and when the resource reactive power output begins responding to the change ⁴⁷	< 500 ms*
Rise Time	Time between a step change in control signal input (reference voltage or POM voltage) and when the reactive power output changes by 90 percent of its final value	< 1–30 sec**
Overshoot	Percentage of rated reactive power output that the resource can exceed while reaching the settling band	< 5 percent***

* Reactive power response to change in POM voltage should occur with no intentional time delay.

** Depends on whether local inverter terminal voltage control is enabled, any local requirements, and system strength (response should be stable for the lowest possible grid strength). Response time may be modified based on studied system characteristics.

*** Any overshoot in reactive power response should not cause BPS voltages to exceed acceptable voltage limits.

⁴⁵ The small disturbance response characteristic may apply for periods after a larger disturbance has occurred once voltage has recovered to within the normal operating range, depending on how the inverter and plant-level controls are coordinated.

⁴⁶ This aligns with the expected performance of other generating resources connected to the BPS (e.g., synchronous machine technology).

⁴⁷ Time between the step change in voltage and reaching 10 percent of new steady-state value can be used as a proxy for determining this time.

Inverter-based resources should operate in closed loop automatic voltage control at all times to support voltage regulation and voltage stability. Either the individual inverters or the plant-level closed loop automatic voltage controller should operate with a relatively fast response characteristic to mitigate steady-state voltage issues from causing dynamic voltage collapse. The plant-level controller may send voltage or reactive power set point changes to the individual inverters relatively fast, or the inverters will respond locally (depending on control architecture). Plants with high-speed communication between the individual inverters and the plant-level controller may not need to employ local control if the overall coordinated controls are fast enough to meet the performance specifications in [Table 3.1](#).

Key Takeaway:

Inverter-based resources should operate in closed loop automatic voltage control at all times to support voltage regulation and voltage stability. Either the individual inverters or the plant-level closed loop automatic voltage controller should operate with a relatively fast response characteristic to mitigate steady-state voltage issues from causing dynamic voltage collapse. The plant-level controller may send voltage or reactive power set point changes to the individual inverters relatively fast, or the inverters will respond locally (depending on control architecture).

Plants with individual inverters that only respond to slow reactive power set point commands from the plant-level controller when operating in the continuous operating range do not support steady-state and postcontingency voltage stability, particularly when the plant-level controller is significantly limited in its response time. As the grid becomes more dominated by inverter-based resources, inverter-based resources need to provide the fast voltage regulation that conventional synchronous generating resources do today. Most WTGs already operate in this fashion with each turbine on a local voltage control responding to changes in set point commands from the slower plant-level controller when in normal operation or for small disturbances. This enables the plant-level controller to operate on a relatively slower response time (e.g., five–30 seconds) to avoid any interactions between the local inverter voltage control and the plant-level voltage control. If this capability is not possible for existing inverter-based resources, then the response time of these resources should be relatively fast (at least in the two–four second range) to accommodate the lack of automatic voltage control at the inverter level. While faster response times typically support postcontingency voltage support and voltage stability, the response should not cause transient voltage overshoot issues. Tuning should be based on system impact studies performed during the interconnection process as described in NERC Reliability Standard FAC-002-2. Default response times should be relatively fast unless system stability studies identify any issues. GOPs of inverter-based resources have stated that their plants in the high penetration areas of ERCOT are tuned with overall plant response times of less than five seconds.

Large Disturbance Reactive Current-Voltage Performance

Large disturbances, for the purposes of this guideline, are disturbances that cause voltage to fall outside the continuous operating range (e.g., 0.9–1.1 pu voltage). The plant-level controller cedes control to the individual inverters (ceases sending new commands), and the inverters typically enter a “ride-through” mode where they assume control of reactive current injection. The dynamic response of the overall inverter-based resources is dominated by the response of the inverters (and any other dynamic devices within the plant). The inverter-based resource should adhere to the following characteristics for large disturbances:

- **Stable Response:** The response of each generating resource over its full operating range and for all expected BPS grid conditions should be stable. The dynamic performance of each resource should be tuned to provide this stable response. The TP and PC ensure during the interconnection process that each resource supports BPS reliability and provides a stable transient response to grid events. The performance specifications described in [Table 3.2](#) may need to be modified, based on studies performed for specific interconnections to provide a stable response.
- **Voltage Outside Continuous Operating Range:** Large disturbances are characterized by inverter terminal voltage falling outside of the continuous operating range. Outside of this range, the plant-level controller

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cedes control to the individual inverters. This range is often 0.9–1.1 pu voltage but may vary by plant. Regardless, a normal operating range is typically specified where the plant-level controller is in control.

- **Local Control and Faster Response Time:** Since the local inverters are in control of the response during large disturbances, the response times can be significantly faster.
- **Voltage Measurement:** Local inverter controls, in response to the voltage measured at their terminals, drive overall plant response during large disturbances (not the voltage at the Point of Measurement for the overall inverter-based resource).
- **Inverter Capability:** Inverters should be designed to have the capability to meet the performance specifications shown in [Table 3.2](#). It is expected that inverters meet these performance specifications, and that inverter-based resources are installed with similar performance characteristics as a default value. However, more detailed studies (during the interconnection process or during Planning Assessments by the TP or PC) may demonstrate the need for modifications to these settings to ensure stable response of the BPS.
- **Inverter Control Flexibility:** The dynamic response of inverter-based resources should be programmable by the GO (in coordination with the inverter manufacturer) to enable changes based on changing grid conditions once installed in the field. This is similar to tuning or modifying response characteristics of an excitation control system for synchronous machines.
- **Current Limiting:** Large changes in terminal voltage will likely cause the inverter to reach a current limit. This is to be expected for inverter-based resources, and current limiters should be coordinated with inverter protection to ensure that the resource is able to respond very quickly while staying within its continuous or short-term overload limits.
- **Fault Inception and On-Fault Current Injection:** During the inception of a fault, priority should be given to delivering as much current to the system as quickly as possible to support protective relay systems to detect and clear the fault.⁴⁸ For the remaining on-fault period after the first couple cycles up to fault clearing (regardless of fault duration), priority should be given to accurately detecting and controlling the type of current needed based on terminal conditions and providing a combination of active and reactive current as necessary.
- **Negative and Zero Sequence Current Injection:** Existing transmission protection systems utilize negative sequence quantities extensively to determine fault direction⁴⁹ to operate reliably. Additionally, providing negative sequence current in addition to positive sequence current will aid in the prevention of overvoltages on the unfaulted phases in the presence of strictly positive sequence currents. More detailed specifications need to be developed by the industry regarding inverter-based resource negative sequence

Key Takeaway:

More detailed specifications need to be developed by the industry regarding inverter-based resource negative sequence current contribution during faults.

⁴⁸ The exception to this statement is in weak grid conditions where system studies may identify potential issues with fast injection of fault current (particularly when current injection accuracy may be compromised). In these cases, the GO, PC, TP, and inverter manufacturer should work together to identify a control strategy that addresses these conditions adequately. Focus should be on providing as much fault current as possible while still ensuring a stable response of the plant in all timeframes.

⁴⁹ Fault direction refers to identifying the location of the fault.

current contribution during faults.^{50, 51, 52, 53} Zero sequence currents are adequately provided by ground source transformers, and typically there is at least one delta/bye transformer between the inverter terminals and the BPS connection. Therefore, zero sequence current is not required to be produced by inverter-based resources.

- **Postfault Current Injection:** Accuracy of current injection after fault clearance is critical for a stable return to precontingency output conditions, transient voltage support, and frequency recovery. Inverter-based resources should accurately detect and control the type of current needed based on terminal conditions, and respond accordingly to provide a combination of active and reactive current injection. Priority should be given to ensuring sufficient local voltage support before attempting to maintain or return to predisturbance active current injection. The transition from inverter control back to plant-level controls (if applicable) once voltage returns within the continuous operation range should not hinder or affect the ability to meet the performance specifications described in this guideline for the overall response of the resource.
- **Postfault Voltage Overshoot Mitigation:** The reactive current response of the inverter should not exacerbate transient overvoltage conditions on the BPS. The controls and response times of the inverter may need to be tuned in some situations, particularly weak grid conditions, to mitigate such conditions from occurring. This may include, but is not limited to, limiting the magnitude of fault current contributed during on-fault conditions⁵⁴ or modifying the response time of the inverter to changes in voltage.

NERC Reliability Standard FAC-002-2 requires each TP and each PC to study the reliability impact of interconnecting new generation as well as studying the impact of any material modifications to existing interconnections of generation. The type of current to be injected during large disturbances should be tuned in coordination with the TP and PC based on detailed system studies. The speed of response should also be tuned to meet the characteristics described above. Inverter-based resources should be capable to meet or exceed the specifications set forth in [Table 3.2](#), although tuning of controls may modify the settings based on the reliability needs of the system.⁵⁵ Refer to [Figure F.1](#) in [Appendix F](#) for an illustration of these recommendations.

⁵⁰ *Fault Current Contribution from PPMS & HVDC*, entso-e, November 2016. Available: https://consultations.entsoe.eu/system-development/entso-e-connection-codes-implementation-guidance-d-3/consult_view/.

⁵¹ VDE-AR-N 4120, “Technical Requirements for the Connection and Operation of Customer Installations to the High Voltage Network (TCC High Voltage)”, Jan. 2015. Available: <https://shop.vde.com/en/vde-ar-n-41202015-01-technical-requirements-for-the-connection-and-operation-of-customer-installations-to-the-high-voltage-network-tcc-high-voltage>.

⁵² IEEE PES–NERC Technical Report, “Impact of Inverter Based Generation on Bulk Power System Dynamics and Short-Circuit Performance”, July 2018. [Online]. Available: http://resourcecenter.ieee-pes.org/pes/product/technical-publications/PES_TR_7-18_0068.

⁵³ PSCR WG C32 “Protection Challenges and Practices for Interconnecting Inverter Based Resources to Utility Transmission Systems” report is expected to have more technical details. The WG is active and the report is being drafted.

⁵⁴ The amplitude of positive sequence reactive current injection may need to be limited for asymmetrical faults. Otherwise there may be an overvoltage on the unfaulted phases.

⁵⁵ The performance being recommended for inverter-based resources aligns with the inherent capability and dynamic response of synchronous machine technology to the most reasonable possible extent (e.g., inherent fast dynamics during fault events as a result of flux dynamics in a rotating machine).

Table 3.2: Large Disturbance Reactive Current-Voltage Performance

Parameter	Description	Performance Target
For a large disturbance step change in voltage, measured at the inverter terminals, where voltage falls outside the continuous operating range, the positive sequence component of the inverter reactive current response should meet the following performance specifications...		
Reaction Time	Time between the step change in voltage and when the resource reactive power output begins responding to the change ⁵⁶	< 16 ms*
Rise Time	Time between a step change in control signal input (reference voltage or POM voltage) and when the reactive power output changes by 90 percent of its final value	< 100 ms**
Overshoot	Percentage of rated reactive current output that the resource can exceed while reaching the settling band	Determined by the TP/PC***

* For very low voltages (i.e., less than around 0.2 pu), the inverter PLL may lose its lock and be unable to track the voltage waveform. In this case, rather than trip or inject a large unknown amount of active and reactive current, the output current of the inverter(s) may be limited or reduced to avoid or mitigate any potentially unstable conditions.

** Varying grid conditions (i.e., grid strength) should be considered and behavior should be stable for the range of plausible driving point impedances. Stable behavior and response should be prioritized over speed of response.

*** Any overshoot in reactive power response should not cause BPS voltages to exceed acceptable voltage limits. The magnitude of the dynamic response may be requested to be reduced by the TP or PC based on stability studies.

Reactive Power at No Active Power Output

Inverters typically start operation once the dc voltage from the input source (e.g., solar PV panels⁵⁷) reaches a sufficient level. Once the source is unable to sustain the dc voltage (e.g., at night for solar) the inverters shut down since the dc voltage drops below the operable threshold. When shut down, inverters do not provide active power or control voltage through reactive power output. However, if configured to do so, inverters can inject (lagging) or consume (leading) VARs at zero active power output by controlling the phase angle of the ac current relative to the ac voltage seen at the terminals of the inverter.⁵⁸ When the dc source is not active, the inverter can use its dc link capacitors to function similar to a STATCOM. The inverters remain operational during this period, which requires some active power consumptions for the inverter power supplies and conversion losses. That active power would need to be supplied from the grid to account for losses and auxiliary loads for plant operation at zero power output. For example, a large inverter in standby mode (e.g., expected solar PV operation during nighttime or WTG with no wind speed or high-speed cutout) might consume a few hundred watts while an operating inverter consumes anywhere from two through 10 kW (ballpark). The inverter would require the ability to power itself; therefore, conventional inverters that operate on a dc source could not provide VARs with no active power output and would need a different source to do so. Once that capability is available, there is little cost from the inverter standpoint to enable this feature assuming it has the capability built into its control. However, there are additional costs associated with operations and maintenance, dc link capacitor lifespan, inverter component lifespans, etc.

⁵⁶ Time between the step change in voltage and reaching 10 percent of new steady-state value can be used as a proxy for determining this time.

⁵⁷ Note that wind has similar capabilities of providing reactive power during conditions when wind speed is zero or too low for active power generation, and battery energy storage also has this capability.

⁵⁸ SMA America, "Q at Night," Accessed Nov 2017. [Online]. Available: https://www.sma-america.com/fileadmin/content/www.sma-america.com/Partners/Images/Knowledgebase/Q_at_night/Q%40NIGHTWP-UUS134511P.pdf

Chapter 3: Reactive Power-Voltage Control

From an equipment specification and design standpoint, the following considerations or changes may be required to operate an inverter for reactive support at zero power output and with no available dc input power:

- The ability to provide reactive power at zero or slightly negative⁵⁹ active power output normally requires a “two-quadrant” inverter and does not require BESS to enable this capability.
- Reactive power controls must be decoupled from active power controls (e.g., the reactive power command path must be independent of the active power command path).⁶⁰ Controls that involve either constant reactive power set point or automatic voltage control (e.g., Volt-Var mode) have this capability. The vast majority of inverters manufactured today have this type of control to meet BPS automatic voltage control requirements⁶¹; however, some legacy inverters that used power factor control mode may not have independent active and reactive power control capability.
- From an inverter hardware perspective, the output limit is the rated current (usually the power electronics device rating), meaning that the inverter is able to supply nearly 100 percent MVA regardless of whether it is supplying active or reactive power (i.e., the inverter should be able to supply nearly 100 percent reactive power with no active power output). However, there are design limitations that may hinder the full reactive capability at low/zero active power output. This include hardware and software limitations, power electronic heating limits,⁶² and other limitations imposed during the design phase of the plant. For these reasons, the amount of reactive power capability at zero active power output may be less than 100 percent, and should be specified by the GOP if this service is provided.
- Many inverters open their ac-side contactor when not generating active power, so operating firmware may need to be modified to be able to provide reactive power at zero or slightly negative active power output.⁶³
- The capability to provide reactive power at zero or slightly negative active power needs to be designed into the firmware controls and hardware of the inverter, otherwise the incremental costs to retrofit this service are not likely cost effective.
- Low voltage ride through may not be achievable during zero active power injection since there is no power into the dc bus to charge and maintain dc voltage. During fault conditions, the power losses without active power support behind the fault will drive voltage low, likely below the operational voltage limit of the inverter. Therefore, these resources use momentary cessation when operating in this mode to maintain the integrity of the dc bus voltage and be able to support voltage recovery after the fault is cleared. The TP, PC, and TOP should be aware of this operational limitation for these resources. Further, the inverter-based resources should return to reactive current injection to support BPS voltage immediately upon fault clearing.

⁵⁹ Active power for the inverter-based resource may be slightly negative to supply power to the inverter power supplies and account for conversion losses.

⁶⁰ Voltage control is tied to the reactive power control loop inside the controller software (active and reactive power control are completely decoupled). This is apparent in the block diagrams of the second generation renewable energy models – regc_a, reec_b, and repc_a.

⁶¹ BES resources are required to operate in automatic voltage control mode, per NERC Standard VAR-002-4, so the capability to provide independent active and reactive power control should be available in every BES-connected inverter-based resource.

⁶² For example, losses in the antiparallel diodes in an IGBT bridge are higher than those in the IGBT itself. Because there are more losses in the reverse-current paths and the out-of-phase current (vars) flows in those paths, more heat is generated during var flow than during watt flow.

⁶³ Inverter-based resources, when not explicitly operating in a reactive power support mode at zero active power output, should isolate the ac filter circuits and any plant-level capacitors and reactors from the grid after production hours unless instructed otherwise by the TOP. This minimizes any injection or consumption of reactive power that may not be expected or planned for by the TP, PC, or TOP. The only remaining consumption is the collector system cable charging, and HV and LV transformer loads, which are provided as part of the reliability studies as losses to the GO/GOP during these conditions.

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From a transmission planning and operations perspective, the BPS would benefit from inverter-based resources actively managing voltage even at zero power output. Although this is not a requirement for BES-connected resources,⁶⁴ some examples of the benefits include the following:

- Customer load can remain high or increase after sunset. Commonly, this load increase is due to HVAC loads during hot summer days related to the time lag of solar heating on homes and businesses. In areas with high penetration of DERs, the loss of DERs after sunset will also increase real and reactive requirements on the BPS. The loss of voltage support at sunset can have a significant impact on BPS voltage control, particularly if a large penetration of inverter-based resources are used to maintain voltage schedules during the day. Maintaining voltage support from BPS-connected solar plants even when solar PV active power is not available can assist in controlling BPS voltages particularly on hot summer evenings.
- In winter, peak load occurs in the early morning and evening hours when there is little to no active power output from solar PV plants. Customer load ramps are frequently more severe in the winter as well due to temperature fluctuations and end-use load behavior patterns. If solar PV plants could provide voltage support in the morning before sunrise and in the evening after sunset, this could help stabilize BPS voltages during sharp load ramp periods.
- In light load periods in the middle of the night, fewer synchronous generators are dispatched to supply customer load, so the number of generators able to regulate grid voltage is reduced. Light load periods can have high voltage problems due to the capacitance of lightly loaded transmission lines. Like most legacy solar inverters, most synchronous generators are not typically able to remain online at zero active power output to regulate voltage. Often, if they can, they have reduced reactive power capability in the leading (absorbing) direction versus the lagging (injecting) direction. In contrast, inverters can provide nearly the same level of reactive power in both leading (absorbing) and lagging (injecting) directions.
- During startup and shutdown of inverters, the inverters may have a noticeable impact on BPS voltage and reactive power injection depending on the voltage before the inverters activate, the rate at which the inverters ramp active power, and the scheduled voltage. This can be mitigated using a ramp rate limit on active and reactive power injection at the inverter or plant-level controller during startup/shutdown; however, providing automatic voltage control during all times would ensure supply of reactive power to support voltage across the different operating modes.

If inverter-based resources were able to regulate voltage during any of these periods when their active power output was at zero (typically the inverter would be off-line), this control could significantly improve BPS voltage profiles, minimize voltage variability, and support voltage stability by providing dynamic reactive power during all operating modes. There may be benefits to enabling this capability in inverters, such as less expensive zero or slightly negative active power voltage support (compared with synchronous machines) and more dispersed resources supporting automatic voltage control. If set up to do so, inverter-based resources can be a valuable asset to provide this ERS when dispatched at zero or slightly negative active power.

In terms of grid planning, TPs and PCs should consider utilizing the reactive capability of inverter-based resources during zero power output conditions during the interconnection process. This type of control can be designed into the generating facilities, and would then need to be compensated accordingly. Reactive power support during these times may be able to offset transmission investments that would otherwise be necessary without the capabilities enabled. Inverter manufacturers have stated that the incremental cost to enable this capability at the solar PV facility is typically significantly less than a transmission-connected dynamic reactive power resource. However, the GO will also need to consider the costs of supplying power to make up losses in the inverters during

⁶⁴ Similarly, IEEE Std. 1547-2018 does not require any reactive power capability for active power output less than 5 percent. Therefore, IEEE Std. 1547-2018 does not require that capability to provide VARs at zero MW output for distribution-connected resources. However, the capability is feasible and many inverter manufacturer include this technology in their latest inverters.

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zero power output conditions as well as any impacts to the lifespan of the inverter components and added operations and maintenance costs.

Conversely, dispersed power producing resources may be capacitive when at zero power output since inverter filter capacitors, plant-side fixed shunt capacitors (if left in-service), feeder line/cable charging, and tie line charging will all contribute to VAR injection.⁶⁵ In aggregate, the amount of VARs produced can be significant in some situations, and TPs, PCs, and TOPs should specify reactive power performance (e.g., type of control) of inverter-based resources during off-line operation. In addition, the TP and PC should be aware of existing practices and the impacts these can have on BPS voltage control during zero power output conditions. In general, inverter-based resources should not inject reactive power under conditions of high voltage and should ensure that inverter filter capacitors, plant fixed shunt capacitors, and any other switchable reactive power device are removed from service such that reactive power at the Point of Interconnection (POI) is near zero when the overall plant is not providing active power (unless otherwise instructed by the TOP). Any requirements or contractual decisions should specify the production capability of VARs when at zero power output as a percentage of nameplate rating (e.g., 44 percent of the nameplate rating of the facility) to ensure a common base. If this is not deployed, then the requirements should clearly state that the reactive power exchange at the POI should be zero during off-line (no active power injection) conditions. These types of specifications are well understood by inverter manufacturers for conditions at low values of active power.

⁶⁵ IEEE Std. 1547-2018 is adding new requirements to limit reactive power exchange between the DER and the Area EPS during offline conditions. At the BPS, reactive power injection when the plant is offline should be zero unless other arrangements or agreements have been made between the TOP and GO.

Chapter 4: Inverter-Based Resource Protection

Inverter-based resources have a number of different types of protective functions throughout the plant, many of which are similar to protective relaying in synchronous machines or transmission-level relaying. However, inverter-based resources also have some unique protective characteristics that are described in more detail in this chapter. Also discussed are various aspects of protective relaying that should be considered by inverter-based resources. These topics have been identified as potential causes for tripping based on recent BPS disturbances where solar PV resources tripped offline for the conditions present at the facility caused by the system fault.

Note that all BES generating resources, including inverter-based resources, are subject to the NERC Reliability Standards based on their applicability with each Reliability Standard. While PRC-024-2 is of particular focus due to recent BPS grid disturbances, all Reliability Standard requirements should be considered. For example, PRC-025-1, PRC-026-1, and PRC-027-1 relate to inverter-based resource protection. Inverter controls and protection need to be coordinated with other forms of protection within the overall plant.

Overview of Inverter-Based Resource Protective Functions

Figure 4.1 shows an example of a simplified one-line diagram of an inverter-based resource (solar PV plant in this example). The plant consists of daisy-chained inverters connected to an aggregating switchgear box (optional) or to the substation collector bus. There are multiple collectors of inverters that connect to the bus. At the low-side (typically 34.5 kV) bus, there are typically shunt capacitors and/or reactors to help offset collector system losses and supplement voltage regulation. Each feeder has a breaker, and the substation GSU also has breakers on both sides. Often, there is a main line EHV transmission circuit that connects the facility to the POI connecting to the TO. The individual inverter transformers are typically a wye (ungrounded)-delta configuration⁶⁶ and the GSU is typically a wye (grounded)-wye (grounded) configuration.

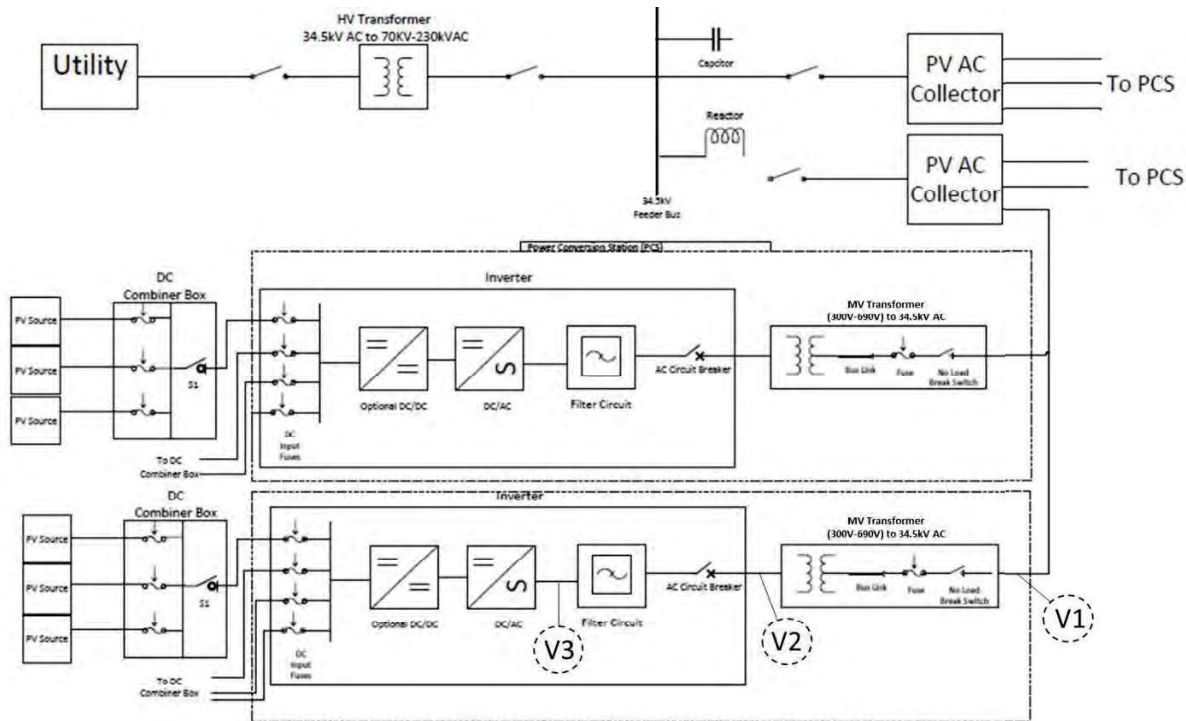


Figure 4.1: Simplified Solar PV Plant One-line Diagram

⁶⁶ Some installations may use a wye-wye (ungrounded) configuration at the inverter transformers; however, this is relatively rare.

The protection systems in the plant can be categorized based on the elements they are protecting, including the following:

- Inverter (protective functions):
 - Open phase (single phase loss) detection
 - ac and dc overcurrent protection
 - ac undervoltage protection
 - dc undervoltage protection (for BESS)
 - Under- and overfrequency protection⁶⁷
 - ROCOF protection (should be disabled)
 - Loss of synchronization
 - Unintentional islanding protection (should be disabled)
 - Passive anti-islanding protection (should be disabled)
 - Reverse current protection (dc voltage low relative to ac voltage, solar PV only)
 - dc ground fault or insulation monitoring protection⁶⁸
 - ac ground fault protection
 - Negative sequence current protection⁶⁹
 - Reverse phase sequence protection (46 element)
 - Internal inverter temperature protection
 - Other internal health monitoring protection
- Inverter transformer protection:
 - Current limiting fuse (fast)
 - Expulsion fuse (slow)
- Collector system protection:
 - Under- and overvoltage protection
 - Overcurrent protection (50 and 51 elements)⁷⁰
 - Under- and overfrequency protection⁷¹
- Substation and GSU protection:
 - Differential protection (transformer and bus)

⁶⁷ May be used for protection of inverter fans, transformers, magnetics, etc., but should be based on a physical equipment limitation; otherwise, the tripping thresholds should be expanded to the widest possible extent.

⁶⁸ The negative terminal of the PV system is grounded and protection is monitoring the positive side. On floating systems, the protection is monitoring insulation resistance.

⁶⁹ Typically monitoring for ~2 percent long-term/continuous negative sequence current, which can be damaging to capacitors and other elements.

⁷⁰ IEEE Standard for Electrical Power System Device Function Numbers, Acronyms, and Contact Designations', IEEE Std. C37.2-2008.

⁷¹ Typically used for 3-phase loads, frequency sensitive loads, fire pumps, and other auxiliary loads; otherwise, the tripping thresholds should be expanded to the widest possible extent.

- Breaker failure protection (high side breaker)
- Ground fault protection:
- Main line/breaker protection⁷²
 - Under- and overvoltage protection
 - Overcurrent protection (50 and 51 element)
 - Zone (impedance-based) protection (21 element)
 - Under- and overfrequency protection

As with most resources, the protective functions can and often do use phase-based quantities rather than a positive sequence value. Therefore, positive sequence dynamic simulation tools may not capture the conditions in which inverter-based resources may trip. This should be acknowledged during studies, and engineering judgment should be used to understand the extent to which tripping will also occur for these studies. For example, simulated delayed clearing faults may extend past the ride-through capability of inverter-based resources. This may not be captured using the positive sequence voltage quantity in simulation, yet the faulted phase (in which the inverter-based resource may take protective action based on) will exceed the ride-through criteria. In this case, the resource should be tripped in simulation.

A useful reference for protective relaying at wind power plants is the IEEE Power System Relaying Committee (PSRC) Working Group C25, which is drafting Guide for Protection of Wind Power Plants.⁷³ This guide provides more detail related to the various types of WPP protection systems.

Inverter Tripping and Shutdown

Figure 4.2 shows a simplified one-line diagram of one individual inverter connected at the plant shown in Figure 4.1. How an inverter responds to a fault condition depends on if the fault code initiates on the dc or ac side of the inverter. At a high level, this can be described as follows:

- **DC-side Fault:** If the fault code initiates on the dc side, the inverter stops gating the power electronics and ceases energization within microseconds, and the inverter shuts down. The inverter ac circuit breaker does not necessarily have to open.
- **AC-side Fault:** If a fault occurs on the ac side, inverter protection (e.g., under- and overvoltage, overcurrent) may operate. Inverter controls stop gating the power electronics and cease energization within microseconds. The inverter breaker then opens based on the protection trip command.

While the phenomena that causes the inverter to cease energization may be different, both conditions are considered a “trip” where the protective functions and/or circuit breaker operation impact current injection and energization to the BPS. While in some cases the inverter IGBT gating may cease, this action is not considered momentary cessation since the fast recovery of current once voltage returns to within acceptable limits does not occur. For a given disturbance, inverter-based resources may exhibit tripping of all inverters or only partial tripping of inverters depending on what each individual inverter experiences at its terminals during the event.

⁷² The TSP/TO for which the inverter-based resource is connected to at the transmission level will most likely weigh in heavily on the type of protection required at the EHV bus and main line protection to match the existing protection philosophies used at that utility (e.g., standardized line protection relations, permissive over-reaching transfer trip, current differential).

⁷³ IEEE Power System Relaying Committee, “Guide for Protection of Wind Plants,” IEEE C25, draft guide. <http://www.pes-psrc.org/c/c25/c25.html>.

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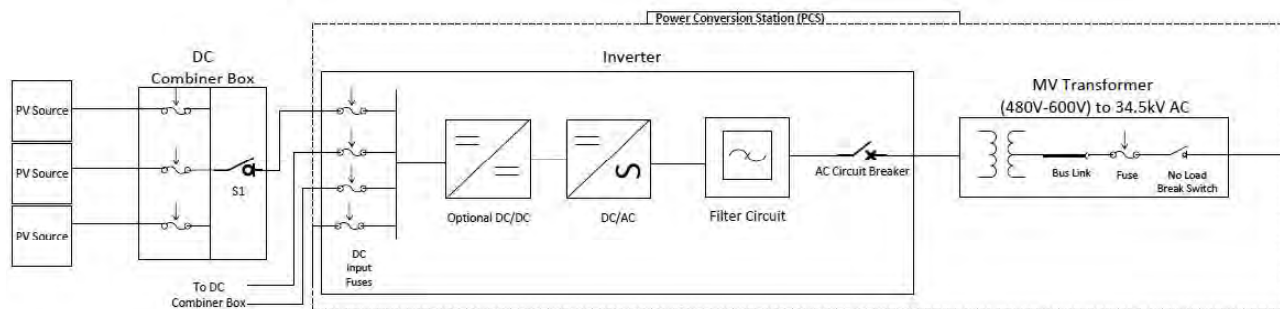


Figure 4.2: Simplified Inverter One-line Diagram

Return to Service following a Trip

Inverters that trip off-line due to faults on the BPS will typically automatically return to service with a specified time delay.⁷⁴ The time delay can be separated into two distinct time frames:

- **Inverter Reset Mode:** Some tripping actions require a full inverter reset that typically requires one to two minutes to complete. This may be for inverter software or hardware requirements, or may be to charge the dc bus before returning to service. Regardless, these are required actions before the inverter is able to reconnect to the BPS.
- **Intentional Time Delay:** Some inverters may use an intentional, programmed time delay to return to service following a trip. IEEE Std. 1547-2018 Requirement 4.10.3 requires an adjustable range of the minimum intentional delay between 0–600 seconds, with a default of 300 seconds (five minutes). Past disturbances on the BPS have identified that this five-minute timer is implemented into many BPS-connected inverters.

Any resource that trips off-line should reconnect to the BPS based on the reconnection requirements specified by their BA, if any. BAs should consider the current and future penetration of inverter-based resources and determine if automatic reconnection is acceptable to maintain reliable performance and generation-load balance. Large amounts of automatic reconnection of any resource may pose challenges for the BA to maintain this balance and ensure stability. At higher penetration levels, BAs should consider whether automatic/uncontrolled reconnection is allowable. BAs may consider implementing reconnection requirements following tripping. These requirements may include, but are not limited to: notification by the GOP that the plant experienced a whole or partial trip⁷⁵ and an estimated time to return, reconnection approval, and reconnection ramp rates. In any case, BAs should require that GOs of inverter-based resources using automatic reconnection specify the time to reconnection for these automatic actions. If there are different times depending on different protective actions, each should be specified so the BA can have full situational awareness and understanding of tripping and reconnection events.

Frequency and Voltage Ride-Through Related to PRC-024-2

Frequency and voltage protection aspects are discussed in more detail in the subsequent sub-sections. However, it is important to first clarify some aspects of the PRC-024-2 ride-through curves, particularly related to inverter-based resources. Figures 4.3 and 4.4 show the frequency and voltage ride-through curves from PRC-024-2, respectively. The corresponding tables can be found in the standard. The following observations are provided:

⁷⁴ Some inverter fault codes require a manual reset while many fault codes allow for automatic reconnection.

⁷⁵ If the partial loss inverter(s) at the facility does not impact the amount of output power expected to be delivered to the BPS, then it should not need to be reported. This could include individual inverter trips where another inverter is quickly brought online to maintain the scheduled value.

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- The region outside the “No Trip Zone” for both the frequency and voltage protection ride-through curves is not a “Must Trip Zone.”⁷⁶
- The ride-through curves apply to the POI voltage for the overall inverter-based resource and not for each individual inverter. Inverters may experience transient terminal voltages that are higher or lower than those shown in the ride-through curves. Inverters are expected to ride through those voltages⁷⁷ so long as the POI voltage is within acceptable limits, per PRC-024-2.
- If the resource is subjected to successive faults in a period of time that necessitates tripping to protect from the cumulative effects of those successive faults, the resource may trip to ensure safety and equipment integrity. For example, wind turbines may trip to protect the drivetrain from cumulative torsional stress due to successive faults within a given period of time (mechanical fatigue protection).
- Inverter voltage and frequency trip settings should not be based solely on the PRC-024-2 voltage ride-through curves. These settings should account for physical equipment limitations to protect the inverter and associated equipment. Voltage and frequency trip settings should be set as wide as possible while still protecting the inverter equipment from damage.
- While the frequency ride-through tables allow for an “instantaneous” trip for high or low frequency, this frequency should be accurately calculated over a time window (e.g., around six cycles) and should not use an instantaneously calculated value; it should be filtered over a time window. The ride-through curve uses a logarithmic scale, which starts at 100 ms, and is more indicative of a minimum time to take frequency-related tripping action.
- Item 1 of the Curve Details of Attachment 2 of PRC-024-2 states that “[t]he per unit voltage base for these curves is the nominal operating voltage specified by the Transmission Planner in the analysis of the reliability of the Interconnected Transmission Systems at the point of interconnection to the Bulk Electric System (BES).” TPs generally limit acceptable operating voltages to some range of the system nominal voltage. The GO should confirm the system nominal voltage for the POI bus that is used in the TP’s model of the BES, which typically does not vary from bus to bus for a given voltage level of the BES (e.g., 230 kV, 500 kV). Since the no-trip zone limits are steady-state representations of the severity of the voltage transient versus the time to recover during a transient event, it is acceptable to use the system model nominal voltage in defining these limits.
- Item 5 of the Curve Details of Attachment 2 of PRC-024-2 states that “[v]oltages in the curve assume minimum fundamental frequency phase-to-ground or phase-to-phase voltage for the low voltage duration curve...” Either the phase-to-ground or phase-to-phase voltage, whichever selected, should use the fundamental frequency component of the signal when comparing to the ride-through curve.
- Item 5 of the Curve Details of Attachment 2 of PRC-024-2 states “...and the greater of maximum RMS or crest phase-to-phase voltage for the high voltage duration curve.” However, this signal should be a fundamental frequency voltage well-filtered over a window (e.g., RMS) to avoid spurious tripping during voltage transients. Therefore, an RMS voltage measured over around one cycle is best suited in comparison with the voltage ride-through curve of PRC-024-2 (within the equipment limitations).

⁷⁶ Footnote 1 of PRC-024-2 states: “Each Generator Owner is not required to have frequency or voltage protective relaying (including but not limited to frequency and voltage protective functions for discrete relays, volts per hertz relays evaluated at nominal frequency, multi-function protective devices or protective functions within control systems that directly trip or provide tripping signals to the generator based on frequency or voltage inputs) installed or activated on its unit.” This further reinforces the concept that the area outside of the “No Trip Zone” is not a “Must Trip Zone”.

⁷⁷ This is predominantly a voltage-related issue since frequency is relatively the same between the inverter terminals and the POM.

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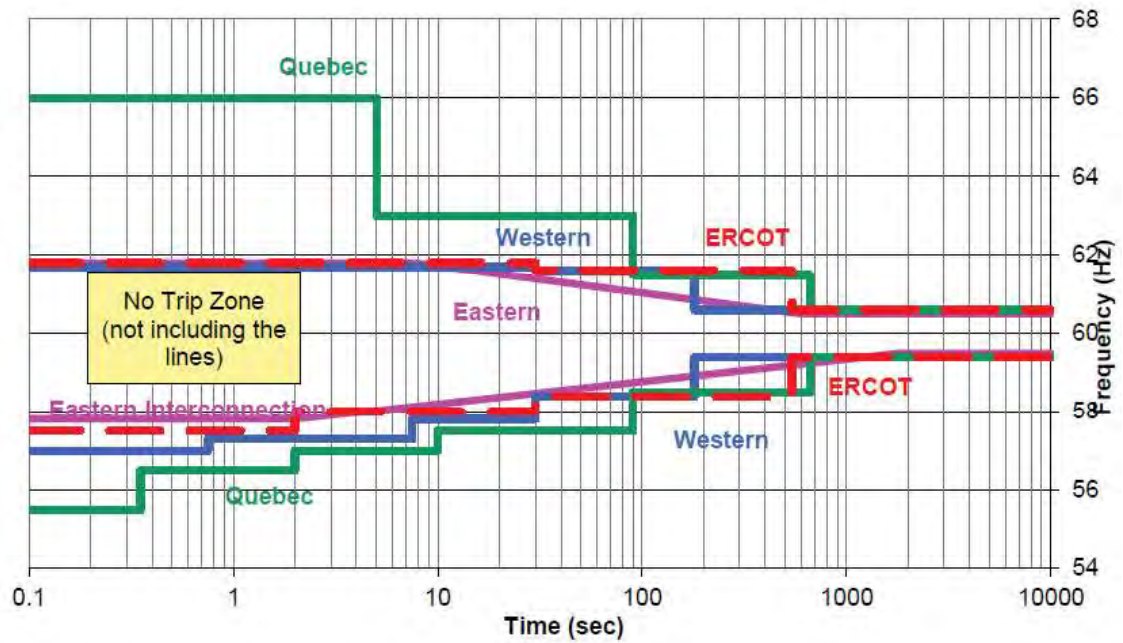


Figure 4.3: Off-Nominal Frequency Capability Curve from PRC-024-2

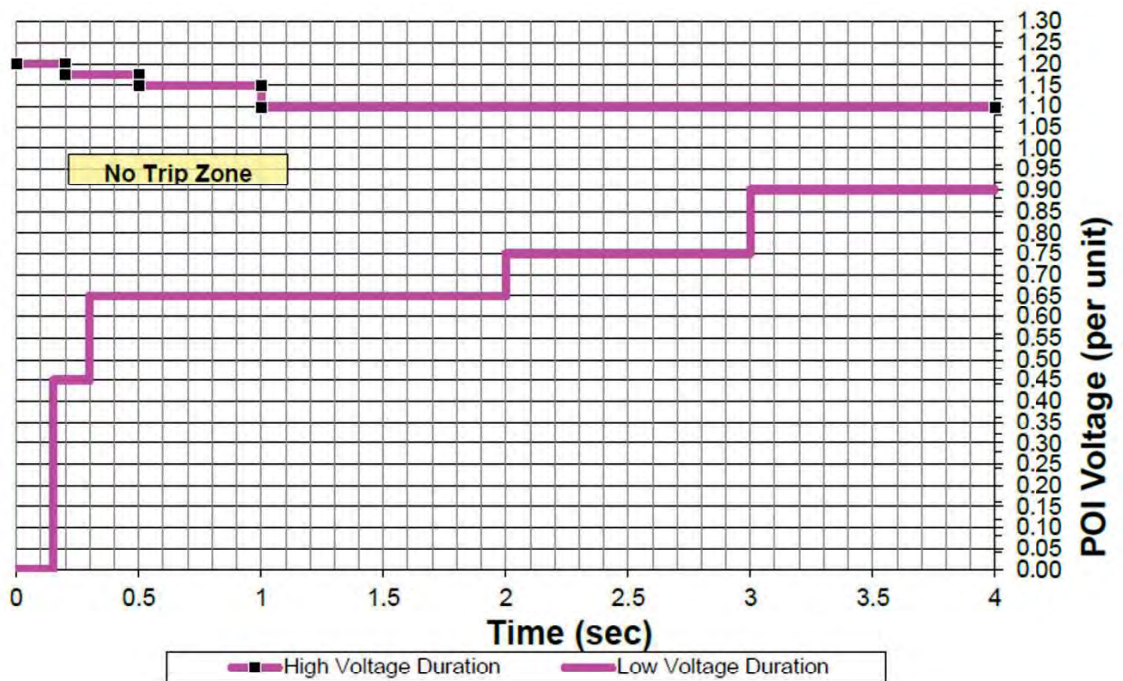


Figure 4.4: Voltage Ride-Through Time Duration Curve from PRC-024-2

Overvoltage Protection

Figure 4.5 shows transient overvoltage conditions at the terminals of an inverter during one of the faults during the Canyon 2 Fire disturbance. Inverters tripped on a sub-cycle (less than quarter cycle) measured voltage above the overvoltage protective settings for the inverter. This illuminated a need to specify recommended voltage protection, particularly overvoltage protection, to ensure inverter-based resources are not susceptible to spurious tripping on transient overvoltages caused by faults, switching, or instantaneous changes in controls.

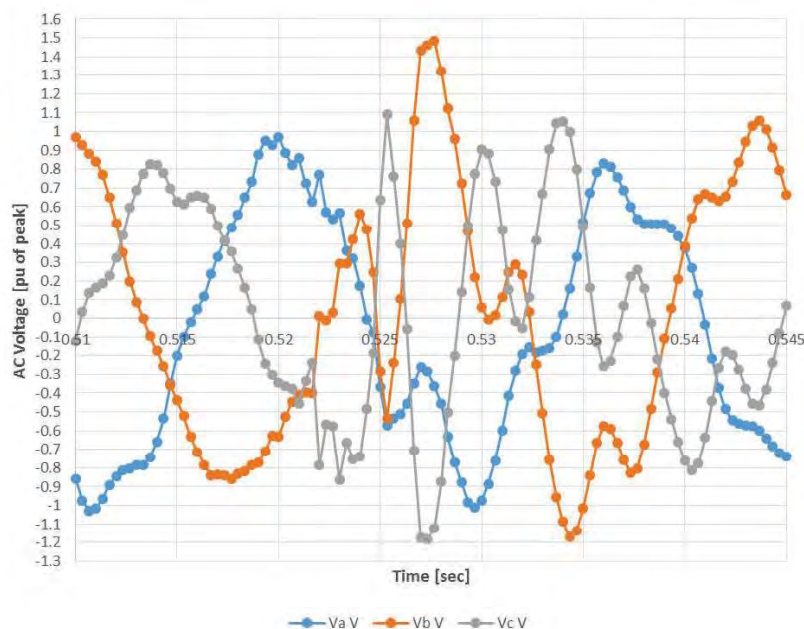


Figure 4.5: Phase Voltages during On-Fault Conditions

Voltage Measurement Filtering and Instantaneous Trip Settings

The PRC-024-2 ride-through curve and voltage-time characteristics were derived based on conventional relaying philosophies. Modern digital protective relays typically use a filtered (e.g., bandpass filter) RMS signal for voltage sensing, which eliminates any susceptibility to tripping for transient overvoltages. Instantaneous voltage values are not used since voltage transients are common on the BPS due to switching actions, fault clearing, lightning, etc. These types of transients should not result in protective relay action unless a fault condition exists and relays are set using filtered quantities to ensure secure operation. Inverters should not be set to trip on an instantaneous, unfiltered voltage measurements. Inverter protective functions should use a fundamental frequency voltage for overvoltage protection when compared with the PRC-024-2 ride through curve. While the protective function can be “instantaneous,” the filtering on the voltage measurement should occur over at least a cycle or longer, and the inverter should not operate on an instantaneous voltage measurement (except due to known equipment limitations).

The overvoltage trip settings, based on a fundamental frequency, filtered voltage measurement should also be coordinated with other forms of plant protection to ensure equipment reliability. Trip commands and opening of the inverter circuit breaker typically require three to four cycles, and therefore do not protect the equipment from damage caused by instantaneous overvoltage. Therefore, sub-cycle transient overvoltages are typically protected against using surge arresters (described below).

Protection Coordination Improvements

Most high voltage equipment on the BPS have two voltage ratings:

1. **Basic Impulse Level (BIL) Rating:**⁷⁸ The electrical strength of insulation expressed in terms of the crest value of a standard lightning impulse (e.g., $1.2 \times 50 \mu\text{s}$ wave) under standard atmospheric conditions. This rating is the maximum voltage that the equipment can withstand without breakdown of electrical insulation and damage caused by a transient voltages wave with fast rise time and decay time. BIL ratings are typically anywhere from 2.5 to 15 times rated voltage (much higher than maximum operating voltage rating).
2. **Maximum Operating Voltage Rating:** The maximum operating voltage is the maximum fundamental frequency voltage that the equipment can withstand without damage.

Since exceeding the BIL rating can result in nearly instantaneous damage to the equipment, de-energizing the equipment using ac circuit breaker operation is typically too slow. For this reason, surge arresters are used to clamp voltage to a specific level below the BIL, allowing energy to dissipate nearly instantaneously through the surge arrester to protect the equipment from damage. Fast-front, sub-cycle overvoltages are remediated in many applications by applying surge arrestors. Besides the very fast time constants for protecting against these transient conditions, another advantage of using arresters is that it allows the equipment to continue operation throughout the short-duration transient overvoltage, ride through the disturbance, and continue operation after the overvoltage conditions is eliminated. The effectiveness of surge arresters is a function of the impedance between the overvoltage requirement location and the inverter terminal where the surge arrester is installed. For this impedance, a per unit value is defined when designing and testing the overvoltage capability of the inverters to ensure that equipment provided by various suppliers has indeed similar capability. The impedances of the step-up transformer (“MV transformer” in [Figure 4.1](#)) and the inverter are typically used for this purpose.

Most BPS equipment also has a maximum operating voltage that it can withstand, which is a voltage measured at fundamental frequency. This inherently means that the voltage is measured over some time, and a time delay may be incorporated before de-energizing the equipment. So, for fundamental frequency overvoltage conditions, overvoltage protective elements typically use some form of bandpass filtered RMS value. This helps mitigate tripping for any spurious transients that occur during fault conditions. Even for “instantaneous” trip functions in conventional protective relays, some filtering is applied to ensure it is operating on fundamental frequency quantities. This helps ensure protection system security (tripping only when intended).

Inverter protection should be coordinated with the use of surge arresters with inverter protective tripping functions to securely protect against transient, sub-cycle overvoltages. Surge arrestors applied to the inverters can clamp transient overvoltages to acceptable levels while still ensuring continuous operation of the inverter. Protective functions within the inverter should operate on a filtered fundamental frequency RMS quantity to avoid erroneously tripping on transient overvoltages that are cleared before the inverter or circuit breaker can even respond.

Recommended Overvoltage Protection

Inverter-based resources should use protection settings based on design specifications from the manufacturer to ensure equipment integrity while also ensuring secure operation. Protection settings should not be based solely on the ride-through curves in PRC-024-2. This protection philosophy is separated into two aspects: sub-cycle transient overvoltage protection, and fundamental frequency overvoltage protection. [Figure 4.6](#) shows recommended transient overvoltage ride-through (protection) performance for inverter-based resources, and [Table 4.1](#) shows a tabular representation of the curve. The curve is based on historical events and input from inverter manufacturers, and it is intended to guide future inverter-based resource specifications as well as

⁷⁸ See IEEE Std. 1313.2 “IEEE Guide for Application of Insulation Coordination”

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potential changes to existing resources (to the most possible extent, based on equipment capability) to improve ride-through performance. The following observations describe the overvoltage ride-through curve in more detail:

- The right axis represents a fundamental frequency RMS voltage measured at the POI. The blue portion of the curve uses this axis and mirrors the overvoltage ride-through curve in PRC-024-2.⁷⁹ This curve starts at 16.66 ms to account for filtering of the voltage waveform. Protective functions being applied to the PRC-024-2 ride-through curve should use a well-filtered fundamental frequency RMS voltage measurement. Many different types of filtering methods can be applied, and any method should filter out harmonics and sub-cycle spikes that are not part of the fundamental frequency ac voltage waveform. This mitigates erroneous tripping during sub-cycle spikes for this type of protection.
- The left axis represent the instantaneous voltage at the inverter terminals (“V2” in [Figure 4.1](#)) in per unit of nominal instantaneous peak base voltage. Inverters should be designed to withstand sub-cycle transient overvoltages that may occur during fault conditions or switching events while also protecting the inverter from damage. Inverter ac breakers require at least three to four cycles to operate (and often much longer for the types of breakers used at the inverter terminals), and therefore are not effective protection mechanisms for mitigating sub-cycle transient overvoltages. The red portion of the curve uses this axis and represents the recommended sub-cycle performance for inverters. Inverters should be able to withstand higher voltages for shorter durations and higher voltage magnitudes typically only persist for a very short time and decay very quickly.⁸⁰ Within the curve, these voltage spikes should not result in inverter tripping action.
- The area within both the instantaneous inverter terminal voltage (red) and filtered RMS POI voltage (blue) portions of the curve should be treated as a “No Trip Zone,” where the overvoltage protection should not operate within this area. The area outside this region of the curve should be considered as a “May Trip Zone” and not as a “Must Trip Zone.”
- For sub-cycle transient overvoltage protection, inverters may need to use alternative operating modes for very short times (e.g., on-fault conditions) to sustain very high short-duration overvoltages. For example, current clipping, gate pulse suppression, or other fast controls within the inverter can help ensure a stable response that does not lead to tripping. Any reduction in current should be restored immediately (within cycles) once voltage returns to acceptable levels within the fundamental frequency RMS voltage portion of the curve. This is different than momentary cessation, which involves a resource returning over a relatively longer time frame with a specified delay and ramp rate.
- IEEE Std. 1547-2018 includes a requirement that “DER shall not cause the instantaneous voltage on any portion of the Area EPS to exceed the magnitudes and cumulative durations” shown by the dotted line in [Figure 4.6](#). This is provided here only for reference and completeness.⁸¹ DERs are expected to not contribute reactive current to the grid during overvoltage conditions (in per unit of nominal instantaneous peak base) above the curve. However, DERs do not necessarily have to trip for these conditions. Rather, they must ensure that their current contribution does not exacerbate the overvoltage.

⁷⁹ This curve focuses on transient overvoltage and thus ends at 200 ms, while the PRC-024-2 curve continues to four seconds.

⁸⁰ For example, the Ontario Transmission System Connection Point Performance Standards—Appendix 2 states that “all equipment shall be able to withstand capacitor switching surges that transiently increase voltage to twice normal levels.” Available: https://www.oeb.ca/documents/cases/RP-2004-0220/appendix2_clean.pdf.

⁸¹ Refer to IEEE Std. 1547-2018, Section 7.4.2, Figure 13.

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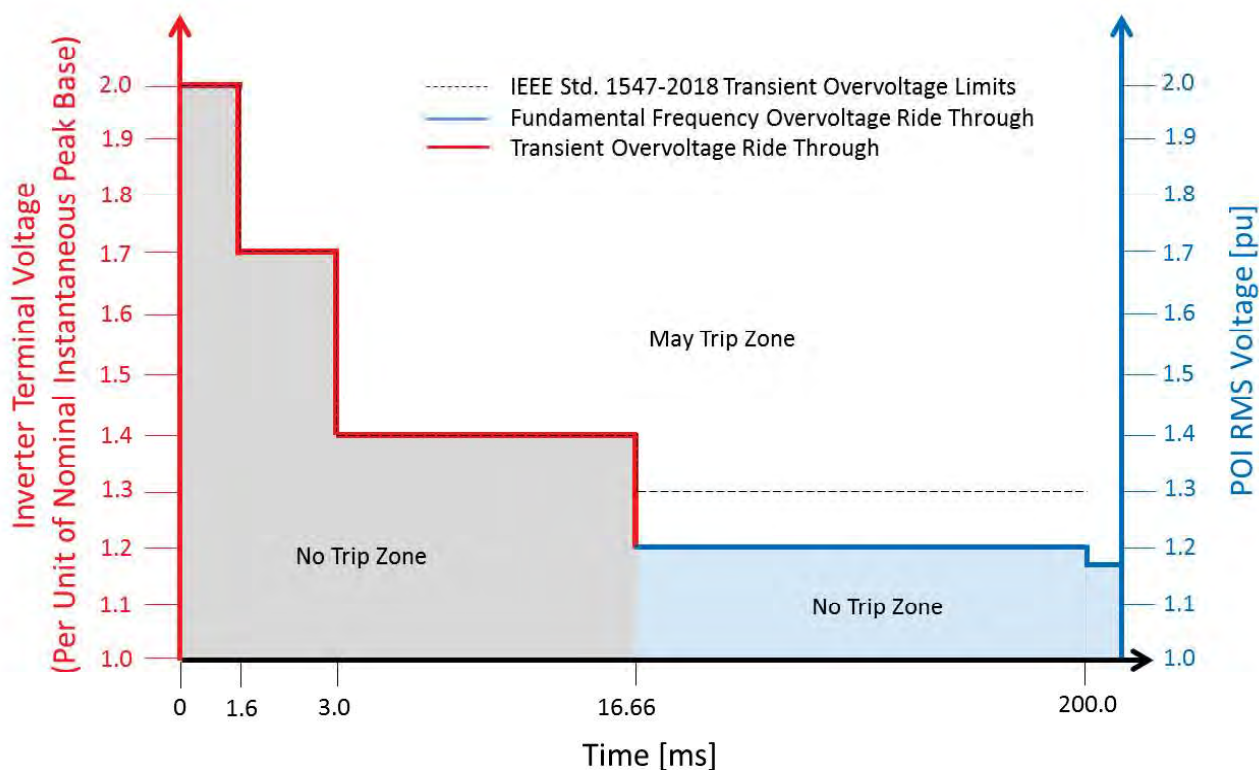


Figure 4.6: Recommended Overvoltage Ride-Through Curve

Table 4.1: Recommended Overvoltage Ride-Through Characteristic		
Curve Section	Voltage (pu)	Time (sec)
Instantaneous Inverter Terminal Voltage	≥ 2.000	Instantaneous Trip Acceptable
	≥ 1.700	0.0016
	≥ 1.400	0.003
Fundamental Frequency RMS POI Voltage	≥ 1.200	0.0167
	≥ 1.175	0.20
	≥ 1.150	0.50
	≥ 1.100	1.00

In cases where the inverters with integrated fast-acting controls, surge arresters, or other clamping circuits are provided with a standalone step-up or grid interface transformer, the instantaneous overvoltage requirements on the left axis can be applied at a point further in the supply system (“V1” in [Figure 4.1](#)). Application of the overvoltage curve in the supply system should account for the full range of potential initial operating points of the inverter as well as the impedances that play into the given point of interface. This is to ensure successful ride-through of the system of connected resources for the overvoltages shown in [Figure 4.6](#).

Frequency Tripping Mechanism

An inverter-based resource should protect itself against over- and underfrequency issues that could cause damage or safety issues at the resource for frequencies outside the “No Trip Zone” of PRC-024-2.⁸² PRC-024-2 provides clarity for dispersed power producing resources regarding ride-through requirements of the generator frequency protective relaying. It states in Footnote 2 the following:

“For frequency protective relays associated with dispersed power producing resources identified through Inclusion I4 of the Bulk Electric System definition, this requirement applies to frequency protective relays applied on the individual generating unit of the dispersed power producing resources, as well as frequency protective relays applied on equipment from the individual generating unit of the dispersed power producing resource up to the point of interconnection.”

Although PRC-024-2 does not specify how frequency should be measured, frequency should be calculated with sufficient accuracy (accounting for phase jumps or distorted waveforms due to faults or harmonics) such that protective actions operate as expected and the number of undesired operations of protection systems is minimized. There are multiple ways an inverter can calculate frequency and take protective action on the calculated value. [Figure 4.7](#) shows two different forms of frequency derivation and how those calculations feed the frequency protective relaying. In the past, frequency was derived using from zero crossings of the measured phase voltages. Today, grid frequency is most commonly calculated using the derived phase quantity from the PLL since the PLL is used to maintain synchronization to the grid. In this setup, the derived phase from the PLL is fed through an integrator ($d\theta/dt$) and that signal should then be filtered⁸³ (e.g., low pass filter) over some time. This signals is then passed to the frequency protective relaying function where any potential tripping of the inverter would take place.

⁸² And should otherwise not trip on frequency-related protection for frequencies within the PRC-024-2 ride-through curves.

⁸³ Using a filter mitigates any potential erroneous tripping on higher frequency components or spikes in the calculated frequency.

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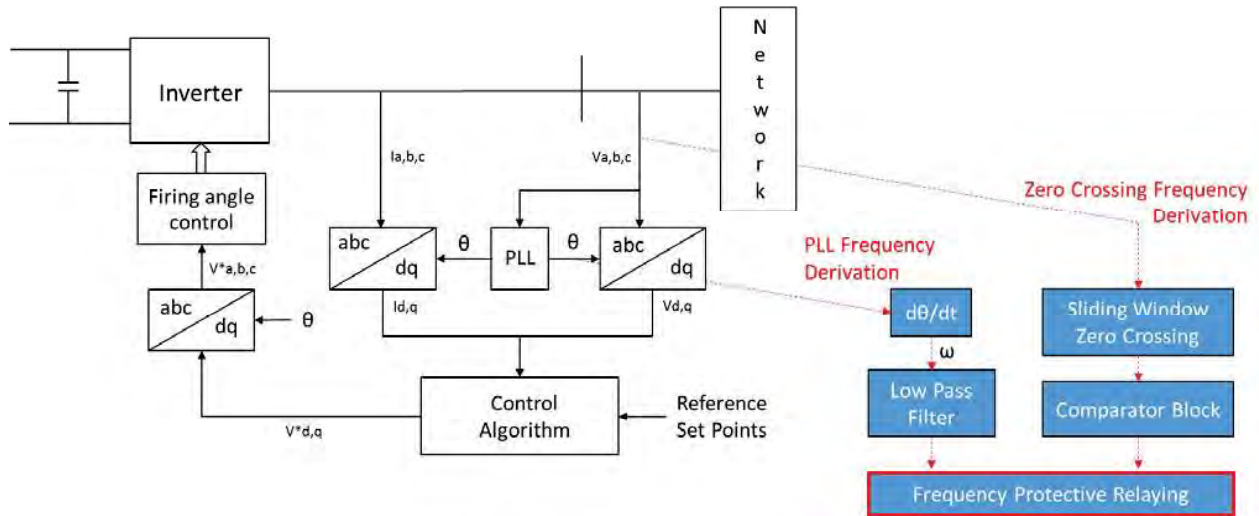


Figure 4.7: Frequency Protective Relaying using PLL Controls
[Source: Adapted from EPRI]

Rate-of-Change-of-Frequency Measurement and Protection

Inverter-based resources do not have an equipment limitation or need to trip on high rate-of-change-of-frequency (ROCOF). ROCOF protection has been used in certain grid code requirements around the world, particularly for small island systems, and for passive islanding detection for DER installations. However, ROCOF relays should not be used for inverter-based resources connected to the BPS and should be disabled in the inverter.

Measured frequency changes at the inverter are either caused by phase shifts on the BPS (due to faults, line switching, or other normally occurring fast transient events) or by a generation-load imbalance in the system. Phase shifts from fault events, for example, cause an instantaneous change in phase angle that results in a very high instantaneously calculated ROCOF value. Inverter-based resources are expected to ride through these events, regardless of the ROCOF, using advanced controls to maintain PLL synchronism during the high ROCOF and potential momentary (cycles) loss of PLL lock. On the other hand, the BPS may experience a relatively high system-wide ROCOF during a large generation-load imbalance situation. However, these conditions are significantly slower than the instantaneous phase jumps caused by faults, and inverter-based resources should ride through these events and continue to provide active and reactive current, as necessary. In either case, a BPS-connected inverter-based resource should not have ROCOF protection enabled and should be able to ride through phase jumps and high system-wide ROCOF events. PLL controls should be robust enough to ride through these events using advanced logic. Tripping due to high ROCOF is not acceptable ride through performance.

Key Takeaway:

Inverter-based resources do not have an equipment limitation or need to trip on high ROCOF. Inverter relays or controls should not be used for BPS-connected inverter-based resources and should be disabled in the inverter.

Over- and Underfrequency Protection

Generator protection settings should be based on physical equipment limitations, and generators should remain connected to support BPS frequency control and stability during large BPS disturbances to the best possible extent. Frequency trip settings for inverter-based resources should be set as wide as possible while still ensuring equipment protection and personnel safety to support BPS reliability. This aligns with the intent of PRC-024-2 and the concept that the region outside of the “No Trip Zone” should not be interpreted as a “Must Trip Zone.”

Frequency is not a primary concern for inverter preservation. There are no limitations that require inverters to trip based on off-nominal frequency within expected abnormal BPS operations (e.g., ± 3 Hz). Many inverter manufacturers have stated that inverters can operate indefinitely for frequencies down to 57 Hz (and those with universal design for 50 Hz systems can sustain down to 47 Hz). Therefore, inverter-based resources should be able to operate for frequencies between 57–63 Hz moving forward. Limitations of inverter-based resources are more related to the specifications used when the inverter was designed.

Key Takeaway:

Frequency trip settings for inverter-based resources should be set as wide as possible while still ensuring equipment protection and personnel safety to support BPS reliability. This aligns with the intent of PRC-024-2, and the concept that the region outside of the “No Trip Zone” should not be interpreted as a “Must Trip Zone.”

PRC-024-2 frequency limits were based on synchronous machine limitations, protection settings, and coordination with underfrequency load shedding (UFLS) programs. IEEE 1547-2003 requirements for disconnection within a specified period of time were predominantly based on anti-islanding considerations on the distribution system and should not be applied to BPS-connected resources. Revisions in IEEE 1547-2018 have proposed frequency ride-through requirements that more closely align with, and use wider trip thresholds than, PRC-024-2.

Phase Lock Loop Loss of Synchronism

Sudden changes in BPS voltage magnitude and phase occur during faults on the BPS. Recent disturbance events identified that some inverters’ PLL loss of synchronism may cause an ac synchronization fault (loss of PLL synchronization), resulting in protective action to open the inverter primary circuit breaker. For these inverters, this action is taken for complete loss or sudden fluctuation in BPS voltage that causes the inverter PLL to lose synchronism with the ac waveform. This triggers a five-minute restart action by the inverter. At the plant where this occurred, other fault indicators also took action to trip the inverter and PLL loss of synchronism was not the primary cause of inverter tripping.⁸⁴ On the other hand, other plants did experience only a PLL synchronism fault code that tripped inverters. Therefore, it is worthwhile to clearly articulate the recommended performance specifications for PLLs during BPS disturbances.

PLL loss of synchronism should not result in inverter tripping. Momentary cessation, as described in [Chapter 1](#), should also not be used, to the possible extent, when PLL loss of synchronism temporarily occurs. The PLL is able to resynchronize to the grid within a couple electrical cycles and should be able to immediately return to expected current injection. Alternative operating modes such as current clipping or gate pulse suppression could be used during transient conditions to ensure equipment safety; however, recovery and resynchronization should occur nearly instantaneously once PLL lock is regained. Current limits should ensure that overcurrent protective functions do not operate during PLL loss of synchronism conditions.

DC Reverse Current Protection

Inverters have anti-parallel diodes across the power electronic switches (insulated-gate bipolar transistors (IGBTs)) to mitigate voltage spikes during switching. These diodes are used to allow current through the inductive load to go to zero (current through an inductor cannot change instantly otherwise transient voltage spikes occur), and a small amount of reverse current may flow during normal switching operations. However, this amount is relatively low. When ac voltage is higher than dc bus voltage during transient ac overvoltage conditions, higher amounts of dc reverse current may flow. However, the dc reverse current protection is typically used for the following purposes:

⁸⁴ See the Canyon 2 Fire disturbance report for more details. Available:

http://www.nerc.com/pa/rrm/ea/October%202017%20Canyon%20Fire%20Disturbance%20Report/900_MW_Solar_Photovoltaic_Resource_Interruption_Disturbance_Report.pdf.

- **Short Circuit Protection:** protection against short circuit faults (due to component failures) on the dc side that can lead to risk of fire, electric shock, or injury to personnel
- **Inverter Back Feed Current Onto the Array:** protection against short circuits in the PV array that can cause back feed currents from the inverter

UL Std. 1741⁸⁵ includes a testing requirement that reverse current should not exceed the manufacturer's specification for maximum reverse current. The maximum dc reverse current specification here depends on the inverter and is specified by the manufacturer. However, it does not specify a maximum duration and provides sufficient design flexibility that it should be feasible for inverters to not trip due to reverse current during transient ac over-voltages. According to a number of equipment manufacturers, current in the reverse direction is generally not damaging to the inverters, the dc power source, nor the collector systems. Rather, detection and protection of this dc reverse current is used to protect the PV modules, particularly for local faults in the collector system. An inverse time characteristic could be used for dc reverse current protection. Instantaneous tripping should not be used unless current exceeds the dc reverse current rating of the inverter or PV modules. Therefore, inverter reverse current protection should be coordinated with the PV module limitations and operate for dc short circuits yet not operate for transient ac overvoltage conditions caused by external BPS faults. Any modifications to protection settings should ensure that protection operates to ensure equipment and personnel safety.

Successive Voltage Dips

Successive voltage dips may occur on the BPS for a number of reasons such as reclosing into permanent faults or environmental conditions (e.g., lightning storms, wildfires). [Figure 4.8](#) shows multiple unsuccessful transmission line reclosing attempts into a permanent fault.⁸⁶ Voltage continued to rise after each reclosing attempt as inverters tripped off-line. From a BPS performance perspective, inverter-based resources should ride through successive fault events to the possible extent to provide BPS voltage support. However, if the resource is subjected to successive faults in a period of time that necessitates tripping to protect from the cumulative effects of those successive faults, the resource may trip to ensure safety and equipment integrity. For example, wind turbines may trip to protect the drivetrain from cumulative torsional stress due to successive faults within a given period of time (mechanical fatigue protection).

Voltage protective relaying/controls of inverter-based resources should be set such that these resources do not trip within the No Trip zone of the PRC-024-2 voltage ride-through curve, which represents the cumulative voltage duration at the POI. Existing resources that were not designed with this performance characteristic may need to consider the most effective upgrade to ensure ride-through capability. In the event that an inverter-based resource cannot ride through successive fault events, the GO should document and communicate these limitations to the PC and TP, similar to other equipment limitations for a single ride-through event.

⁸⁵ UL 1741, "Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources". Available: https://standardscatalog.ul.com/standards/en/standard_1741_2.

⁸⁶ Note that some protection system philosophies may not result in as many attempted recloses as shown in the figure. However, this is an actual event captured using a digital fault recorder near multiple inverter-based resources.

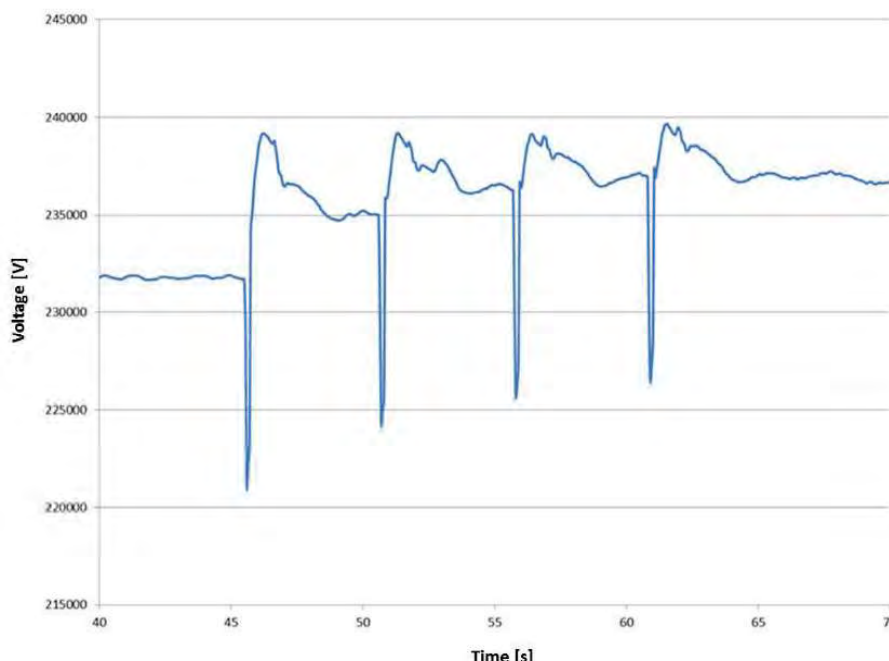


Figure 4.8: Successive Fault Events Example – Inverter Tripping Impacts on Voltage

Inverters have traditionally used a protection feature that operates⁸⁷ if the number of ride-through events⁸⁸ exceeds a predetermined threshold programmed into the inverter within a specified period of time (e.g., 24 hours). This has been used in the past to detect internal failures or faults within the inverter and shut down for any potential equipment malfunction.⁸⁹ Inverters should shut down and trip with no intentional time delay for internal failures or faults to ensure equipment and personnel safety within the plant. However, this function should not be used for taking protective operation based on external faults.

An inverter needs to maintain adequate energy to the power supply used for the inverter controls. These power supplies need a specified amount of energy to continue running. Inverters use some form of capacitance (e.g., a large capacitor) to support the dc bus voltage during low voltage conditions. The capacitor has a given charging time constant that is required to recharge the capacitor to prepare for the next event. If the time between successive events is too short, the energy supply may fall below acceptable levels for the inverter to reliably operate. The dc bus capacitor should be sized such that the inverter-based resource can successfully ride through any number of successive fault events on the system spaced apart by four seconds.

These protection actions were a contributor to the South Australia disturbance that occurred on September 28, 2016.⁹⁰ However, the Australian Energy Market Operator was unaware of this protection feature because it is not represented in the simulation models used for system planning and operating studies, and limited industry experience with successive low voltage conditions.

Since it is rare to apply more than two successive events in simulation studies, adding a hard limit in the dynamic models may not be warranted. Also, the number of allowed successive events is not typically easy for

⁸⁷ These actions typically either trip the resources, cease energization of the resource, or reduce output of the resource.

⁸⁸ Ride through events are simply events in which the voltage falls below a specified threshold programmed in the inverter.

⁸⁹ Synchronous machines commonly use differential protection to detect faults within the generator and trips to lock out the machine. The differential scheme only operates for faults within the generator and not for faults external to the generator. The same concept should apply to inverter-based resources regarding internal and external faults.

⁹⁰ See the disturbance report developed by the Australian Energy Market Operator (AEMO). Available: [HERE](#).

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manufacturers to define. The limit could be driven by complex factors that would be difficult to model or fall into timeframes outside normal stability simulations. Programming a simple limit into the model may not reflect reality. If this were to be explored, it could be added to the voltage ride-through model *lhvrt* that usually accompanies the REGC/REEC models.

Chapter 5: IEEE Std. 1547 and UL Std. 1741

This chapter provides a brief overview of UL Std. 1741 *Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources* and IEEE Std. 1547-2003 (and the new IEEE Std. 1547-2018) *Standard for Interconnecting Distributed Resources with Electric Power Systems*. It also discusses the relationship between the two standards and considerations that should be made when interconnecting inverter-based resources to the BPS related to these two standards.

Description of IEEE Std. 1547

IEEE Std. 1547-2018 “establishes criteria and requirements for interconnection of distributed energy resources with electric power systems (EPS) and associated interfaces.”⁹¹ IEEE Std. 1547 defines and quantifies a set of technical requirements for interconnection of DERs with the local EPS. The recently published IEEE Std. 1547-2018⁹² revisions to IEEE Std. 1547-2003 made substantial changes to the original standard requirements including ride through, active power-frequency control, reactive power-voltage control, etc. These requirements in IEEE Std. 1547-2018 are more aligned with requirements on the BPS in some aspects. The proposed revisions were approved by the IEEE Standards Association on March 15, 2018, and were published and available as of April 6, 2018. Regardless, IEEE Std. 1547 is a standard relevant only to distribution connected resources, not resources connected to the BPS. Inverter manufacturers may need to meet the requirements of IEEE Std. 1547 for distribution connected resources, but BES resources will be subject to NERC Reliability Standards. Individual utilities or regions may also have facility connection requirements or interconnection agreements that specify performance for certain issues of interest.

Key Takeaway:

IEEE Std. 1547 is a standard relevant only to distribution connected resources, not resources connected to the BPS. Inverter manufacturers may need to meet the requirements of IEEE Std. 1547 for distribution connected resources, but BES resources will be subject to NERC Reliability Standards.

TSPs who have LGIAs/SGIAs that contain language referencing any technical standards such as IEEE Std. 1547 should fully understand the distinctions between technical requirements for distribution-connected resources and those for BPS-connected resources. Entities should ensure there are no conflicting requirements between the referenced standards and the NERC Reliability Standards to ensure alignment and minimize any potential reliability issues. Key points in IEEE Std. 1547 that may not be appropriate for BPS interconnections include the following:

- Enter service and return to service after trip conditions
- Considerations for grounding and ground fault protection
- Cease to energize application at the distribution system
- Reactive power capability and controls for DER and BPS-connected facilities
- Area fault and open phase conditions between BPS and distribution protection systems.
- Use of “must trip” requirements for DER resources as compared with the “may trip” mentality of NERC PRC-024-2.
- Unintentional and intentional islanding requirements and usage

⁹¹ IEEE Std 1547-2018, “Standard for Interconnecting Distributed Energy Resources with Associated Electric Power System Interfaces”, April 6, 2018.

⁹² <https://standards.ieee.org/findstds/standard/1547-2018.html>

Description of UL Std. 1741

UL Std. 1741 sets requirements that “cover inverters, converters, charge controllers, and interconnection system equipment (ISE) intended for use in stand-alone (not grid-connected) or utility-interactive (grid-connected) power systems.” The requirements for utility-interactive equipment “are intended to supplement and be used in conjunction with...IEEE 1547, and...IEEE 1547.1.” The requirements cover products “intended to be installed in accordance with the National Electrical Code, NFPA 70.” The UL Std. 1741 Supplement A (SA) certifies inverters and other utility-connected equipment “for grid support functions” that may be available in “advanced inverters.” The UL Std. 1741 SA testing was designed to test grid-interactive functions that are required in, for example, State of California Electric Tariff Rule 21 (“Rule 21”) made by the California Public Utility Commission (CPUC). “Rule 21 is a Source Requirement Document (SRD) to be used with the UL 1741 SA. SRDs set the specific parameter settings to be used with the test methods of the UL 1741 SA. Other SRDs may also be used with the UL 1741 SA as other markets look to build smart grid functionality into the modernization of their electrical power system.”⁹³

UL Std. 1741 Certification and IEEE Std. 1547

It was brought to the attention of NERC during the Blue Cut Fire analysis that many inverters connected to the BPS are subject to the National Electric Code (NEC) since the majority of solar PV power plants are often not constructed by local electric utilities (that are generally exempt from NEC by their state jurisdiction). There were concerns that the NEC requires a UL listing and that the UL listing requires that the inverter be compliant with IEEE Std. 1547. Subsequent to that initial finding, NERC coordinated with UL Std. 1741 and IEEE Std. 1547 representatives to further understand this relationship and determined the following.

The majority of solar development owners are not electric utilities and therefore are subject to the NEC. The NEC requires that the inverters they install have UL 1741 certification. To obtain UL 1741 certification, an inverter must pass one of the UL 1741 certification tests. These certification tests are based on distribution connection requirements. Even though the inverter must pass these distribution requirement based tests, it does not preclude the inverter from being able to be configured, via user settings, to a different configuration that would meet BPS connection requirements. This could be done via different profiles selected in the inverter configuration setup, such as country codes, or other methods. As long as the inverter is configured appropriately for the application in which it is installed, the UL 1741 certification requirement should not be an issue.

NERC does not require a third-party certification, such as UL, to assure the inverter can meet BES requirements. However, if an inverter manufacturer wished to obtain a third party certification that their inverter meets BES requirements, such as PRC-024-2, they are free to supply PRC-024-2 as a Source Requirements Document to establish a UL PRC-024-2 certification test.

Key Takeaway:

Inverter manufacturers have acquired UL 1741 certification. This testing does not preclude the inverter from being tested and certified to configurable settings that meet BES connection requirements. As long as the inverter is configured appropriately for the application in which it is installed, the UL 1741 certification requirement should not be an issue. If an inverter manufacturer wishes to obtain a third party certification that their inverter meets BES requirements (e.g., PRC-024-2), they are free to supply PRC-024-2 as a SRD to establish a UL PRC-024-2 certification test.

⁹³ UL 1741-SA, “Supplement SA – Grid Support Utility Interactive Inverters and Converters”, 9/16/2016, p. 1.
Available: https://standardscatalog.ul.com/standards/en/standard_1741_2

Chapter 6: Measurement Data and Performance Monitoring

Large power system disturbances, and the response of generating resources to these disturbances, include many discrete events in rapid succession. Various measurement and monitoring technologies are used to capture the performance of these resources. Sequence of events recording (SER) data provides information regarding what occurred and when each action was taken. Digital fault recorder (DFR) and dynamic disturbance recorder (DDR) data captures the dynamic response of the resource at the Point of Measurement (POM) and within the plant. Other plant-level controller triggers and the plant Supervisory Control and Data Acquisition (SCADA) data are valuable in understanding the longer-term trends in performance. This chapter describes the various types of measurement technologies and data sources used for performance monitoring of inverter-based resources connected to the BPS.

Measurement Technologies

A wide array of measurement technologies can be used to monitor the performance of inverter-based resources. These data sources may include, but are not limited to the following:

- **Supervisory Control and Data Acquisition (SCADA) Data:**
 - Generally one to four second scan rate
 - Can capture steady-state performance characteristics (e.g., active-power frequency droop, reactive-power voltage droop) and static set point values
 - Likely will miss any dynamic response such as momentary cessation
 - Can be used to capture general tripping behavior
- **Dynamic Disturbance Recorder (DDR) Data:**
 - Data resolution of 30–60 samples per second
 - Time-synchronized positive sequence phasor⁹⁴ data
 - Useful for comparing dynamic response from multiple plants
 - Useful for corroborating with other BPS events during a disturbance due to time synchronization records voltage and current phasors (and therefore active and reactive power) at POM of inverter-based resource
- **Digital Fault Recorder (DFR) Data:**
 - High resolution (> 960 samples per second), point-on-wave (POW) three-phase measurement data
 - Most effective measurement for capturing momentary cessation and fast dynamics from overall plant
 - POW can be converted to sequence data for comparison with PMU data
- **Sequence of Events Recording (SER) Data:**
 - Internal time resolution of sub-millisecond

⁹⁴ This data is typically provided from a Phasor Measurement Unit (PMU) or other device that has PMU capability. See: *IEEE Standard for Synchrophasor Measurements for Power Systems*, IEEE Std. C37.118.1-2011. [Online]. Available: <https://standards.ieee.org/findstds/standard/C37.118.1-2011.html>.

Chapter 6: Measurement Data and Performance Monitoring

- Synchronized to time reference, captures discrete changes in plant characteristics (control modes, relay targets, alarms, tripping, etc.) and statuses
 - May be integrated into various devices within the inverter-based resource or in the plant-level controller
 - Typically memory-based storage of event logs that should be extracted on a periodic basis to avoid data loss
- **Individual Inverter Data:**
 - Very high resolution data within the inverter
 - Inverter fault codes
 - Triggered dynamic response files
 - Change of operating mode
 - Inverter control and feedback signals
 - Typically proprietary data extracted from the inverter and supplied to equipment manufacturer

Figure 6.1 shows plant-level three-phase POW data capturing momentary cessation. From this data, one can deduce that at least most of the inverters entered momentary cessation (reduction in current output to near zero) and that there is a delay upon recovery from momentary cessation (not recommended). This can be observed in the delayed recovery of current even though voltage has recovered. **Figure 6.2** shows RMS data for another event where a DFR captured momentary cessation. This data is useful in understanding how the inverter responds to a BPS event in terms of active and reactive power output. It is clear that the inverter immediately provides reactive current (reactive power) while delaying the recovery of active current (active power) (not recommended) followed by a clear ramp rate response back to predisturbance output.

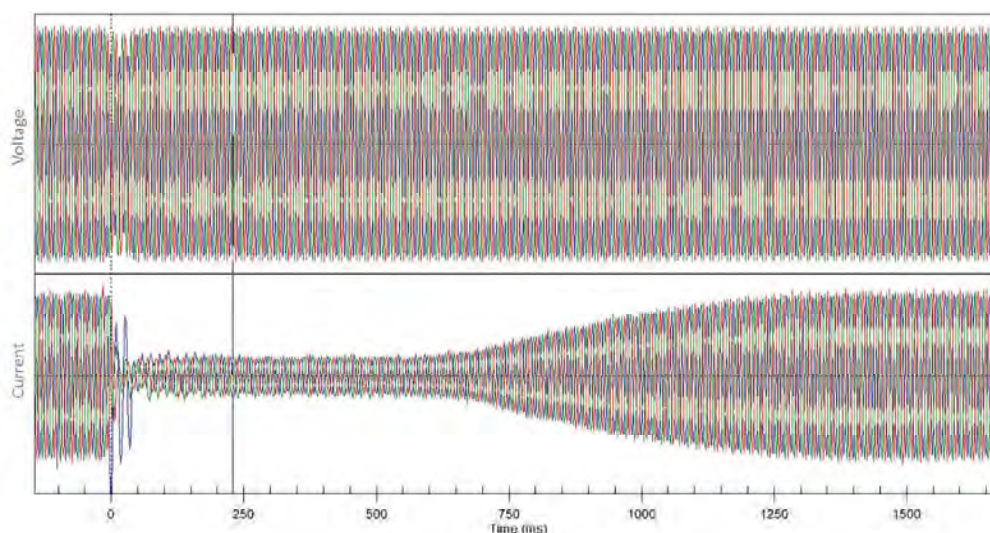


Figure 6.1: DFR POW Data Capturing Momentary Cessation Event

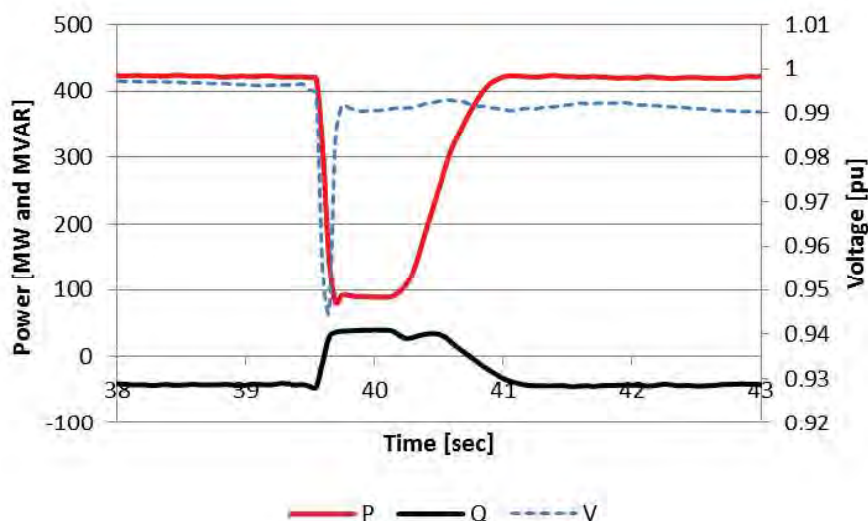


Figure 6.2: DFR RMS Data Capturing Momentary Cessation Events

Measurement and Monitoring Data

Measurements are taken all throughout the inverter-based resource from the individual inverters all the way to the POM and POI by using the technologies described above. The types of data, resolution of that data, and retention of that data are provided in [Table 6.1](#). This table is not intended to be all-inclusive; rather, it provides an overview of the types of measurements.

Data Time Synchronization

All data within an inverter-based resource should be time synchronized to a common reference time (e.g., Coordinated Universal Time (UTC)).⁹⁵ This makes any analysis of plant behavior, including inverter actions and dynamic response, more effective (and even possible in some situations). If the plant has a PMU (or PMU-capable device) that is synchronized to GPS⁹⁶ and using a GPS receiver, GPS clock, and time distribution (typically over IRIG-B), then synchronization is fairly straightforward. The other measurement devices within the substation can also be time synchronized to that common reference time that is then also referenced to the same time used by the TSP, RC, and other entities. This ensures that the “plant time” is accurate and synchronized to UTC. Distribution of this time to other components (e.g., the inverters) can be done using various methods. Network Time Protocol (NTP)⁹⁷ is one timing option supported by many devices, but this protocol is not typically able to meet 1 ms accuracy for every time stamp. IEEE Std. 1588 Precision Time Protocol (PTP)⁹⁸ can achieve a higher accuracy over a network and may be a useful option moving forward. Regardless, timing within the plant should have as best an accuracy and resolution as possible.

Data Retention

Data should be retained to support event analysis, improve plant performance, and possibly perform dynamic model verification. [Table 6.1](#) shows the recommended retention of the different types of data within an inverter-based resource. GOs and GOPs should store any and all data available for a given disturbance if requested by the TP, PC, TSP, RC, or BA. This event data should be saved per [Table 6.1](#) so that it is available at a later time for forensic analysis. This includes collecting all locally stored data as well as data streamed to a centralized location. The requesting entities should develop procedures and processes for requesting this data effectively from the

⁹⁵ <https://www.nhc.noaa.gov/aboututc.shtml>

⁹⁶ <https://www.gps.gov/>

⁹⁷ <https://www.cisco.com/c/en/us/support/docs/availability/high-availability/19643-ntpm.html>

⁹⁸ <https://www.nist.gov/el/intelligent-systems-division-73500/ieee-1588>

GO/GOP. This process and expectations for data collection should be discussed between these entities ahead of time.

Latching of Inverter Events

During BPS events, the magnitude of the disturbance, as seen at the terminals of each inverter, will vary within a PV plant based on system impedance (transmission line, plant HV transformer, collection system impedance, and LV transformer). Hence, inverter response may also vary slightly within a plant. Usually BPS disturbances are short-lived (e.g., no more than a few electrical cycles) before system conditions return to a new steady state. Depending on the data collection capability of plant data historians from the inverters, BPS events may or may not be captured which makes it difficult to determine which inverters within a PV plant experienced the BPS event.

To address this issue, inverters should have a specific data tag defined for each type of BPS event (e.g., LVRT, HVRT, FRT), and these tags should be part of the data transmitted to the plant data historian. During a BPS event, these data tags should be latched high within the inverter and should remain high for at least three to five times the data collection period, even after the BPS returns to nominal and allows for the plant data historian to capture the events. Using the latching concept for tag information, the plant data historian will be able to store the information, and the user can then identify which inverters experienced the BPS events.

Table 6.1: Recommended Measurement Data and Retention

Data Type	Measurement/Data Points	Resolution	Retention
Plant Control Settings and Static Values	This data includes the settings, set points, and other static information that should be captured about the plant. This information should be captured at a resolution sufficient to identify any changes (i.e., when settings are changed). Data points include the following: • Active power/frequency control mode of operation • Reactive power (current)/voltage mode of operation • Individual inverter mode of operation (e.g., reactive, voltage, or power factor) • Digital control system gains, time constants, limiters, etc.	Static, as changed	One year
Plant SCADA Data	The plant SCADA system is often a lower resolution repository of information that should include, at a minimum, the following data points: • All breaker statuses • Shunt (dynamic or static) reactive compensation statuses • Shunt (dynamic or static) reactive power output • Substation transformer status • Substation transformer tap position • Time synchronization (e.g., GPS status word) • Medium voltage collector system statuses • Individual inverter statuses • External control signals from the BA, RTO, RC, etc. • External automatic generation control signals • Active and reactive power commands sent to individual inverters • Active and reactive power output of individual inverters • Overall plant active and reactive power output • Point of Measurement voltage and medium voltage collector system voltages	One to two seconds	One year

Chapter 6: Measurement Data and Performance Monitoring

Table 6.1: Recommended Measurement Data and Retention

Data Type	Measurement/Data Points	Resolution	Retention
Sequence of Events Recording (SER) Data	SER devices should be sized to capture and store hundreds or thousands of event records and logs. SER event records can be triggered for many different reasons but include the following at a high level: • Event date/time stamp (synchronized to common reference (e.g., Coordinated Universal Time (UTC))) • Event type (status changes, synchronization status, configuration change, etc.) • Description of action • Sequence number (for potential overwriting)	≤ one millisecond	90 days
Digital Fault Recording (DFR) Data	This data should be captured for at least the plant-level (e.g., at the Point of Measurement) response to BPS events. It is typically high resolution (kHz) point-on-wave data and triggered based on configured settings. Data points should include the following: • Bus voltage phase quantities • Bus frequency (as measured/calculated by the recording device) • Current phase quantities • Calculated active and reactive power output • Dynamic reactive element voltage, frequency, current, and power output	> 960 samples per second, triggered	90 days
Dynamic Disturbance Recorder (DDR) Data	A DDR (e.g., a PMU or digital relay with this capability) should capture the plant-level response during normal and disturbance events. This data should be captured continuously at the Point of Measurement and can be used for multiple purposes including event analysis and disturbance-based model verification. Data points should include the following: • Bus voltage phasor (phase quantities and positive sequence) • Bus frequency • Current phasor (phase quantities and positive sequence) • Calculated active and reactive power output	> 30 samples per second, continuous	One year

Chapter 6: Measurement Data and Performance Monitoring

Table 6.1: Recommended Measurement Data and Retention

Data Type	Measurement/Data Points	Resolution	Retention
Inverter Fault Codes and Dynamic Recordings	The individual inverters are highly complex pieces of equipment with a vast amount of information continually being calculated and stored within them. The data from inverters is very high resolution. At a high level, for grid BPS faults, the following information should be available from the inverters for analysis by the GO: • All major and minor fault codes • All fault and alarm status words • Change of operating mode ○ High and low voltage fault ride through ○ High and low frequency ride through ○ Momentary cessation (if applicable) ○ PLL loss of synchronism • dc current and voltage • ac phase currents and voltage • Pulse width modulation index • Control system command values, reference values, and feedback signals	Many kHz	90 days

Chapter 7: Other Topics for Consideration

Inverter-based technology continues to evolve, and the performance capabilities of these resources connected to the BPS also continue to improve. There are other considerations and trends with inverter-based resources that are described briefly in this chapter. These topics are covered to acknowledge the existing or growing importance of inverter-based resources as their penetration continues to increase.

Controls Interactions and Controls Instability

Inter-plant coordination is increasingly important as the penetration of inverter-based resources continues to grow. When multiple resources attempt to control the same location on the BPS (e.g., controlling voltage at the same POM, or two or more POMs in close electrical proximity), their control systems need to be coordinated with one another. If not, this could result in reactive power output imbalance, circular reactive power flows, controls overshoot, voltage control hunting, or unstable oscillations. The inverter and plant-level controls (e.g., deadbands, response times, control gains) can interact with each other unless properly coordinated. **Figure 7.1** shows an example of two inverter-based resource control systems interacting with each other; this interaction caused abnormal oscillatory behavior from both resources. These examples exist throughout North America and are dealt with during the interconnection study process, in the transmission planning horizon, and when they unknowingly occur on the BPS.

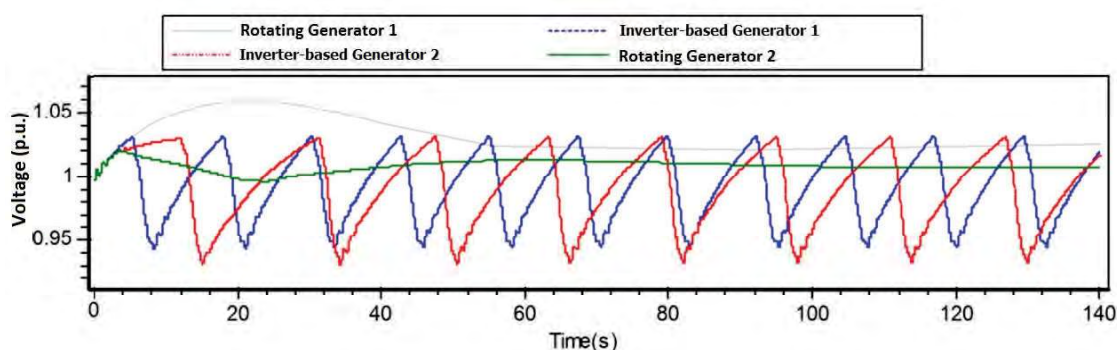


Figure 7.1: Inverter-Based Resource Controls Interactions

Coordination issues should be evaluated in the interconnection process prior to connection of these resources to the BPS. It is common for inverter-based resources to be connected very close to each other, often at the same POM. For example, phases of wind or solar PV projects may connect to the same BPS bus or daisy-chain the connections to each other. As each phase is added, controls should be evaluated and updated to ensure stable operation. Control systems for a single plant connected at one location are different than control systems that coordinate or share between resources. TPs and PCs should maintain up-to-date models and data on generator control settings and ensure sufficient studies are performed during the planning process. Additionally, TPs and PCs could work with entities in other areas to evaluate potential issues related to control interactions. Solutions are often location-specific but, at a high level, some solutions that can be used to coordinate controls may include the following:

- Use of reactive droop to share responsibility of reactive power output for changes in POM voltage
- Tuning of response times, deadbands, and controller gains to ensure stable dynamic response
- Additional features or control strategies for specific operating conditions or topologies
- Master-slave or other control systems for resources in very close electrical proximity

Chapter 7: Other Topics for Consideration

The changing nature of the electric grid and the growing complexity of control systems can also impact the performance of inverter-based resources and should be studied regularly to ensure reliable operation of the BPS. An example of these changes is the continued reduction of short circuit levels in areas of high penetration of inverter-based resources. **Figure 7.2** shows a wind instability event that occurred under low short circuit strength conditions.⁹⁹ An operating state not planned for (due to forced outage) caused two Type 4 wind power plants (300 MW total) to enter into negative damping oscillations near 3.5 Hz. The short circuit strength was significantly reduced by the outage, and the instability was not associated with any fault or switching on the system at the time the oscillation began. The instability was likely due to ramping of the wind power resource after the switching action occurred earlier that day.

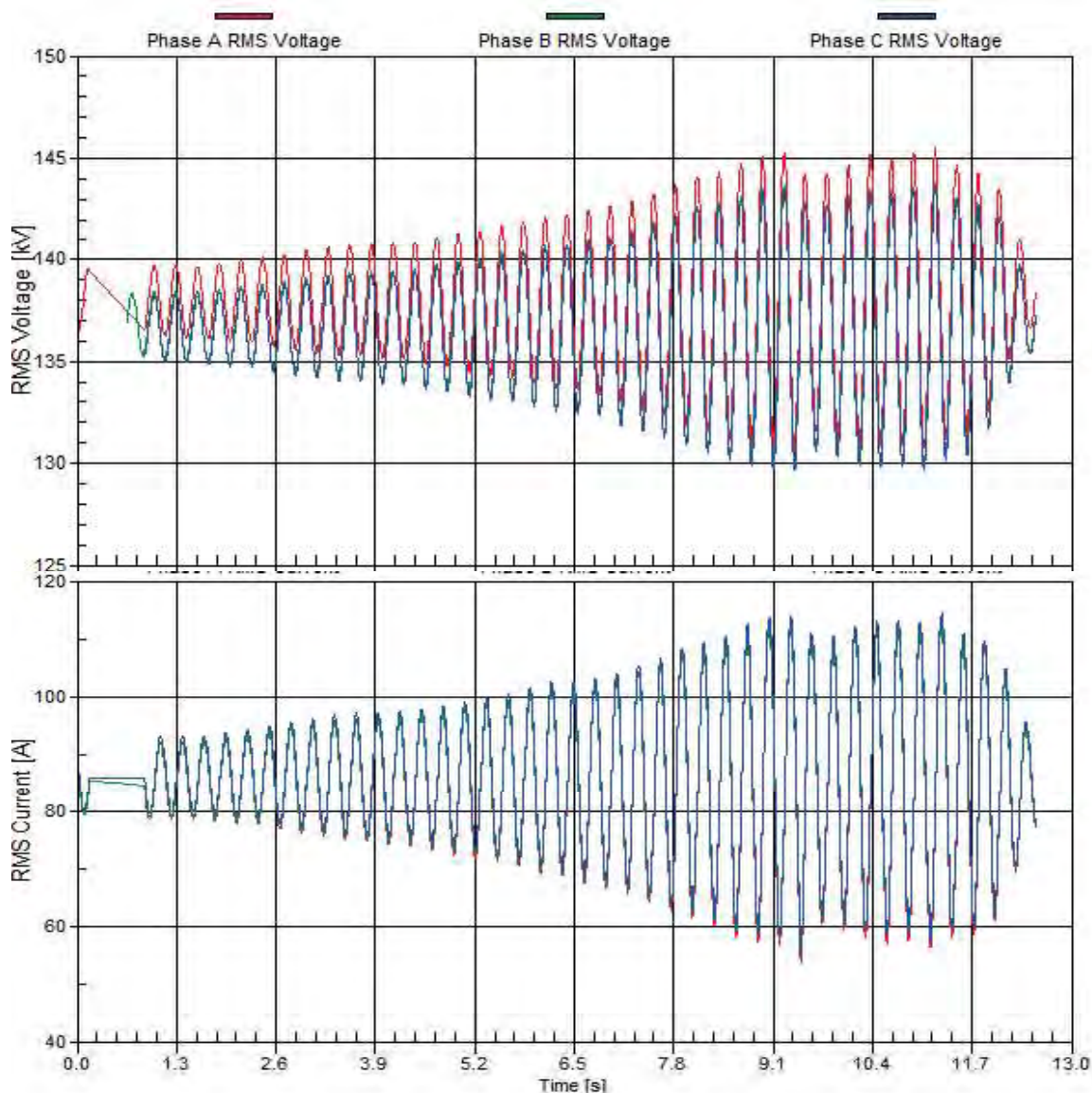


Figure 7.2: Wind Power Plant Controls Instability under Low Short Circuit Strength

⁹⁹ Refer to the NERC Reliability Guideline on *Integrating Inverter-Based Resources into Low Short Circuit Strength Systems* for more information. Available: https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Item_4a_Integrating%20Inverter-Based_Resources_into_Low_Short_Circuit_Strength_Systems_-_2017-11-08-FINAL.pdf.

Dispatchability

Many inverter-based resources today are allowed to deliver energy to the BPS as environmental or facility conditions warrant. Due to commonly applied economic drivers, these facilities generally do not receive dispatch signals directly from TOPs or BAs. As the penetration of inverter-based resources increases, the ability of system operators to increase or decrease active and reactive power output through direct control will become more important for reliability issues occurring on the BPS. To maintain grid reliability and balance generation and load, system operators will need direct observability and control for dispatching and scheduling these BPS-connected resources.

The following plant operational data should be available to the TOP or BA either continuously or as requested:

- Plant MW output
- Plant MVAR output
- Plant POI/POM terminal voltage
- Reactive device status (e.g., LTC, shunts, dynamic reactive devices)
- Maximum available active and reactive power
- MW control set point with feedback
- Number/percentage of inverters producing power
- Number/percentage of inverters available
- Number/percentage of inverters experiencing localized curtailment (e.g., high speed cutout, low temperature cutout, momentary cessation, high voltage, unit protection)
- Plant ramp rate settings and capability
- Environmental criteria that could impact energy production (e.g., wind speed, ambient temperature, solar incidence)

Operation of inverter-based resources through automatic control systems external to plant controllers should also be considered. Although de-energizing a facility through remote opening of a SCADA-controlled switching device at the POI is generally available as a last resort, this is not always an optimal solution to many problems that may arise on the BPS. This may also be detrimental to the operation of inverter-based resource facilities. Inverter-based resources should be capable of receiving dispatch signals from the BA via SCADA control. The ability of a system operator to curtail or return from curtailment in a controlled and expedited manner is beneficial to overall BPS reliability. TSPs may consider revisions to their interconnection agreements to require dispatchability of inverter-based resources.

Grid Forming Inverter Concept

An inverter used in renewable energy applications is almost always a voltage source inverter in that a dc voltage (usually held by a capacitor) is converted to an ac voltage via switching of the IGBTs in the inverter. This is different from a current source inverter, largely used in motor drive applications, where the dc side energy is held in an inductor. However, traditional inverter control for renewable energy sources connected to the BPS transform the voltage source inverter to a virtual current source (as seen by the power system) by means of strict control on the current output. As a result of being a strict virtual current source, in order to inject current into the power system, the inverter controls need to “know” the load level. Thus, most of the inverters connected to the BPS are considered “grid following,” which implies that they rely on a strong grid for synchronizing their PLL and thus follow the grid behavior by responding to the measured quantities. Often, this strong grid is considered an infinite

Chapter 7: Other Topics for Consideration

bus with high inertia and high short circuit strength. Some further classify these grid following devices as “grid supportive,” which may be either a voltage or current source inverter that have control capabilities to support the balances of grid voltage and frequency.

On the other hand “grid forming” inverters have unique characteristics that are particularly important for high penetration inverter-based resource systems. These inverters control the voltage source converter as a voltage source and can thus establish and control grid voltage and frequency independent of the status of the grid. The current output from the inverter is then automatically determined by the grid until the current hits the inverter maximum current limit. As in, rather than relying on the strong grid voltage to synchronize, they can form their own synchronism with the grid and actually control the grid voltage and phase through their internal controls. At a high level, the aim of a grid forming inverter is to replicate the behavior of the infinite bus network (i.e., maintain constant voltage and frequency as long as it can without violating its current limits). These type of inverters are capable of blackstart since they can generate their own voltage source, and they do not rely on a PLL to start producing a sinusoidal voltage at their terminals. They may still have a PLL to keep track of inverter output and use that information in their control systems; however, the PLL is not required for starting the inverter-based resource.

A future BPS could consist of some grid forming inverters and many grid following inverters. One critical question for future high penetration inverter-based resource systems is how the grid forming inverters synchronize with each other. Grid forming inverters are able to start up on their own without support from the grid. Grid following inverters track the grid that could be formed by the grid forming inverter (very similar to synchronous machine theory). Under these very low short circuit strength conditions, special care may be needed to ensure stable operation between the grid following inverters. Additional grid forming inverters may be added to the BPS, however, they need to ensure that their output voltage magnitude and phase at the inverter are the same as the grid-side of the inverter circuit breaker where it connects for proper synchronization. Grid forming inverters could use a PLL to track the grid in grid supportive mode for a short time, synchronize, and then return to grid forming mode once synchronized. Future work is needed in this area to develop operating plans.

Grid forming inverter technology enables blackstart capability from inverter-based resources. Dispatchable inverter-based resources could be capable of operating as a blackstart resource, when utilizing inverters operating in grid forming mode, since they are able to generate their own voltage waveform and are not reliant on the BPS to synchronize. Blackstart service from BPS-connected inverter-based resources should be implemented in coordination with the TOP, RC, BA, etc.

The implications and impacts these controls could have on synchronous machines also need to be more clearly understood, particularly during the transition a conventional power system to a very high penetration inverter-based power system. NERC will continue to coordinate with national laboratories, researchers, academia, and registered entities testing these types of inverters (e.g., for microgrid applications and islanded systems) to expand industry knowledge in this area.

Appendix A: Recommended Performance Specifications

The following specifications are recommended for inverter-based resources and are a concise description of the technical material presented throughout the guideline. The following sub-sections address the following:

- General requirements for inverter-based resources
- Momentary cessation mitigation and behavior
- Fault ride-through, and frequency and voltage protection philosophies
- Steady-state and dynamic active power-frequency control
- Steady-state and dynamic reactive power (current)-voltage control

0. General Requirements

- 0.1. The dynamic models used to represent inverter-based resources should accurately capture the small and large disturbance aspects of the resource. Accurate models should be used in the interconnection study process, per NERC Reliability Standard FAC-002-2, and model verification should be performed, per NERC Reliability Standards MOD-026-1 and MOD-027-1. Accurate steady-state, dynamic, and short circuit models should be provided to the Planning Coordinator, per NERC Reliability Standard MOD-032-1, based on the data reporting requirements.
- 0.2. Inverter-based resources should be capable of receiving dispatch signals from the BA via SCADA control.
- 0.3. The following information should be available to the TOP or BA, either continuously or as needed:
 - Plant MW output
 - Plant MVAR output
 - Plant POI/POM terminal voltage
 - Reactive device status (LTC, shunts, dynamic reactive devices, etc.)
 - Maximum available active and reactive power
 - MW control set point with feedback
 - Number/percentage of inverters producing power
 - Number/percentage of inverters available
 - Number/percentage of inverters experiencing localized curtailment (e.g., high speed cutout, low temperature cutout, momentary cessation, high voltage, unit protection)
 - Plant ramp rate settings and capability
 - Environmental criteria that could impact energy production (e.g., wind speed, ambient temperature, solar incidence)

1. Momentary Cessation

- 1.1. Momentary cessation should not be used within the voltage and frequency ride through curves specified in PRC-024-2. Use of momentary cessation is not considered “ride through” within the “No Trip” zone of these curves.

Appendix A: Recommended Performance Specifications

- 1.2. Exception: Use of momentary cessation may be needed under low short circuit strength conditions in rare situations. Any use of momentary cessation should be studied during the interconnection process and approved on a case-by-case basis by the TP and PC.
- 1.3. If the use of momentary cessation cannot be eliminated for some existing resources due to equipment limitations, the GO should document and communicate this “to its PC and TP within 30 calendar days” as an equipment limitation, per PRC-024-2 Requirement R3.
- 1.4. If the use of momentary cessation cannot be eliminated for some existing resources due to equipment limitations, the following setting philosophies should be used:
 - 1.4.1. The momentary cessation low voltage threshold should be reduced to the lowest value possible.
 - 1.4.2. The momentary cessation high voltage threshold should be set no lower than the PRC-024-2 voltage ride-through curve levels.
 - 1.4.3. The recovery delay (time between voltage recovery and start of current injection) should be set to the shortest value possible (e.g., on the order of one–three electrical cycles).
 - 1.4.4. The active power ramp rate upon return from momentary cessation should be increased to at least 100 percent per second (e.g., return to predisturbance active current injection within one second). *An exception to this is if the generation interconnection studies, or direction from the Transmission Planner or Planning Coordinator, specify a slower ramp rate (i.e., low short circuit strength areas).
 - 1.4.5. Active current injection upon restoration from momentary cessation should not be impeded by a plant-level controller or other outer-loop controls that could inhibit the inverter returning to predisturbance active current injection.

2. Fault Ride-Through and Protection

- 2.1. The PRC-024-2 voltage and frequency ride-through curves specify a “No Trip Zone” for protection system (and control system) settings. Outside of the “No Trip Zone” should not be interpreted as a “Must Trip Zone.” Rather, it should be considered a “May Trip Zone.”
- 2.2. Inverter protective relaying or controls should only operate based on physical equipment limitations or specifications. Protection functions should be set as wide as possible while ensuring equipment safety and reliability.
- 2.3. Any tripping on calculated frequency should be based on an accurately calculated and filtered frequency measurement over a time window (e.g., around six cycles) and should not use an instantaneously calculated value.
- 2.4. Inverter overvoltage protection should be based on the performance specified in [Figure A.1](#) and [Table A.1](#). Review the section on recommended overvoltage protection for more details.

Appendix A: Recommended Performance Specifications

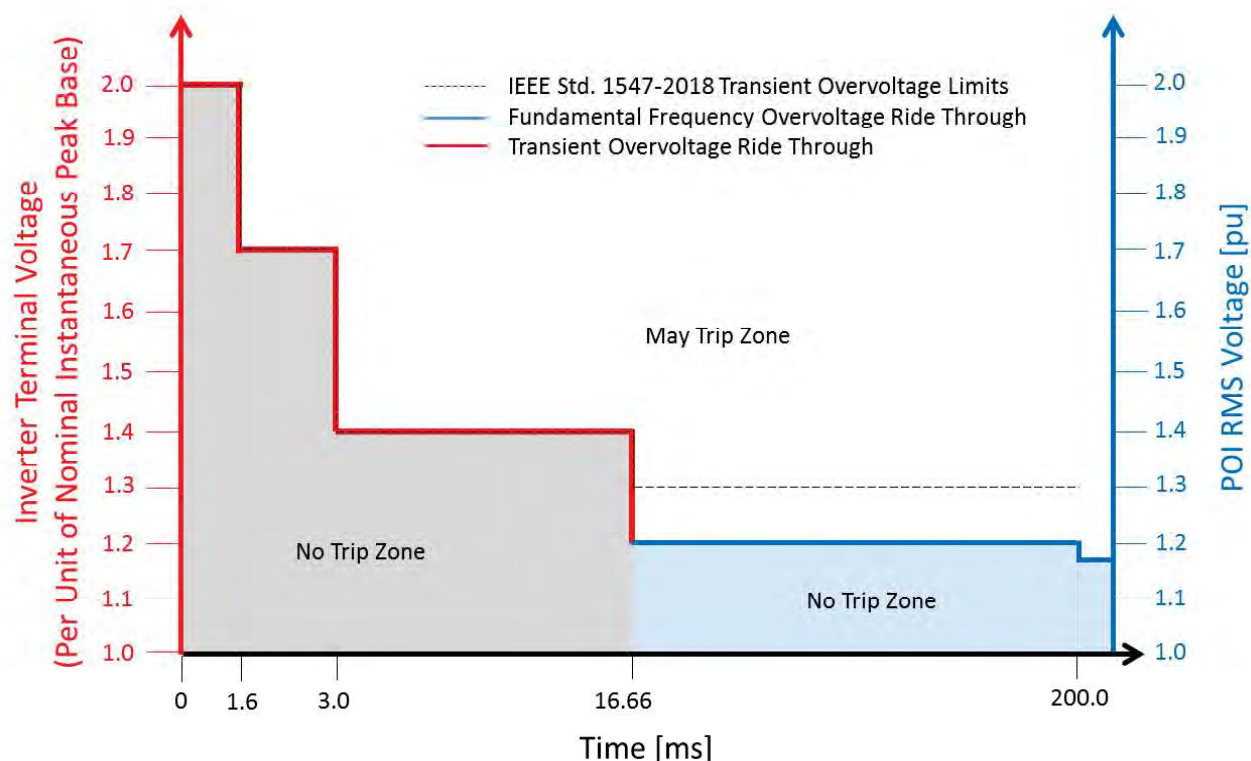


Figure A.1: Recommended Overvoltage Ride-Through Curve

Table A.1: Recommended Overvoltage Ride-Through Characteristic		
Curve Section	Voltage (pu)	Time (sec)
Instantaneous Inverter Terminal Voltage	≥ 2.000	Instantaneous Trip Acceptable
	≥ 1.700	0.0016
	≥ 1.400	0.003
Fundamental Frequency RMS POI Voltage	≥ 1.200	0.0167
	≥ 1.175	0.20
	≥ 1.150	0.50
	≥ 1.100	1.00

2.5. If the resource is subjected to successive faults in a period of time that necessitates tripping to protect from the cumulative effects of those successive faults, the resource may trip to ensure safety and equipment integrity.

Appendix A: Recommended Performance Specifications

- 2.6. Dc reverse current protection should be coordinated with the PV module ratings and set to operate for short circuits on the dc side. Dc reverse current protection should not operate for transient overvoltages or for ac-side faults.
- 2.7. Inverter-based resources connected to the BPS should not use rate-of-change-of-frequency (ROCOF) protection, unless an equipment limitation exists that requires the inverter to trip on high ROCOF. However, in most instances, ROCOF protection should not be used for BPS-connected resources.
- 2.8. Inverter phase lock loop (PLL) loss of synchronism should not cause the inverter to trip or enter momentary cessation within the voltage and frequency ride-through curves of PRC-024-2. Inverters should be capable of riding through temporary loss of synchronism, and regain synchronism, without causing a trip or momentary cessation of the resource.
- 2.9. Any resource that trips off-line should reconnect to the BPS based on the reconnection requirements specified by their BA. BAs should consider the current and future penetration of inverter-based resources, and determine if automatic reconnection is acceptable to maintain reliable performance and generation-load balance.

3. Active Power-Frequency Control

- 3.1. All inverter-based resources should include an operable, functioning governor or equivalent control system that is responsive to changes in frequency while the resource is online (except, possible, during startup or shut down). Resources should respond to frequency excursion events accordingly; however, reserving generation headroom to provide response to underfrequency events is not required.
- 3.2. Frequency should be calculated over a period of time (e.g., three to six cycles), and filtered to take control action on the fundamental frequency component of the calculated signal. Calculated frequency should not be susceptible to spikes caused by phase jumps on the BPS. Frequency should be calculated over a time window (e.g., three to six cycles), and filtered to take action on the fundamental frequency component.
- 3.3. The active power-frequency control system, and overall response of the inverter-based resource (plant), should meet the following performance aspects¹⁰⁰ (see [Figure A.2](#)):
 - 3.3.1. The active power-frequency control system should have an adjustable proportional droop¹⁰¹ characteristic with a default value of five percent. The droop response should include the capability to respond in both the upward (underfrequency) and downward (overfrequency) directions. Frequency droop should be based on the difference between maximum nameplate active power output ($P_{\max}$) and zero output ($P_{\min}$) such that the five percent droop line is always constant for a resource.
 - 3.3.2. If the active power-frequency control system has a deadband, it should be a nonstep¹⁰² deadband¹⁰³ that is adjustable between 0 Hz and the full frequency range of the droop characteristic with a default value not to exceed ± 0.036 Hz.
 - 3.3.3. Inverter-based resources may consider a small hysteresis characteristic where linear droop meets any deadband to reduce dithering of inverter output when operating near the edges of the deadband. The hysteresis range should not exceed ± 0.005 Hz on either side of the deadband. If measurement resolution is not sufficient to measure this frequency, hysteresis should not be used.

¹⁰⁰ The curve for inverter-based battery energy storage systems may include the negative active power quadrant of this curve.

¹⁰¹ The droop should be a permanent value based on $P_{\max}$ (maximum nominal active power output of the plant) and $P_{\min}$ (typically 0 for an inverter based resource). This keeps the proportional droop constant across the full range of operation.

¹⁰² Nonstep deadband is where the change in active power output starts from zero deviation on either side of the deadband.

¹⁰³ Frequency deadband is the range of frequencies in which the unit does not change active power output.

Appendix A: Recommended Performance Specifications

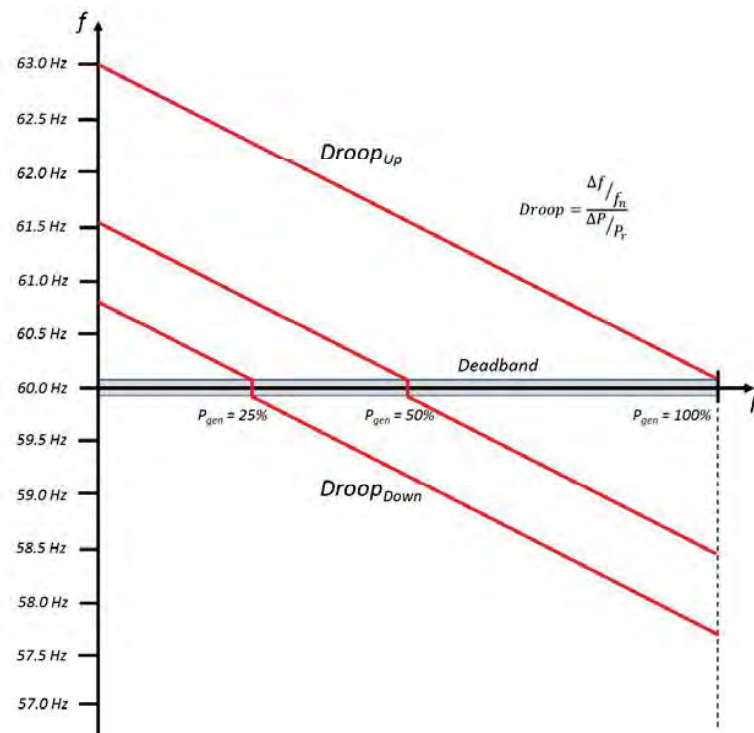


Figure A.2: Recommended Active Power-Frequency Control Characteristic

- 3.3. The closed-loop dynamic response of the active power-frequency control system of the overall inverter-based resources, as measured at the POM (or possibly the POI), should have the capability to meet or exceed the performance specified in [Table A.2](#). The Generator Owner should ensure that the models and parameters for the generator and control equipment are consistent with those provided during the interconnection study process and that any updates have been provided to the Transmission Planner and Planning Coordinator, reflecting currently implemented settings and configuration.

Table A.2: Dynamic Active Power-Frequency Performance		
Parameter	Description	Performance Target
For a step change in frequency at the POM of the inverter-based resource...		
Reaction Time	Time between the step change in frequency and the time when the resource active power output begins responding to the change ¹⁰⁴	< 500 ms
Rise Time	Time in which the resource has reached 90% of the new steady-state (target) active power output command	< 4 sec

¹⁰⁴ Time between step change in frequency and the time to 10 percent of new steady-state value can be used as a proxy for determining this time.

Appendix A: Recommended Performance Specifications

Table A.2: Dynamic Active Power-Frequency Performance		
Parameter	Description	Performance Target
For a step change in frequency at the POM of the inverter-based resource...		
Settling Time	Time in which the resource has entered into, and remains within, the settling band of the new steady-state active power output command	< 10 seconds
Overshoot	Percentage of rated active power output that the resource can exceed while reaching the settling band	< 5%**
Settling Band	Percentage of rated active power output that the resource should settle to within the settling time	< 2.5%**

** Percentage based on final (expected) settling value

4. Reactive Power-Voltage Control

- 4.1. Inverter-based resources should operate in a closed-loop, automatic voltage control mode to maintain voltage at the Point of Measurement to within the specified voltage schedule provided by the Transmission Operator, per NERC Reliability Standard VAR-001-4.2. The following principles should be adhered to, in coordination with the Transmission Planner, Planning Coordinator, and Transmission Operator.
 - 4.1.1. A single plant connected to a bus should operate in voltage control that ensures no steady-state error between nominal value and steady-state output (e.g., a PI controller). In some cases, reactive droop may be required for more stable operation.
 - 4.1.2. Multiple plants connected to the same bus may require reactive droop (a set point value at off-nominal reactive current based on the given voltage deviation from nominal operating voltage). Reactive droop should be based on the scheduled voltage set point and the high and low schedule limits such that the entire capability of the resource from full leading to full lagging reactive power output should be utilized across the range of acceptable voltages.
- 4.2. Inverter-based resources should utilize the dynamic reactive capability from the inverters to the greatest possible extent within the specified power factor requirements. Newly interconnecting resources, per FERC Order No. 827, will meet power factor requirements at the point of measurement (POM) of 0.95 leading to 0.95 lagging.
- 4.3. FERC Order No. 827 requires a triangle-shaped reactive capability with proportional reduction in reactive capability at lower active power output. However, reactive capability outside the triangular-shaped requirement yet within the reactive capability of the plant, should be utilized to the greatest possible extent. Inverters should not have artificial settings imposed to limit reactive power output to the triangular boundary (other than the maximum power operating point, and other plant-level limits, or voltage limits at the terminals of the inverter) when the capability can be utilized with no reduction of active power.
- 4.4. Inverter-based resources should have a continuously acting automatic control system that stably controls reactive power and reactive current injection across all expected operating conditions for the resource. The steady-state and dynamic performance of the resource should be studied during the interconnection process leading up to commissioning and energization. Control settings should be agreed upon between the Generator Owner and the Transmission Service Provider (TSP).

Appendix A: Recommended Performance Specifications

4.5. Overall plant small disturbance¹⁰⁵ reactive power-voltage control should meet the following performance characteristics:

- 4.5.1. Inverter-based resources should operate in closed loop automatic voltage control at all times to support BPS voltage schedules, postcontingency voltage recovery,¹⁰⁶ and voltage stability. Either the individual inverters or the plant-level closed loop automatic voltage controller should operate with a relatively fast response characteristic to mitigate steady-state voltage issues from causing dynamic voltage collapse. The plant-level controller may send voltage or reactive power set point changes to the individual inverters relatively fast, or the inverters will respond locally (depending on control architecture).
 - 4.5.1.1. If this capability is not possible for existing inverter-based resources, then the response time of these resources should be relatively fast (at least in the two to four second range) to accommodate the lack of automatic voltage control at the inverter level.
- 4.5.2. Reactive power-voltage controls should be tuned based on system impact studies performed during the interconnection process, as described in NERC Reliability Standard FAC-002-2.
 - 4.5.2.1. The controls should have the capability to be adjustable and tunable in the field based on reliability studies.
- 4.5.3. Inverter-based resources should have the capability to meet or exceed the performance characteristics shown in [Table A.3](#). These characteristics are specified for the response of reactive power of the overall closed-loop response of the inverter-based resource (plant).

Table A.3: Dynamic Reactive Power-Voltage Performance		
Parameter	Description	Performance Target
For a step change in voltage at the POM of the inverter-based resource...		
Reaction Time	Time between the step change in voltage and when the resource reactive power output begins responding to the change ¹⁰⁷	< 500 ms*
Rise Time	Time between a step change in control signal input (reference voltage or POM voltage) and when the reactive power output changes by 90% of its final value	< 2–30 sec**
Overshoot	Percentage of rated reactive power output that the resource can exceed while reaching the settling band	< 5%***

* Reactive power response to change in POM voltage should occur with no intentional time delay.

** Depends on whether local inverter terminal voltage control is enabled, any local requirements, and system strength (higher short circuit ratio allows for faster response). Response time may need to be modified based on studied system characteristics.

*** Any overshoot in reactive power response should not cause BPS voltages to exceed acceptable voltage limits.

¹⁰⁵ Where voltage remains within the continuous operating range and the plant-level controller maintains reactive power/voltage control

¹⁰⁶ The small disturbance response characteristic may apply for periods after a larger disturbance has occurred once voltage has recovered to within the normal operating range, depending on how the inverter and plant-level controls are coordinated.

¹⁰⁷ Time between the step change in voltage and reaching 10 percent of new steady-state value can be used as a proxy for determining this time.

Appendix A: Recommended Performance Specifications

- 4.6. Overall plant large disturbance¹⁰⁸ reactive current-voltage control should meet the following performance characteristics:
- 4.6.1. The reactive current-voltage control should be stable over all expected operating conditions. The dynamic performance of each resource should be tuned to provide this stable response. Reactive current-voltage controls should be tuned based on system impact studies performed during the interconnection process, as described in NERC Reliability Standard FAC-002-2.
 - 4.6.1.1. The controls should have the capability to be adjustable and tunable in the field based on reliability studies.
 - 4.6.2. Inverters should be designed to have the capability to meet the performance specifications shown in [Table A.4](#). Inverter-based resources should be installed with similar performance characteristics as a default value. However, more detailed studies (during the interconnection process or during Planning Assessments by the Transmission Planner or Planning Coordinator) may demonstrate the need for modifications to these settings to ensure stable response of the BPS.
 - 4.6.3. Inverter response to fault events on the BPS should use the following principles:
 - 4.6.3.1. During fault inception, priority should be given to delivering as much current to the system as quickly as possible to support protective relay operation to clear the fault.¹⁰⁹
 - 4.6.3.2. For the remaining on-fault period after the first couple cycles up to fault clearing (regardless of fault duration), priority should be given to accurately detecting the type of current needed based on terminal conditions and providing a combination of active and reactive current as necessary.
 - 4.6.3.3. During postfault clearing, inverters should accurately detect the type of current needed based on terminal conditions and respond accordingly to provide a combination of active and reactive current injection. The transition from inverter control back to plant-level controls (if applicable) once voltage returns within the continuous operation range should not hinder or affect the ability to meet the performance specifications described in this guideline for the overall response of the resource.
 - 4.6.3.4. Inverter reactive current injection should not exacerbate transient overvoltage conditions on the BPS.
 - 4.6.4. Inverters should be capable (and configurable) of providing negative sequence current. Zero sequence current is not required to be produced by inverter-based resources.

¹⁰⁸ Where voltage falls outside the continuous operating range.

¹⁰⁹ The exception to this statement is in weak grid conditions, where system studies may identify potential issues with fast injection of fault current (particularly when current injection accuracy may be compromised). In these cases, the GO, PC, TP, and inverter manufacturer should work together to identify a control strategy that addresses these conditions adequately. Focus should be on providing as much fault current as possible while still ensuring a stable response of the plant in all timeframes.

Appendix A: Recommended Performance Specifications

Table A.4: Dynamic Reactive Current-Voltage Performance		
Parameter	Description	Performance Target
For a large disturbance step change in voltage, measured at the inverter terminals, where voltage falls outside the continuous operating range, the positive sequence component of the inverter reactive current response should meet the following performance specifications...		
Reaction Time	Time between the step change in voltage and when the resource reactive power output begins responding to the change ¹¹⁰	< 16 ms*
Rise Time	Time between a step change in control signal input (reference voltage or POM voltage) and when the reactive power output changes by 90 percent of its final value	< 100 ms**
Overshoot	Percentage of rated reactive current output that the resource can exceed while reaching the settling band	As Determined by the TP/PC***

* For very low voltages (e.g., less than around 0.2 pu), the inverter PLL may lose its lock and be unable to track the voltage waveform. In this case, rather than trip or inject a large unknown amount of active and reactive current, the output current of the inverter(s) may be limited or reduced to avoid or mitigate any potentially unstable conditions.

** Varying grid conditions (i.e., grid strength) should be considered and behavior should be stable for the range of plausible driving point impedances. Stable behavior and response should be prioritized over speed of response.

*** Any overshoot in reactive power response should not cause BPS voltages to exceed acceptable voltage limits. The magnitude of the dynamic response may be requested to be reduced by the TP or PC based on stability studies.

¹¹⁰ Time between the step change in voltage and reaching 10 percent of new steady-state value can be used as a proxy for determining this time.

Appendix B: List of Acronyms

Table B.1: List of Acronyms	
Acronym	Term
A/D	Analog-Digital
ac	Alternating Current
ACE	Area Control Error
AVR	Automatic Voltage Regulator
BA	Balancing Authority
BES	Bulk Electric System
BESS	Battery Energy Storage System
BIL	Basic Impulse Level
BPS	Bulk Power System
CAISO	California Independent System Operator
dc	Direct Current
DDR	Dynamic Disturbance Recorder
DER	Distributed Energy Resource
DFR	Digital Fault Recorder
EHV	Extra High Voltage
EMT	Electromagnetic Transient
EPRI	Electric Power Research Institute
EPS	Electric Power System
ERCOT	Electric Reliability Council of Texas
ERS	Essential Reliability Service
ERO	Electric Reliability Organization
FACTS	Flexible ac Transmission System
FERC	Federal Energy Regulatory Commission
FRT	Fault Ride-Through
GO	Generator Owner
GOP	Generator Operator

Appendix B: List of Acronyms

Table B.1: List of Acronyms	
Acronym	Term
GPS	Global Positioning System
GSU	Generator Step Up
HFRT	High Frequency Ride-Through
HV	High Voltage
HVDC	High Voltage Direct Current
HVRT	High Voltage Ride-Through
IEEE	Institute of Electrical and Electronics Engineers
IEEE PSRC	IEEE Power System Relaying Committee
IGBT	Insulated Gate Bipolar Transistor
IP	Intellectual Property
ISO	Independent System Operator
LADWP	Los Angeles Department of Water and Power
LCC	Line Commutated Converter
LF	Loop filter
LFRT	Low Frequency Ride-Through
LGIA	Large Generator Interconnection Agreement
LV	Low Voltage
LVRT	Low Voltage Ride-Through
MPPT	Maximum Power Point Tracking
MW	Megawatt
MV	Medium Voltage
MVA	Megavolt-ampere
MVAR	Megavolt-ampere (reactive)
NEC	National Electric Code
NERC	North American Electric Reliability Corporation
NERC ERSWG	NERC Essential Reliability Services Working Group
NERC IRPTF	NERC Inverter-Based Resource Performance Task Force

Appendix B: List of Acronyms

Table B.1: List of Acronyms	
Acronym	Term
NOPR	Notice of Proposed Rulemaking
NTP	Network Time Protocol
OEM	Original Equipment Manufacturer
PC	Planning Coordinator
PID	Proportional-Integral-Derivative Control
PLL	Phase Lock Loop
PMU	Phasor Measurement Unit
POC	DER Point of Connection
POI	Point of Interconnection
POM	Point of Measurement
POW	Point-on-Wave
PTP	Precision Time Protocol
PU	Per-Unit
PV	Photovoltaic
RC	Reliability Coordinator
RE	Regional Entity
RMS	Root-Mean-Square
ROCOF	Rate-of-Change-of-Frequency
RTO	Regional Transmission Organization
SCADA	Supervisory Control and Data Acquisition
SCE	Southern California Edison
SER	Sequence of Events Recording (Recorder)
SGIA	Small Generator Interconnection Agreement
SRD	Source Requirements Document
STATCOM	Static Compensator
SVC	Static Var Compensator
TO	Transmission Owner

Appendix B: List of Acronyms

Table B.1: List of Acronyms	
Acronym	Term
TOP	Transmission Operator
TP	Transmission Planner
TSP	Transmission Service Provider
UFLS	Underfrequency Load Shedding
UPS	Universal Power Supply
UTC	Coordinated Universal Time
VSC	Voltage Source Converter
WECC	Western Electricity Coordinating Council
WPP	Wind Power Plant
WTG	Wind Turbine Generator

Appendix C: IEEE Standard 1547-2018 Terminology

This section provides some of the definitions in IEEE Std. 1547–2018, particularly those related to the performance specifications discussed in this guideline. These definitions are provided here for reference only, and they only apply to IEEE Std. 1547-2018. They should not be applied to BPS-connected resources described in this guideline.

- **Cease to Energize:** Cessation of active power delivery under steady state and transient conditions and limitation of reactive power exchange.¹¹¹
- **Continuous Operation:** Exchange of current between the DER and an EPS within prescribed behavior while connected to the Area EPS and while the applicable voltage and the system frequency is within specified parameters.
- **Energize:** Active power outflow of DER to an EPS under any conditions (e.g., steady state and transient).
- **Mandatory Operation:** Required continuance of active current and reactive current exchange of DER with Area EPS as prescribed, notwithstanding disturbances of the Area EPS voltage or frequency having magnitude and duration severity within defined limits.
- **Momentary Cessation:** Temporarily cease to energize an EPS, while connected to the Area EPS, in response to a disturbance of the applicable voltages or the system frequency, with the capability of immediate Restore Output of operation when the applicable voltages and the system frequency return to within defined ranges.
- **Operating Mode:** Mode of DER operation that determines the performance during normal or abnormal conditions.
- **Performance operating region:** An area bounded by pair points consisting of magnitude (voltage or frequency) and duration which define the operational performance requirements of the DER.
- **Permissive Operation:** Option for the DER to either continue to exchange current with or to cease to energize an EPS, while connected to the Area EPS, in response to a disturbance of the applicable voltage or the system frequency.
- **Point of common coupling (PCC):** The point where a Local EPS is connected to an Area EPS.
- **Point of Distributed Energy Resources Connection (Point of DER Connection–PoC):** The point where a DER unit is electrically connected in a Local EPS and meets the requirements of this standard exclusive of any load present in the respective part of the Local EPS.¹¹²
- **Postdisturbance Period:** The period starting upon the return of all applicable voltages or the system frequency to the respective ranges of the mandatory operation region or continuous operation region.
- **Restore Output:** Return operation of the DER to the state prior to the abnormal excursion of voltage or frequency that resulted in a ride-through operation of the DER.
- **Return to Service:** Enter service following recovery from a trip.
- **Ride-Through:** Ability to withstand voltage or frequency disturbances inside defined limits and to continue operating as specified.
- **Trip:** Inhibition of immediate return to service, which may involve disconnection.¹¹³

¹¹¹ This may lead to momentary cessation or trip. This does not necessarily imply nor exclude disconnection, isolation, or a trip. Limited reactive power exchange may continue as specified (e.g., through filter banks). Energy storage systems are allowed to continue charging.

¹¹² For (a) DER unit(s) that are not self-sufficient to meet the requirements without (a) supplemental DER device(s), the point of DER connection is the point where the requirements of this standard are met by DER (a) device(s) in conjunction with (a) supplemental DER device(s) exclusive of any load present in the respective part of the Local EPS.

¹¹³ Trip executes or is subsequent to cessation of energization.

Appendix D: Methods for Deriving Grid Frequency

Inverters calculate grid frequency by measuring it through the electrical quantities observed at their terminals (or plant POM for a plant-level controller). There are various ways an inverter-based resource may calculate frequency, and there are no standardized approaches to the calculation methods. However, each method should be robust to large phase jumps and should not result in erroneous tripping of inverter-based resources. Some of the methods employed by inverter-based resources are described here.

Frequency Measurement Fundamentals

Frequency is fundamentally the number of complete cycles of a periodic signal over a specified period of time. Periodic signals, by definition, occur only in steady state and therefore frequency is a steady-state measurement. Frequency is most effectively calculated as the rate of change of rotor angular position, or angular velocity, of a synchronous machine. However, once we consider frequency derived from an electrical quantity such as voltage or current, the link to physical equipment no longer holds. Power system measurements are constantly fluctuating due to small load perturbations, generator rotors oscillating, etc. System voltage and current phase quantities are therefore continuously changing, and their waveforms are not periodic. Further, discrete changes in the system, such as switching events, make calculating frequency more difficult. Strictly speaking, frequency should not be calculated during switching events since the period or frequency cannot be measured.¹¹⁴

There currently is not a common definition of dynamic frequency nor a standardized means of calculating frequency during dynamic events. Each measurement method is able to calculate and define frequency. While different methods may derive very similar frequency measurements during steady-state and during slow changes to electrical quantities, large fluctuations in input signals may yield drastically different results based on measurement technique.

Historically, inverters needed to respond very quickly in order to meet the IEEE 1547-2003 fast “must trip” requirements of 0.16 seconds. Frequency ride through was not a consideration at that time and so instantaneous tripping was allowed. At that time, the prevailing philosophy for DERs was to trip as quickly as possible during abnormal grid conditions, including off-nominal frequencies. Therefore, a method for quickly determining frequency was desired. However, recent BPS disturbances, such as the Blue Cut Fire disturbance, have proved that accurately measuring, filtering, and calculating grid frequency are essential to reliable inverter behavior. In addition, inverters should be robust to anomalous frequency measurements calculated during grid transient events such as faults.

Methods for Deriving Grid Frequency

Various methods are used by microprocessor-based protective relays, frequency recorders, phasor measurement units (PMUs), and inverters to calculate grid frequency using input electric quantities. Microprocessor-based devices have demonstrated excellent reliability and performance in detecting off-nominal frequency conditions. Further, false operation of these relays, especially for voltage transient conditions due to the occurrence and clearing of high voltage transmission faults, is extremely rare. These devices provide high accuracy measurements around nominal frequency (can use internal device processes such as waveform sampling), are relatively insensitive to switching events on the BPS (ensure a periodic input signal), and balance sufficient filtering with necessary speed of calculation over a time window. Inverter-based resources that calculate frequency internally are expected to have these same attributes as conventional microprocessor-based devices.

¹¹⁴ B. Kasztenny, “A new method for fast frequency measurement for protection applications,” Schweitzer Engineering Laboratory, Pullman, WA, Accessed 2017. [Online]. Available: https://static.selinc.com/assets/Literature/Publications/Technical%20Papers/6734_NewMethod_BK_20151112_Web.pdf?v=20160310-154646.

Phase Lock Loop

A PLL is a control loop used in inverter control systems to track the phase angle of the grid.¹¹⁵ Successful tracking of phase angle results not only in a successful synchronization of the inverter with the grid but also allows the inverter control system to adequately decide the necessary angle required for its terminal voltage in order to inject current into the network. Operation of the PLL closed loop can be related to the natural interaction that occurs between the rotor angle of a synchronous machine and its terminal voltage angle.

While there are many different ways a PLL may be implemented, a typical implementation is based on the dq frame transformation.¹¹⁶ This transformation takes the three phase ABC reference frame quantities (i.e., phase voltages) and converts the values into a dq frame rotating at synchronous speed such that the fundamental frequency quantity of the ABC frame becomes a constant “dc value” in the dq frame. A simple block diagram of such a PLL¹¹⁷ is as shown in [Figure D.1](#).

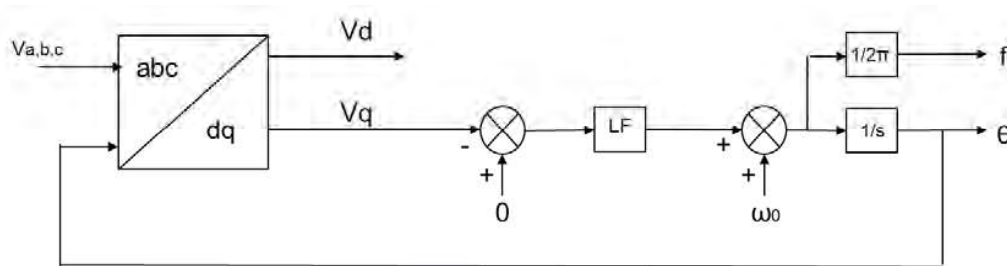


Figure D.1: Basic Synchronous Reference Frame PLL

The loop filter (LF) block is traditionally a PI controller with the aim to drive the q component of the dq transformed voltage to zero. By doing so, the value of the d component becomes equal to the magnitude of the complex number $V_d + jV_q$ while the value of θ becomes the angle of the input ABC frame quantities.

Frequency, f , and angle, θ , become outputs of the PLL. As mentioned, the primary goal of the PLL is to track the grid angle under varying conditions of voltage magnitude and phase jumps (associated with BPS events like faults and line-switching events). In tracking phase, the frequency output of the PLL can have large spikes in order to produce the required quick change in phase angle θ . Consider [Figure D.2](#), which illustrates the behavior of a digital PLL (no external inverter control loops or network modeled) for a voltage dip to 0.5 pu for a duration of around 6 cycles. The change in voltage magnitude and phase was applied uniformly to all three phases, but only a single phase is shown for simplicity. A phase jump of -60 degree occurs at the initiation of the voltage dip while a phase jump of 170 degree occurs at the clearance of the dip. Frequency of the three ABC phase voltages remains unchanged. This scenario is a conservative representative of a fault on a long EHV transmission circuit relatively nearby the measurement location, followed by outage of the circuit upon clearance of the fault.

¹¹⁵ P. M. Anderson and A. A. Fouad, “Power System Control and Stability,” IEEE Press, 2003.

¹¹⁶ R.H. Park, “Two Reaction Theory of Synchronous Machines,” AIEE Transactions, vol. 48, no. 3, July 1929.

¹¹⁷ This simple illustration of a PLL provides an example of PLL functionality while, in practice, manufacturers may use advanced loop filters and signal conditioning on input and output signals to further improve PLL performance.

Appendix D: Methods for Deriving Grid Frequency

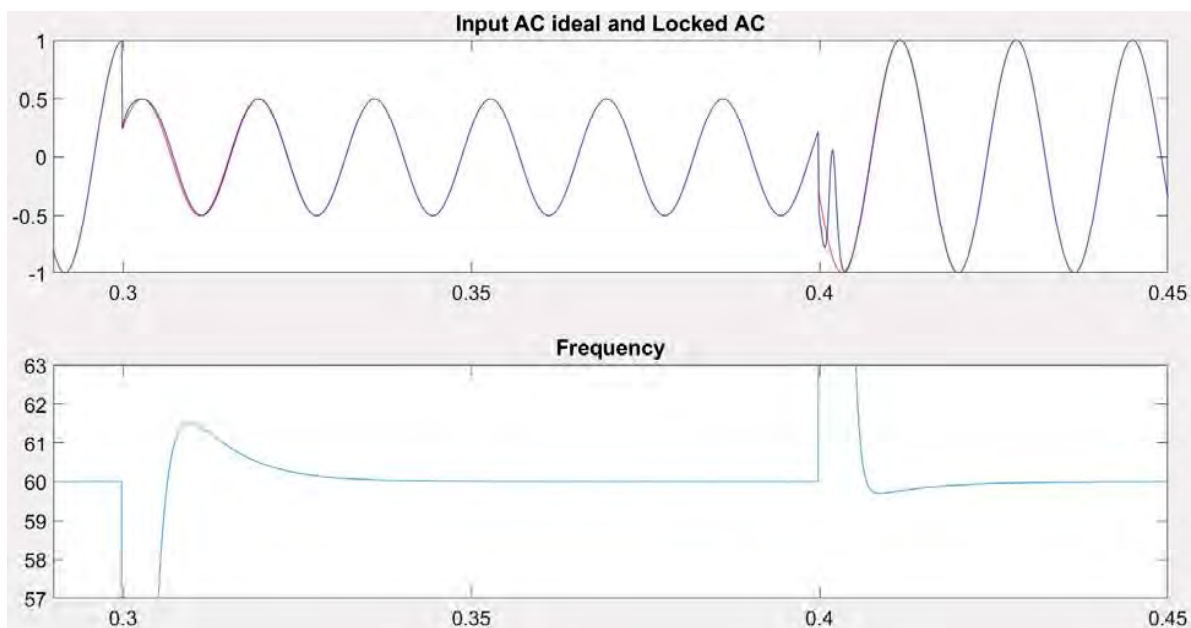


Figure D.2: PLL Performance for Second Scenario

The PLL has good performance as it is able to track the angle of the input voltage wave within a couple of cycles. However, in order to do so, the control loop of the PLL must cause a large change in the numerical value of frequency. As the performance goal of the PLL is to track the input voltage angle, the spikes in the PLL frequency are of relatively less significance to the inverter control loop. However, if this same frequency signal has to be used as an input to frequency protection settings, care must be taken to adequately filter out the large sub-cycle jumps in frequency. Additionally, if the input voltage wave is not balanced, a positive-negative sequence decomposition is carried out and then the positive sequence portion is typically used as an input to the PLL loop.

Zero Crossing

Zero crossing was used by early generation inverter technology and provides a relatively crude method for calculating frequency, particularly under transient conditions. It is prone to miscalculations under heavy harmonic distortion and for large phase jumps caused by switching events or faults. These errors should be filtered out, rather than averaged, to avoid erroneous frequency calculations. Validated frequency measurements are then filtered to improve accuracy, and measurements are reported as zero crossings are detected. This makes frequency calculations during transient events highly nonlinear. Many of the heuristic methods employed to improve accuracy and quality are proprietary, making the results inconsistent across manufacturers. For these reasons, zero crossing methods are not recommended and typically not used by modern inverter technology.

The zero crossing method uses one or more of the voltage phases sampled by an A/D converter. Voltage signals are scaled, isolated (if needed) and low pass filtered for anti-aliasing prior to input to the A/D converter. A typical sample rate might be 15 kilohertz. As the waveform is being captured, additional digital low pass filtering may be applied. The intent of low pass filtering prior to performing the comparison for zero crossing is to minimize the chance of noise or surges on the line from impacting the determination of a zero crossing.

If the first sample is negative then a positive going zero crossing is searched for first, otherwise a negative going zero crossing is searched for first. Searching for a positive going zero crossing, one looks for the voltage sample that meets the following condition:

$$v_i \geq 0 \text{ AND } v_{i-1} < 0$$

Appendix D: Methods for Deriving Grid Frequency

When this condition is true; a zero crossing has been detected, then the time of the zero crossing is stored as say t_0 . A convenient time clock in a microprocessor is a 32bit program counter, PC , which increments with each clock cycle. A convenient clock rate for such a microprocessor might be 10 MHz (f_{CLK}), meaning that PC increments every $t_{CLK} = 0.1$ microseconds. Checking for further zero crossings is then inhibited for a period of time so that waveforms with high frequency noise near the zero crossing do not generate multiple detections. This inhibit time would typically be $\frac{1}{4}$ of a nominal grid cycle. Once the inhibit period is over, searching for a negative zero crossing commences looking for the next voltage sample to meet the following condition:

$$v_i \leq 0 \text{ AND } v_{i-1} > 0$$

When this condition is met, the time of the negative zero crossing is stored as time t_1 , reading time from the PC . Inhibit time is applied again, then the search for the next positive zero crossing is done, yielding time t_2 .

It is preferred to estimate frequency using integer multiples, N , of one full cycle. The frequency estimate may be updated every $\frac{1}{2}$ cycle. Frequency is then computed as follows:

$$frequency = N * f_{CLK} / (t_j - t_{j-2N})$$

where

- j is the index of the most recent zero crossing time
- N is the number of grid cycles over which to measure frequency

There is no firm standard for how zero crossing detection is performed. The calculation techniques are up to the manufacturer to derive, and the manufacturers test their approach to verify proper performance. Therefore, standardized testing of frequency calculations from inverters is essential.

Appendix E: Other Power Electronic Resources on the BPS

This appendix provides useful reference material for the performance characteristics of other power electronic-based elements connected to the BPS, namely BESS, STATCOMs, SVCs, and HVDC technology. This material is based on discussions between NERC and multiple equipment manufacturers. The performance aspects described here are intended to provide illustrative comparisons, not detailed equipment specifications.

Battery Energy Storage Systems

BESS controls are similar to those of other inverter-based resources (with a few differences), particularly solar PV inverters, as presented throughout this guideline. BESS controls include current regulation loops, PLLs, dc bus voltage regulation loops, battery charge and discharge control loops, active power-frequency and reactive power-voltage controls, plant-level controls, etc. Performance specifications recommended in Appendix A, for inverter-based resources, are also recommended to be used for BESS plants.

Compared to inverter-based generating resources such as solar PV and wind turbines, BESS can operate in both load and generation modes when connected to the BPS. Therefore, the power capability curve for BESS is a four-quadrant curve similar to the one that is shown in [Figure E.1](#). A BESS might have different maximum charge active power and maximum discharge active power limits, and its reactive power capability might not be the same when operating in load or generation modes. Current injection from BESS during large signal disturbances is recommended to follow the behavior as presented in Chapters 2 and 3, regardless of the BESS being in load or generation mode. It is recommended for BESS resources to provide dynamic reactive power support within their capability curve. It is not recommended to artificially limit reactive power output capability of the resource to the triangular or rectangular area boundaries, within the capability of the inverters or other plant-level limits as shown in [Figure E.1](#). If the inverter-based resource can provide more reactive current within its limitations to maintain scheduled voltage pre- or post-contingency, the inverter and plant-level controls should be programmed to do so.

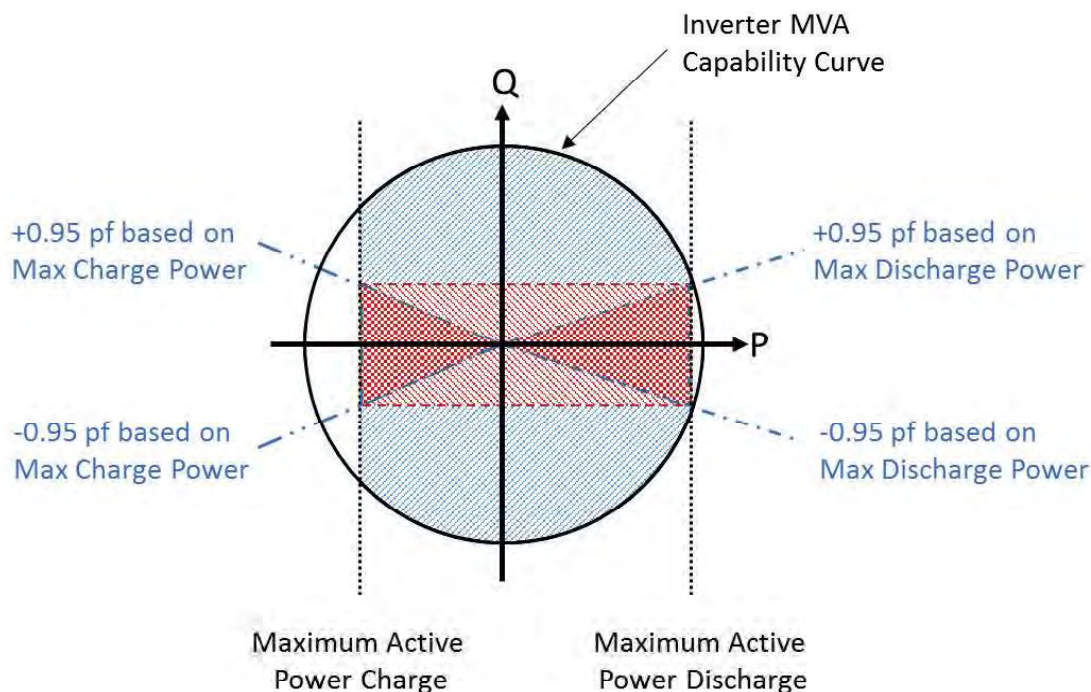


Figure E.1: BESS Inverter Capability Curve

Momentary Cessation used in FACTS Devices and HVDC

Momentary cessation (commonly referred to as “blocking” by these technologies) is used in BPS-connected FACTS devices and HVDC circuits. Blocking is initiated at low voltage; however, unlike inverter-based generating resources (e.g., solar PV and WTGs), there is no active power source in these devices to sustain current injection at zero voltage. They are purely reactive devices and have some key distinctions from inverters used in generating facilities. Often, these resources are used to maintain system stability upon fault clearing (e.g., transient voltage recovery) or during continuous steady-state operation. The controls and protection (including blocking) are set to avoid spurious tripping of these devices in conditions where they are designed to operate to ensure system stability and reliability. In some cases, the consequences of erroneous tripping could result in unreliable operation of the BPS and potential instability. Some considerations for SVCs and STATCOMS include the following:

- SVCs are a line-commutated (thyristor-based) technology, directly dependent on synchronization to the ac bus voltage. For this reason, the PLL must remain locked on the ac voltage to avoid commutation failure. Typically, SVC thyristor branches are blocked below low voltages around 0.3 pu of the nominal ac bus voltage. The reason is to ensure that the SVC remains online and is able to “de-block” very quickly following fault clearance to provide dynamic reactive support in the postfault period as voltages recover.
- STATCOMs behave in a similar way to other inverter-based technologies. STATCOMs use voltage-source converters with IGBTs or other types of semiconductors with “turn off” switching capability (similar to inverter-based generation). A STATCOM operates by inverting its internal dc voltage to an ac phasor at its terminals in order to either inject or absorb reactive power from the grid and control terminal ac bus voltage. It keeps synchronism with the grid using a PLL, similar to other inverter-based resources. During severe voltage dips or phase jumps, the PLL may lose synchronism, which may lead to the STATCOM dc-link being either drained or charged. This is not desired, from the equipment perspective, since it can lead to dc undervoltage or overcharging depending on the direction of active power flow. For this reason, STATCOMs are designed to block at very low voltages around 0.2 to 0.3 pu.
- Line commutated converter (LCC) HVDC may use both blocking or bypassing of the thyristor valves at low voltage to protect the valves and avoid thyristor misfiring when synchronization is lost. To ensure grid stability and proper control of the dc circuit, LCC HVDC uses voltage-dependent current order limits (VDCOL) to deliberately reduce the power transfer (current order) during ac faults. These are necessary functions for stable operation of an LCC HVDC system and should be properly designed and tuned for each installation.¹¹⁸ Also, ac faults on the inverter end may result in temporary commutation failure. This may appear as “momentary cessation,” but this is a well-understood behavior of LCC HVDC that needs to be properly accounted for in planning, design, and control of such systems (and modeled accordingly). For voltage source converter (VSC) HVDC, blocking is used to protect the dc bus voltage to avoid tripping the entire circuit, to maintain current control, and to not adversely impact the other end of the dc circuit.

Table E.1 shows common momentary cessation (or “blocking”) characteristics used by these resources. These values are provided as an illustrative reference.

¹¹⁸ This is outside the scope of this guideline. More information can be found in *Power System Control and Stability*, by P. Kundur, 1994.

Appendix E: Other Power Electronic Resources on the BPS

Table E.1: Momentary Cessation Characteristics for FACTS and HVDC

Parameter	Performance Characteristic
FACTS Momentary Cessation (Blocking) Voltage Threshold	0.2-0.3 pu of nominal
LCC HVDC Inverter-Side Blocking Voltage Threshold	0.8-0.9 pu of nominal
Delay in Recovery Upon Voltage Restoration	1-2 cycles (16-33 ms)
Reactive Current Response Time	< 2 cycles (33 ms)
Time to Restoration of Pre-Disturbance Active Current (HVDC)	< 250 ms*

* The rate of recovery may be tuned, or slowed, in some systems based on interconnection studies or planning studies.

Dynamic Performance Characteristics of STATCOMs and SVCs

Typical dynamic performance characteristics for STATCOMs and SVCs during small signal disturbances (relatively small voltage fluctuations) are shown in [Table E.2](#).¹¹⁹ Response times depend on voltage regulator gain in relation to system fault level and short circuit ratio, which is often set for each specific installation based on system studies. The values also assume coordinated conditions between short circuit ratio and gain settings.

Table E.2: Dynamic Performance Characteristics for STATCOMs and SVCs

Parameter	Description	Performance Target*
For a step change in voltage at the terminals of the FACTS device...		
Delay Time	Time between the step change in voltage and the time when the resource reactive power output begins responding to the change ¹²⁰	< 1 cycle (< 16.66 ms)
Rise Time	Time in which the resource has reached 90 percent of the new steady-state reactive power output command	< 2-3 cycles (<33-50 ms)
Settling Time	Time in which the resource has entered into, and remains within, the settling band of the new steady-state reactive power output command	< 10 cycles (< 166 ms)
Overshoot	Percentage of rated reactive power output that the resource can exceed while reaching the settling band	< 5-10%
Settling Band	Percentage of rated reactive power output that the resource should settle to within the settling time	< 5%

* The performance for each installation will be tuned to meet the local grid needs, and needs of the specific application. These are provided for reference with other inverter-based generation specifications.

¹¹⁹ Response may be expressed in terms of voltage response rather than reactive power in some cases. However, the values in the table should be similar.

¹²⁰ Time between the step change in voltage and the time to 10 percent of new steady-state value can be used as a proxy for determining this time.

SVCs and STATCOMs are able to design their control systems to minimize transient voltage overshoot following fault clearing. Relative to SVCs, STATCOMs are inherently more lenient in this respect in that a STATCOM has a finite internal voltage source, which is beneficial during postfault voltage recovery. Capacitor-based devices produce reactive power proportional to the square of the voltage, so these types of devices have more susceptibility to transient overvoltage unless they can be swiftly removed (not likely in the sub-cycle transient time period). In SVCs, there are control mechanisms that attempt to cater to this, and the protection is coordinated to avoid spurious tripping during transient overvoltages. Coordinated control for avoiding transient overvoltages is essential for many BPS-connected FACTS applications.

The issue of “weak grid” conditions (i.e., low short circuit strength areas of the system) is particularly a problem for line-commutated equipment and less of a problem for self-commutated equipment. Specialized studies are often performed to establish control system designs that function properly in these conditions. These controls may include regulator gain limitations or adaptive gain scheduling that reduces the gain of the controls as the system condition weakens. The effective short circuit ratio is specifically reviewed for each application, and the device configurations are adapted accordingly. In addition, focus is given to more robust PLL controls since phase shifts are particularly amplified in “weak grid” conditions. Regarding areas of low short circuit current contribution (high penetration of inverter-based resources), the low short circuit currents have not proved an issue for the equipment.¹²¹ The devices rely on their protective control functions in the device controllers as well as an array of conventional protective relays (e.g., differential and overcurrent protection) on these devices that are not prone to misoperation for low short circuit conditions.

STATCOM Protection Example

Table E.3 shows some of the protection and control functions within a typical STATCOM. These help understand the relation to inverter-based generating resources connected to the BPS. In general, dc overvoltage protection operates on an instantaneous value. On the other hand, ac overvoltage protection uses filtered quantities and requires some sampling to get RMS-type (d-q decomposition) quantities. Filtering is used on the ac voltage waveform signals prior to protection system operation to avoid any spurious transients.

FACTS devices are typically designed to the requirements at hand, and the equipment manufacturers are strong advocates of the utilities considering what types of overvoltages they may encounter. There is a difference between SVCs and STATCOMs in this respect in that the SVC is inherently resilient against overvoltage. For the STATCOM, like any IGBT or other “turn off” semiconductor-based device, it has to be designed to the extreme voltage level at which it is required to operate. All these devices have semiconductors with antiparallel diodes. This means they become rectifiers when the voltage rise to levels high enough, resulting in overcharging the dc-link. They then have to trip, and blocking is not an option because of the diode. The only option is to design the equipment prior to installation (or significant equipment replacement) for the higher voltage. For STATCOMs this typically translates to 1.3 to 1.5 pu, except for short duration transient overvoltages. **Figure E.3** shows an example voltage profile.

Equipment manufacturers have stated that overvoltage is not a justifiable cause of tripping for BPS-connected STATCOMs and SVCs. The general idea is that the transmission protective relaying should operate before the device protection does. There are practical and economic aspects to this, but the overall philosophy is that the STATCOM or SVC should be the last element to trip. To the greatest possible extent, the device equipment is set outside the transmission system protection settings. The protective time settings are important in this respect since actual overvoltage levels, practically speaking, are usually based on estimations. This often requires some

¹²¹ However, it is noted that low short circuit currents have been identified as a potential issues for overall transmission system protective relaying. NERC and IEEE jointly developed a report that outlines some of these issues, and directs industry to continue work in this area. Available: http://resourcecenter.ieee-pes.org/pes/product/technical-publications/PES_TR_7-18_0068?utm_source=PES_PR_TCReports-JULY2018&utm_campaign=2018-PR.

Appendix E: Other Power Electronic Resources on the BPS

study and coordination with the TP and PC to understand specific aspects of each installation during the interconnection studies.

Table E.3: Dynamic Performance Characteristics for STATCOMs and SVCs			
Type	Condition	Typical Value	Protection Action
ac	Extreme High Voltage	$> 1.5 \text{ pu}$	Trip
ac	Internal Smoke Detection	OEM specific settings	Trip
ac	Internal Faults ¹	OEM specific settings	Trip
ac	High Voltage	$1.15 \text{ pu} < HV < 1.5 \text{ pu}^2$	Momentary Cessation
ac	Low Voltage	$< 0.2 \text{ pu}$ (could be as low as 0.1 pu)	Momentary Cessation
dc	Overvoltage	Specific to OEM	Momentary Cessation
dc	Undervoltage	Specific to OEM	Momentary Cessation
Freq	High Frequency	$+3 \text{ Hz}^2$	Momentary Cessation
Freq	Low Frequency	-3 Hz^2	Momentary Cessation
Freq	df/dt	4 Hz/s^2	Momentary Cessation

¹ Similar to synchronous generator protection (e.g., overcurrent)

² Varies by equipment manufacturer

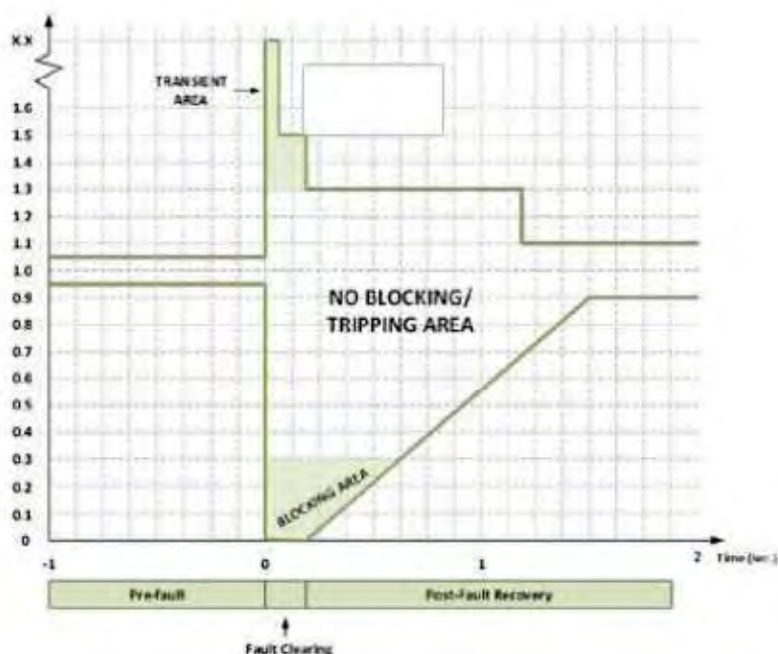


Figure E.2: STATCOM Ride-Through Profile Illustration [Source: ABB]

Appendix F: Response Characteristic Reference

Chapters 3 and 4 related to active power-frequency, reactive current-voltage, and reactive power-voltage response characteristics, including tables that specify the recommended performance for changes in terminal frequency or voltage. Each table uses some or all of the performance characteristics shown in **Figure F.1**, based on BPS performance needs. **Figure F.1** does not include specific times or quantities, so it can be used for each of the tables respectively.¹²²

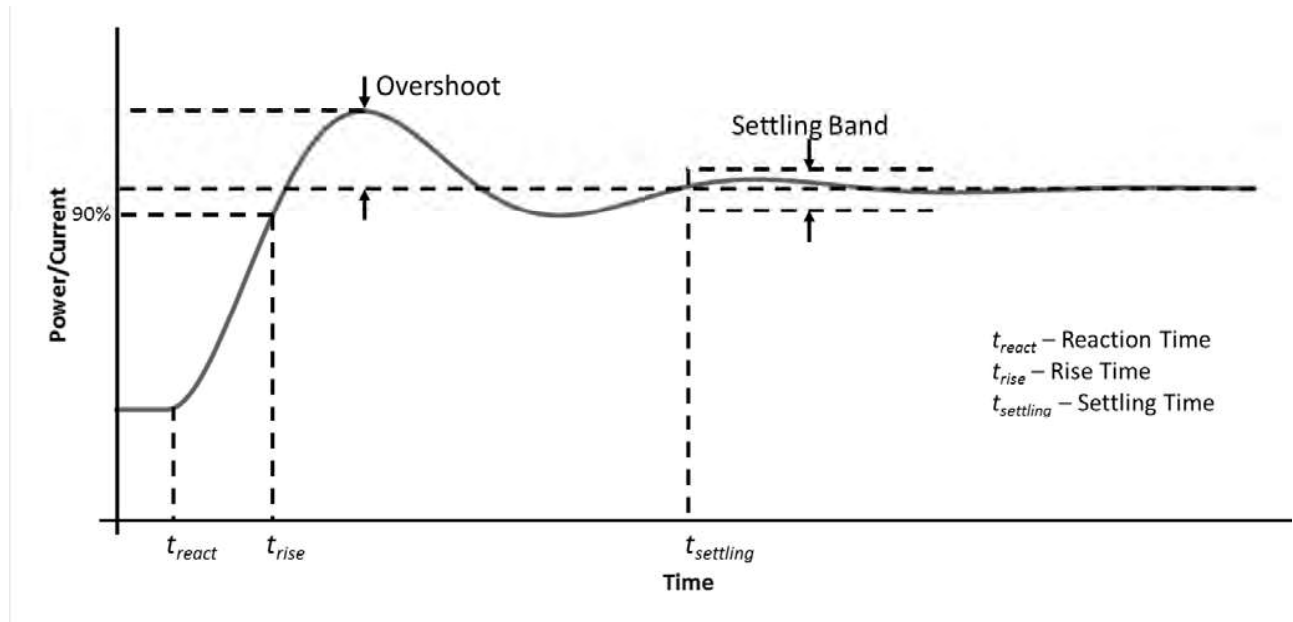


Figure F.1: Power/Current Response Characteristic

¹²² The performance specs were adapted from IEEE Std. 1031-2011, "IEEE Guide for the Functional Specification of Transmission Static Var Compensators". Available: <https://standards.ieee.org/findstds/standard/1031-2011.html>.

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Richard Bravo	Southern California Edison Company	IRPTF Member
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Leo Casey	GoogleX	IRPTF Member
Kevin Collins	First Solar Electric	IRPTF Member
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Kevin Damron	Avista Utilities	IRPTF Member
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Anthony Doering	ITC Holdings	IRPTF Member
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Errata

December 6, 2018

Page 21: (Table 2.1), “< 500 minutes” was changed to “< 500 ms”.

Lesson Learned

Battery Energy Storage System Cascading Thermal Runaway

Primary Interest Groups

Generator Operators (GOPs)
Generator Owners (GOs)
Transmission Operators (TOPs)
Transmission Planners (TPs)
Resource Planning (RP)

Problem Statement

A fire started in a Battery Energy Storage System (BESS), resulting remote alarm triggering at approximately 16:55 PST. The utility, the maintenance provider, and fire fighters responded to the site. At approximately 20:04 PST, an explosion occurred that injured several firefighters and significantly damaged the BESS. A comprehensive investigation of the event was performed that identified the cause of the fire as being a cascading thermal runaway event that was initiated by an internal cell failure within one battery cell in the BESS.

Details

On the day of the event, the 2 MW/2 MWh BESS was performing a solar smoothing function (this entails charging during the daytime; absorbing solar energy produced from rooftop solar on the circuit) and discharging through evening load peak.

At approximately 16:54 PST, a battery cell in the BESS experienced a sudden drop in voltage during a charging cycle. Moments after, the voltage dropped and a battery cell went into thermal runaway. This event generated off-gassing and smoke that activated the smoke detection system, leading to the discharge of the fire suppression system. The initial cell's thermal runaway cascaded into neighboring cells and subsequently into the batteries contained within neighboring modules.

Figure 1 shows the general layout of the BESS. Figure 2 shows how a single cell failure propagated through one Module and consumed the whole rack, releasing a large plume of explosive gases. This could have occurred without a flame, explaining why the gases were not burned as they were emitted.

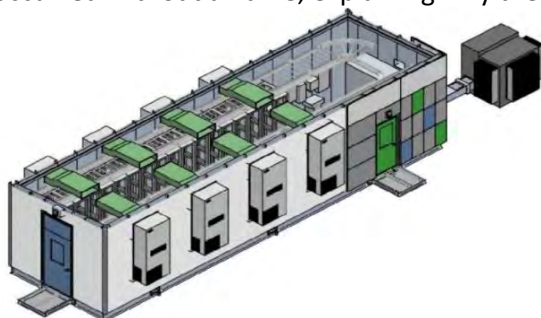


Figure 2: General layout of the BESS
(Image credit: APS)

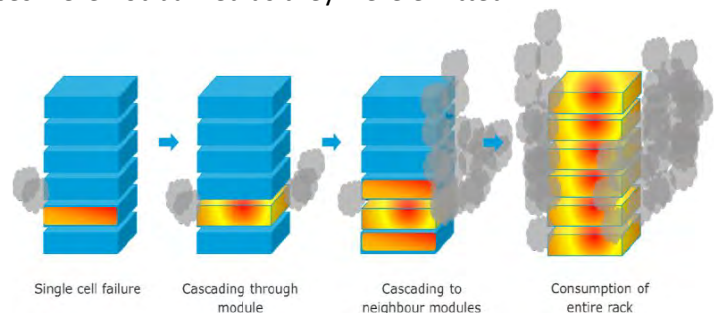


Figure 1: A single cell failure propagated through one Module (Image credit: APS).

A “clean agent” fire suppression system was built into the BESS and functioned as designed. However, the high temperatures generated by the thermal runaway and battery fire negated the agent’s ability to suppress the fire.

Approximately three hours after initiation of the event, emergency responders opened the BESS side container door and approximately two minutes later, an explosion occurred.

An extensive investigation of this event was led by the involved entity that included emergency responders, vendor partners, forensic experts, and nationally recognized research institutions. The investigation uncovered the following five main contributing factors:

- Internal failure in a battery cell initiated thermal runaway
- Lack of thermal barriers between cells led to cascading thermal runaway
- The fire suppression system was incapable of stopping thermal runaway
- Flammable off-gases concentrated without a means to ventilate
- Emergency response plan did not have an extinguishing, ventilation, and entry procedure



Figure 3: BESS Exterior after event (image credit: APS)



Figure 4: All modules in Rack 15 were severely damaged by thermal runaway while leaving nearby racks mostly intact (image credit: APS)

Corrective Actions

The primary hazard during a BESS incident is flammable gas in an enclosed space. Planning, training and design modifications will reduce this risk. The following are actions the entity took:

- Improve training, emergency response planning, and procedures for first responders, operations, and maintenance personnel that account for the risks and hazards of cascading thermal runaway, including flammable gases and how to enter systems after a failure.
- Work with suppliers, industry experts, and standards bodies to improve battery safety and limit potential risk in the following areas:
 - Minimize or eliminate cell-to-cell and module-to-module heat transfer to stop thermal runaway.
 - Implement fire detection and suppression system designs that will fully manage a thermal runaway.
 - Implement design changes incorporating monitoring and remote reporting of flammable gas concentrations and implement ventilation systems to mitigate.

Lesson Learned

NERC Lessons Learned normally provide anonymity for the entities involved in the source events. However, in this case, the entity wished to be known in order to expedite the dissemination of information by providing access to their complete investigation report that contains much more detail and photos and can be found at: www.aps.com/mcmicken

The potential for and impact of the contributing factors to this event were not well known at the time this BESS was commissioned, so these risks were not addressed in the design of that system even though it was constructed according to the standards at the time. Energy storage is a vital (but maturing) technology and entities need to consider these findings and the risk of similar events in their own storage implementations. Standards and regulations have developed slower than the technology and still need some improvement. As a result of this event, the NFPA 855 standard is making progress and now addresses several of these learnings.

Until NFPA 855 has been finalized, entities owning BESS should consider:

- The key to managing risk associated with the installation of a BESS focuses on a hazard mitigation analysis. This will identify gaps along with the appropriate control measures like design modifications, suppression, and training.
- The fire services should not be seeing a BESS for the first time when 911 is called. Consideration should be given to developing a pre-incident guide which will serve as the mutual platform for future training of utility personnel and the fire services.
- Conduct training, familiarization tours and exercises with your local fire department. The approach laid out in previous [NERC Lesson Learned 20190202 “Substation Fires: Working with First Responders”](#) can be used as a template.

NERC contacted an industry substation fire expert who had additional suggestions:

- A registered fire protection engineering firm should perform a hazard mitigation analysis that includes a review of the UL 9540a test data.
- As a best practice, consider following NFPA 68 guidelines for the installation of deflagration venting on future BESS installations.
- Discontinue use of clean agents as a method of suppression.
- Install a fire alarm control panel in a remote location in the facility to allow fire department to monitor conditions without being in harm's way.
- The panel should have also flammable gas monitoring capabilities along with a purge control feature.
- Install a class 1 /division 1 purge system.
- The design of the BESS container should consider garage type doors that would facilitate suppression operations without having to enter the container
- A fire protection engineering firm should also produce a Pre-incident guide (NFPA 1620) that outlines the hazards and response tactics that should be employed during an incident.
- Training should be provided. This will guide both the utility and fire services as to the appropriate actions when responding to low frequency high hazards events, such as BESS emergencies.
- Prior to placing a BESS in service, a familiarization tour should be conducted with local fire services along with any specialized units, such as hazmat, who may respond during an incident.
- Consider conducting an annual exercise with the members of the first response community to validate the plan or identify gaps.

NERC's goal with publishing lessons learned is to provide industry with technical and understandable information that assists them with maintaining the reliability of the BPS. NERC is asking entities who have taken action on this lesson learned to respond to the short survey provided in the link below.



Click here for: [Lesson Learned Comment Form](#)

For more information please contact:

[NERC – Lessons Learned](#) (via email)

Lesson Learned #: 20210301

Date Published: March 29, 2021

Category: Transmission Facilities

This document is designed to convey lessons learned from NERC's various activities. It is not intended to establish new requirements under NERC's Reliability Standards or to modify the requirements in any existing Reliability Standards. Compliance will continue to be determined based on language in the NERC Reliability Standards as they may be amended from time to time. Implementation of this lesson learned is not a substitute for compliance with requirements in NERC's Reliability Standards.

EXHIBIT A.2.4
NERC REQUIREMENTS

The following tables describes the minimum NERC requirements.

Table 1: FAC – 008 NERC Standard Requirements

NERC Standard Title	Facility Ratings
Requirement	R1, R6
Standard Summary	Ensure Facility ratings used are determined based on technically sound principles.
Reference	EPR 5.200 Facility Rating and Reporting, EPR-5.220P01 NERC Facility Rating Methodology
Responsible Party	Contractor to develop the report.
Required Evidence	Comprehensive report including equipment and conductor ratings from individual generators to point of interconnection including current transformer ratings. Report to be submitted as part of 90% design documents

Table 2: MOD – 025 NERC Standard Requirement

NERC Standard Title	Verification and Data Reporting of Generator Real and Reactive Power Capability and Synchronous Condenser Reactive Power Capability
Requirement	R1, R2
Standard Summary	Ensure accurate information on generator gross and net Real and Reactive Power capability and synchronous condenser Reactive Power capability is available for planning models.
Reference	EPR 5.201S Stability Modeling Data Maintenance and Reporting Requirements
Responsible Party	Contractor to develop test plan and complete the necessary documentation after testing is complete. Owner will conduct the test and collect the data.
Required Evidence	Comprehensive report including test plan and test results for MOD-025 testing Report to be submitted within 60 days following substantial completion.

Table 3: MOD – 026 NERC Standard Requirements

NERC Standard Title	Verification of Models and Data for Generator Excitation Control System or Plant Volt/VAR Control Functions
Requirement	R2, R4
Standard Summary	Verify the generator excitation control system or plant volt/var control function model and the model parameters used in dynamic simulations accurately represent the generator excitation control system or plant volt/var control function behavior.
Reference	EPR 5.201S Stability Modeling Data Maintenance and Reporting Requirements
Responsible Party	Contractor to develop a test plan in consultation with the MOD-026 modeling company (Electric Power Engineers (EPE) or owner approved equal). The test plan is to be submitted to the Owner for approval. Contractor to coordinate and conduct the test and collect the data required
Required Evidence	Comprehensive report including modeling of the Var/Volt Control and verification testing of the model per MOD-026. Report due within 60 days following substantial completion.

Table 4: MOD – 027 NERC Standard Requirements

NERC Standard Title	Verification of Models and Data for Turbine/Governor and Load Control or Active Power/Frequency Control Functions
Requirement	R2, R4
Standard Summary	Verify the turbine/governor and load control or active power/frequency control model and model parameters used in dynamic simulations accurately represent generator unit real power response to system frequency variations.
Reference	EPR 5.201S Stability Modeling Data Maintenance and Reporting Requirements
Responsible Party	Contractor to develop a test plan in consultation with the MOD-027 modeling company (Electric Power Engineers (EPE) or owner approved equal). The test plan is to be submitted to the owner for approval. Contractor to coordinate and conduct the test and collect the data required.
Required Evidence	Comprehensive report including modelling the active power / frequency control and verification testing of the model to meet MOD-027. Report due within 60 days following substantial completion.

Table 5: PRC – 005 NERC Standard Requirements

NERC Standard Title	Protection System Maintenance
Requirement	Testing plan designed to assist with Owner’s compliance with PRC-005 to be submitted for Owner’s review and approval prior to testing activities. Final report including all Required Evidence.
Standard Summary	Document and implement programs for the maintenance of all Protection Systems affecting the reliability of the BES so that these Protection Systems are kept in working order.
Reference	EPR 5.704S Battery Maintenance Standard EPR 5.714S Protective Relay Maintenance Standard
Responsible Party	Contractor shall produce all of the necessary documentation.
Required Evidence	Settings files for all protective relays Documentation of testing proving functionality of A/D converters in relays and relay inputs and outputs. Documentation of instrument transformer testing including wiring to relays. Load check of relays when at power to prove proper relay receipt of instrument transformer signal. Documentation of functional testing of control circuitry from the relay output through the trip coils of actuated circuit breakers. Documentation of testing of protection system communication systems – lines interconnecting to remote substations. Completion of initial battery testing including capacity testing. Commissioning testing of substation including end to end testing of line relaying. Written testing procedure to be submitted for review. All documentation submitted to Owner for review two weeks prior to Commercial Operation Date.

Table 6: PRC – 019 NERC Standard Requirements

NERC Standard Title	Coordination of Generating Unit or Plant Capabilities, Voltage Regulating Controls, and Protection
Requirement	R1 [Note that R2 Requirements falls under the Owner’s responsibilities following the project going into commercial operation]
Standard Summary	Verify coordination of generating unit Facility or synchronous condenser voltage regulating controls, limit functions, equipment capabilities and Protection System settings.
Reference	EPR 5.202S NERC Protection System Coordination, Relay Setting, and Reporting Requirements
Responsible Party	Contractor
Required Evidence	Provide evidence of coordinating the voltage regulating system controls, including in-service limiters and protection functions, with the applicable equipment capabilities and settings of the applicable Protection System devices and functions as specified in Requirement R1. The first draft of the report to be completed and approved by Owner as part of the 90% submittal data. The final version is issued as an IFC document.

Table 7: PRC – 024 NERC Standard Requirements

NERC Standard Title	Generator Frequency and Voltage Protective Relay Settings
Requirement	R1, R2, R3
Standard Summary	Ensure that generator protective relays are set such that generating units remain connected during defined frequency and voltage excursions.
Reference	EPR 5.202S NERC Protection System Coordination, Relay Setting, and Reporting Requirements
Responsible Party	Contractor
Required Evidence	Comprehensive report of evidence that relay settings meet PRC-024 voltage and frequency ride through requirements. The first draft of the report to be completed and approved by Owner as part of the 90% submittal data. The final version is issued as an IFC document.

Table8: PRC – 025 NERC Standard Requirements

NERC Standard Title	Generator Relay Loadability
Requirement	R1
Standard Summary	Set load-responsive protective relays associated with generation Facilities at a level to prevent unnecessary tripping of generators during a system disturbance for conditions that do not pose a risk of damage to the associated equipment.
Reference	EPR 5.202S NERC Protection System Coordination, Relay Setting, and Reporting Requirements
Responsible Party	Contractor
Required Evidence	Comprehensive report of evidence that relay settings are set per PRC-025 methodology for applicable relay type, application, and anticipated loads. The first draft of the report to be completed and approved by Owner as part of the 90% submittal data. The final version is issued as an IFC document.

Table 9: PRC – 027 NERC Standard Requirements

NERC Standard Title	Coordination of Protection Systems for Performance During Faults
Requirement	R1, R3
Standard Summary	Set protection relays so that they operate in their intended sequence during faults.
Reference	EPR 5.202S NERC Protection System Coordination, Relay Setting, and Reporting Requirements
Responsible Party	Contractor and Owner shall document coordination with the transmission owner. Contactor shall provide the relay coordination study that has been developed per a process meeting the requirements of R1.
Required Evidence	Provide a relay coordination study per PRC-027. Provide documentation that Transmission Owner has reviewed and approved Project Engineer of Record (EOR) provided settings applied for the protection of the interconnecting element and that Project EOR has reviewed and approved Transmission Owner provided settings applied by the Transmission Owner for protection of the interconnecting element. This study should also include validation that relay setpoints in the PRC-027 Coordination study match those in the studies for PRC-019, “Coordination of Generating Unit or Plant Capabilities, Voltage Regulating Controls, and Protection”; PRC-024, “Generator Frequency and Voltage Protective Relay Settings”; and PRC-025, “Generator Relay Loadability”. This includes protective relaying associated with aggregating system and step-up transformers. PRC-027 portion of relay coordination study to be completed and approved by Owner as part of the 90% electrical design submittal data. The final version is issued as an IFC document.

Exhibit A.3 – Approved Suppliers v3
Xcel Draft (rev A), 20240429

EXHIBIT A.3
APPROVED SUPPLIERS

1.0 GENERAL

- 1.1.1 This exhibit contains a list of approved materials, equipment suppliers, and subcontractors. If Contractor is considering the selection of a material, equipment supplier, or subcontractor that is not listed herein, Contractor shall request approval from Owner prior to executing any contract for the procurement of such material or with such equipment supplier or subcontractor. Equipment catalog cut sheets shall be submitted for Owner review and approval prior to procurement.

2.0 DEFINITIONS

- 2.1 Unless defined in this exhibit, terms that begin with an upper case shall have the meaning defined in Exhibit A.1.

3.0 APPROVED SUPPLIERS

- 3.1 The following is a list of approved suppliers for certain aspects of the Project.

3.1.1 Approved Main-power Transformer Suppliers (as applicable):

- (1) HICO (Memphis, TN; Changwon, South Korea)
- (2) GE Prolec (Waukesha, WI)
- (3) Siemens (Guanajuato, Mexico)
- (4) Hyundai (Montgomery, AL; Ulsan, South Korea)

3.1.2 Approved Medium-voltage Pad-mounted Transformer Suppliers:

- (1) GE Prolec
- (2) Hitachi
- (3) ERMCO
- (4) Eaton-Cooper

3.1.3 Approved Medium-voltage Pad-mounted Box Pad Suppliers:

- (1) Nordic
- (2) Highline
- (3) Oldcastle
- (4) Concast Inc.

Exhibit A.3 – Approved Suppliers v3
Xcel Draft (rev A), 20240429

3.1.4 Approved Capacitor Bank and Capacitor Switcher Suppliers:

- (1) Cooper Power Systems
- (2) Southern States
- (3) GE
- (4) Eaton

3.1.5 Approved High-voltage Circuit Breaker Suppliers:

- (1) General Electric Energy Services
- (2) Hitachi
- (3) Siemens

3.1.6 Approved Medium-voltage Circuit Breaker Suppliers:

- (1) Hitachi
- (2) Siemens
- (3) Myers Power Products

3.1.7 Approved Motor Operated Disconnect Switch Suppliers:

- (1) Southern States
- (2) Royal

3.1.8 Approved Interconnection Line Insulator Suppliers:

- (1) Hubbell
- (2) MacLean

3.1.9 Approved Interconnection Line Hardware Suppliers:

- (1) Anderson
- (2) Fargo
- (3) Hubbell
- (4) Hughes Brothers

3.1.10 Approved Interconnection Line / Substation Pole Suppliers:

- (1) Meyer-Thomas and Betts

Exhibit A.3 – Approved Suppliers v3
Xcel Draft (rev A), 20240429

(2) Sabre-Ft. Worth Tower

(3) Valmont Industries

(4) Camelot

3.1.11 Approved Interconnection Line Optical Ground Wire (OPGW) Suppliers:

(1) AFL

(2) Suzhou Furukawa Power Optic Cable (SFPOC)

3.1.12 Approved Armor Grip Suspension Suppliers:

(1) Preformed Line Products

3.1.13 Approved Electrical Equipment Enclosure Suppliers:

(1) Powell

(2) AZZ

(3) Crown Technical Systems

(4) Trachte

(5) Systems Control

3.1.14 Approved Grounding Transformer Suppliers:

(1) GE Prolec

(2) Hitachi

3.1.15 Approved Lighting Suppliers:

(1) Crouse Hinds

(2) Lithonia

(3) Holophane

(4) GE

3.1.16 Approved Auxiliary Relay Suppliers:

(1) Allen-Bradley

(2) Cutler-Hammer

(3) GE

Exhibit A.3 – Approved Suppliers v3
Xcel Draft (rev A), 20240429

- (4) Potter-Brumfield

3.1.17 Approved Protective Relay Suppliers:

- (1) Schweitzer Engineering Laboratories, Inc. (SEL)
- (2) Electroswitch

3.1.18 Approved Relay Panel Suppliers:

- (1) SEL
- (2) Electrical Power Products (EP2)
- (3) Systems Control
- (4) Western Controls
- (5) Keystone

3.1.19 Approved Battery Suppliers:(125VDC)

- (1) C&D
- (2) GNB
- (3) Exide
- (4) BAE
- (5) Varta

3.1.20 Approved Battery Charger Suppliers (125VDC)

- (1) Exide
- (2) Ametek

3.1.21 Approved Terminal Block Suppliers:

- (1) Allen-Bradley
- (2) Cutler-Hammer
- (3) GE
- (4) Potter-Brumfield

3.1.22 Approved Panelboard Suppliers:

- (1) Cutler-Hammer

Exhibit A.3 – Approved Suppliers v3
Xcel Draft (rev A), 20240429

- (2) GE
- (3) Square-D
- (4) ABB

3.1.23 Approved Cable Tray Suppliers:

- (1) B-Line
- (2) PW Industries
- (3) T&B

3.1.24 Approved 34.5kV Underground Splice Suppliers:

- (1) 3M

3.1.25 Approved 34.5kV Terminations Suppliers:

- (1) Tyco
- (2) 3M
- (3) Richards
- (4) Cooper

3.1.26 Approved 34.5 kV Elbow Arrester Suppliers:

- (1) Cooper
- (2) Hubbell Power Systems
- (3) Richards

3.1.27 Approved PT and CCVT Suppliers:

- (1) Kuhlman
- (2) Hitachi
- (3) Trench
- (4) Alstom
- (5) Artech
- (6) ITEC

3.1.28 Approved Junction Box Suppliers:

Exhibit A.3 – Approved Suppliers v3
Xcel Draft (rev A), 20240429

(1) Nordic

(2) Highline

3.1.29 Approved Low-voltage (<1,500 V) Cable Suppliers:

(1) American Wire Group

(2) Anixter

(3) BICC/Cablec

(4) General Cable

(5) Houston Wire and Cable

(6) Okonite

(7) Southwire

3.1.30 Approved Medium-voltage (34.5 kV) Cable Suppliers:

(1) General Cable

(2) Prysmian

(3) Synergy

(4) Southwire

(5) WTEC

3.1.31 Approved Fiber Optic Cable Suppliers:

(1) Commscope

(2) Furukawa

(3) Brugg

3.1.32 Approved Current and Voltage Test Switches:

(1) ABB flexitest switch

3.1.33 Approved 34.5kV Potential Transformers:

(1) ABB type VOG-20BR

3.1.34 Approved Low-voltage power breakers:

(1) ABB SACE Emax

Exhibit A.3 – Approved Suppliers v3
Xcel Draft (rev A), 20240429

3.1.35 Approved PV Array Modules:

- (1) PV Array Module manufacturers must be rated CC++ or higher in the most recent PV-tech research “PV ModuleTech Bankability Ratings Pyramid”. [Top 50 most bankable module suppliers in the PV industry today - PV Tech \(pv-tech.org\)](https://pv-tech.org/top-50-most-bankable-module-suppliers-in-the-pv-industry-today)
- (2) PV Array Module manufacturer shall contractually certify that the supplied product will be supplied outside of or compliant with antidumping and countervailing duties (AD/CVD).
- (3) PV Array Module manufacturer shall contractually certify all named parties in the Withhold Release Orders (WRO) are excluded from manufacturer’s supply chain.
- (4) PV Array Module manufacturer shall contractually certify any suppliers impacted by the Uyghur Forced Labor Prevention Act (UFLPA) are excluded from manufacturer’s supply chain.
- (5) Contractor to provide 0.1 percent of the modules installed to Owner for spares or a minimum of two pallets of modules.

3.1.36 Approved Solar Inverter Suppliers:

- (1) Sungrow
- (2) SMA

3.1.37 Approved Tracker Suppliers:

- (1) Array Technologies (ATI) (Location dependent based upon site hail conditions)
- (2) NEXTracker

3.1.38 Approved PV Module Racking Suppliers:

- (1) GameChange Solar
- (2) NEXTracker
- (3) Array Technologies, Inc. (ATI)
- (4) Soltec
- (5) PV Hardware

3.1.39 Approved Solar, BESS SCADA Suppliers (including MET station equipment and monitoring)

- (1) Ulteig

3.1.40 Approved CAB Messenger Wire Suppliers:

- (1) CAB Products

Exhibit A.3 – Approved Suppliers v3
Xcel Draft (rev A), 20240429

3.1.41 Approved Parallel Harness Suppliers:

- (1) Shoals Technologies Group

3.1.42 Approved Trunk Bus (BLA) Suppliers:

- (1) Shoals Technologies Group

3.1.43 Approved DC Combiner Box Suppliers:

- (1) Sunlink
- (2) SolarBOS
- (3) Shoals
- (4) Amphenol
- (5) Bentek Solar

3.1.44 3.1.37 Approved Recombiner Box Suppliers (if required):

- (1) Sunlink
- (2) SolarBOS
- (3) Shoals
- (4) Amphenol
- (5) Bentek Solar

3.1.45 Approved Solar / BESS Power Plant Controller Suppliers:

- (1) Ulteig

3.1.46 Approved Storage PCS Suppliers

- (1) Sungrow
- (2) SMA

3.1.47 Approved BESS Integrators

- (1) Flexgen
- (2) Borrego
- (3) Sungrow

3.1.48 Approved BESS Battery Cell Suppliers

Exhibit A.3 – Approved Suppliers v3
Xcel Draft (rev A), 20240429

- (1) CATL

3.1.49 Approved wind turbine manufacturers

- (1) Vestas
- (2) GE

3.1.50 Approved wind turbine tower service lift suppliers:

- (1) 3S Lift CF-120E Climb Auto System including a lift platform, guide rail, control system, traction/motor unit, lift cable, and step up pedal.

3.1.51 Approved Wind turbine and MET tower ADLS Radar suppliers:

- (1) Terma
- (2) DeTect

3.1.52 Approved ADLS Strobe Light System suppliers:

- (1) Techno Strobe

4.0 APPROVED SUBCONTRACTORS

4.1 The following is a list of approved suppliers for certain aspects of the Project. Any deviations from this list shall be explicitly approved by Owner. RFP Clarification: Bidder to supply a list of any subcontractors proposed for the Work with a contract total over \$100,000. Owner will explicitly approve or disapprove of Bidder's proposed list.

4.1.1 Electrical engineering:

- (1) Burns & McDonnell (Substation, Interconnection line)
- (2) HDR Engineering (Substation)
- (3) P&E Engineering (Wind Collection System)
- (4) Power Engineers (Substation, Interconnection Line)
- (5) Ulteig (Substation, Interconnection Line, Wind Collection System, Solar PV Array, BESS Collection System)
- (6) Westwood (Solar PV Array)
- (7) RRC (Solar PV Array)
- (8) RFP Clarification: Bidder to provide any additional subcontractors that are proposed

4.1.2 Electrical commissioning and testing:

Commented [GJ1]: Substation also uses Sargent & Lundy and possibly B&V

Exhibit A.3 – Approved Suppliers v3
Xcel Draft (rev A), 20240429

- (1) CE Power
- (2) High Voltage Service
- (3) L&S Electric
- (4) EPS
- (5) RFP Clarification: Bidder to provide any additional subcontractors that are proposed

4.1.3 Civil and Geotechnical engineering:

- (1) Westwood
- (2) Barr
- (3) RRC
- (4) RFP Clarification: Bidder to provide any additional subcontractors that are proposed

4.1.4 Soil thermal resistivity testing:

- (1) Geotherm

4.1.5 Civil works:

- (1) Borneke
- (2) RFP Clarification: Bidder to provide any additional subcontractors that are proposed

4.1.6 Communications engineering:

- (1) RFP Clarification: Bidder to provide subcontractor list

4.1.7 Communications work:

- (1) RFP Clarification: Bidder to provide subcontractor list

EXHIBIT A.3
APPROVED SUPPLIERS

1.0 GENERAL

- 1.1.1 This exhibit contains a list of approved materials, equipment suppliers, and subcontractors. If Contractor is considering the selection of a material, equipment supplier, or subcontractor that is not listed herein, Contractor shall request approval from Owner prior to executing any contract for the procurement of such material or with such equipment supplier or subcontractor. Equipment catalog cut sheets shall be submitted for Owner review and approval prior to procurement.

2.0 DEFINITIONS

- 2.1 Unless defined in this exhibit, terms that begin with an upper case shall have the meaning defined in Exhibit A.1.

3.0 APPROVED SUPPLIERS

- 3.1 The following is a list of approved suppliers for certain aspects of the Project.

3.1.1 Approved Main-power Transformer Suppliers (as applicable):

- (1) HICO (Memphis, TN; Changwon, South Korea)
- (2) GE Prolec (Waukesha, WI)
- (3) Siemens (Guanajuato, Mexico)
- (4) Hyundai (Montgomery, AL; Ulsan, South Korea)

3.1.2 Approved Medium-voltage Pad-mounted Transformer Suppliers:

- (1) GE Prolec
- (2) Hitachi
- (3) ERMCO
- (4) Eaton-Cooper

3.1.3 Approved Medium-voltage Pad-mounted Box Pad Suppliers:

- (1) Nordic
- (2) Highline
- (3) Oldcastle
- (4) Concast Inc.

Exhibit A.3 – Approved Suppliers v3
Xcel Draft (rev B), 20240606

3.1.4 Approved Capacitor Bank and Capacitor Switcher Suppliers:

- (1) Cooper Power Systems
- (2) Southern States
- (3) GE
- (4) Eaton

3.1.5 Approved High-voltage Circuit Breaker Suppliers:

- (1) General Electric Energy Services
- (2) Hitachi
- (3) Siemens

3.1.6 Approved Medium-voltage Circuit Breaker Suppliers:

- (1) Hitachi
- (2) Siemens
- (3) Myers Power Products
- (4) GE

3.1.7 Approved Motor Operated Disconnect Switch Suppliers:

- (1) Southern States
- (2) Royal

3.1.8 Approved Interconnection Line Insulator Suppliers:

- (1) Hubbell
- (2) MacLean

3.1.9 Approved Interconnection Line Hardware Suppliers:

- (1) Anderson
- (2) Fargo
- (3) Hubbell
- (4) Hughes Brothers

3.1.10 Approved Interconnection Line / Substation Pole Suppliers:

Exhibit A.3 – Approved Suppliers v3
Xcel Draft (rev B), 20240606

- (1) Meyer-Thomas and Betts
- (2) Sabre-Ft. Worth Tower
- (3) Valmont Industries
- (4) Camelot

3.1.11 Approved Interconnection Line Optical Ground Wire (OPGW) Suppliers:

- (1) AFL
- (2) Suzhou Furukawa Power Optic Cable (SFPOC)

3.1.12 Approved Armor Grip Suspension Suppliers:

- (1) Preformed Line Products

3.1.13 Approved Electrical Equipment Enclosure Suppliers:

- (1) Powell
- (2) AZZ
- (3) Crown Technical Systems
- (4) Trachte
- (5) Systems Control

3.1.14 Approved Grounding Transformer Suppliers:

- (1) GE Prolec
- (2) Hitachi

3.1.15 Approved Lighting Suppliers:

- (1) Crouse Hinds
- (2) Lithonia
- (3) Holophane
- (4) GE

3.1.16 Approved Auxiliary Relay Suppliers:

- (1) Allen-Bradley
- (2) Cutler-Hammer

Exhibit A.3 – Approved Suppliers v3
Xcel Draft (rev B), 20240606

- (3) GE
- (4) Potter-Brumfield

3.1.17 Approved Protective Relay Suppliers:

- (1) Schweitzer Engineering Laboratories, Inc. (SEL)
- (2) Electroswitch

3.1.18 Approved Relay Panel Suppliers:

- (1) SEL
- (2) Electrical Power Products (EP2)
- (3) Systems Control
- (4) Western Controls
- (5) Keystone

3.1.19 Approved Battery Suppliers:(125VDC)

- (1) C&D
- (2) GNB
- (3) Exide
- (4) BAE
- (5) Varta

3.1.20 Approved Battery Charger Suppliers (125VDC)

- (1) Exide
- (2) Ametek

3.1.21 Approved Terminal Block Suppliers:

- (1) Allen-Bradley
- (2) Cutler-Hammer
- (3) GE
- (4) Potter-Brumfield

3.1.22 Approved Panelboard Suppliers:

Exhibit A.3 – Approved Suppliers v3
Xcel Draft (rev B), 20240606

- (1) Cutler-Hammer
- (2) GE
- (3) Square-D
- (4) ABB

3.1.23 Approved Cable Tray Suppliers:

- (1) B-Line
- (2) PW Industries
- (3) T&B

3.1.24 Approved 34.5kV Underground Splice Suppliers:

- (1) 3M

3.1.25 Approved 34.5kV Terminations Suppliers:

- (1) Tyco
- (2) 3M
- (3) Richards
- (4) Cooper

3.1.26 Approved 34.5 kV Elbow Arrester Suppliers:

- (1) Cooper
- (2) Hubbell Power Systems
- (3) Richards

3.1.27 Approved PT and CCVT Suppliers:

- (1) Kuhlman
- (2) Hitachi
- (3) Trench
- (4) Alstom
- (5) Artech
- (6) ITEC

Exhibit A.3 – Approved Suppliers v3
Xcel Draft (rev B), 20240606

3.1.28 Approved Junction Box Suppliers:

- (1) Nordic
- (2) Highline

3.1.29 Approved Low-voltage (<1,500 V) Cable Suppliers:

- (1) American Wire Group
- (2) Anixter
- (3) BICC/Cablec
- (4) General Cable
- (5) Houston Wire and Cable
- (6) Okonite
- (7) Southwire

3.1.30 Approved Medium-voltage (34.5 kV) Cable Suppliers:

- (1) General Cable
- (2) Prysmian
- (3) Synergy
- (4) Southwire
- (5) WTEC

3.1.31 Approved Fiber Optic Cable Suppliers:

- (1) Commscope
- (2) Furukawa
- (3) Brugg

3.1.32 Approved Current and Voltage Test Switches:

- (1) ABB flexitest switch

3.1.33 Approved 34.5kV Potential Transformers:

- (1) ABB type VOG-20BR

3.1.34 Approved Low-voltage power breakers:

- (1) ABB SACE Emax

3.1.35 Approved PV Array Modules:

- (1) PV Array Module manufacturers must be rated CC++ or higher in the most recent PV-tech research “PV ModuleTech Bankability Ratings Pyramid”. [Top 50 most bankable module suppliers in the PV industry today - PV Tech \(pv-tech.org\)](https://www.pv-tech.org/top-50-most-bankable-module-suppliers-in-the-pv-industry-today)
- (2) PV Array Module manufacturer shall contractually certify that the supplied product will be supplied outside of or compliant with antidumping and countervailing duties (AD/CVD).
- (3) PV Array Module manufacturer shall contractually certify all named parties in the Withhold Release Orders (WRO) are excluded from manufacturer’s supply chain.
- (4) PV Array Module manufacturer shall contractually certify any suppliers impacted by the Uyghur Forced Labor Prevention Act (UFLPA) are excluded from manufacturer’s supply chain.
- (5) Contractor to provide 1.0 percent of the modules installed to Owner for spares or a minimum of two pallets of modules.

3.1.36 Approved Solar Inverter Suppliers:

- (1) Sungrow
- (2) SMA

3.1.37 Approved Tracker Suppliers:

- (1) Array Technologies (ATI) (Location dependent based upon site hail conditions)
- (2) NEXTracker

3.1.38 Approved PV Module Racking Suppliers:

- (1) GameChange Solar
- (2) NEXTracker
- (3) Array Technologies, Inc. (ATI)
- (4) Soltec
- (5) PV Hardware

3.1.39 Approved Solar, BESS SCADA Suppliers (including MET station equipment and monitoring)

- (1) Ulteig

3.1.40 Approved CAB Messenger Wire Suppliers:

Exhibit A.3 – Approved Suppliers v3
Xcel Draft (rev B), 20240606

- (1) CAB Products

3.1.41 Approved Parallel Harness Suppliers:

- (1) Shoals Technologies Group

3.1.42 Approved Trunk Bus (BLA) Suppliers:

- (1) Shoals Technologies Group

3.1.43 Approved DC Combiner Box Suppliers:

- (1) Sunlink
- (2) SolarBOS
- (3) Shoals
- (4) Amphenol
- (5) Bentek Solar

3.1.44 3.1.37 Approved Recombiner Box Suppliers (if required):

- (1) Sunlink
- (2) SolarBOS
- (3) Shoals
- (4) Amphenol
- (5) Bentek Solar

3.1.45 Approved Solar / BESS Power Plant Controller Suppliers:

- (1) Ulteig

3.1.46 Approved Storage PCS Suppliers

- (1) Sungrow
- (2) SMA

3.1.47 Approved BESS Integrators

- (1) Flexgen
- (2) Borrego
- (3) Sungrow

3.1.48 Approved BESS Battery Cell Suppliers

- (1) CATL

3.1.49 Approved wind turbine manufacturers

- (1) Vestas
- (2) GE

3.1.50 Approved wind turbine tower service lift suppliers:

- (1) 3S Lift CF-120E Climb Auto System including a lift platform, guide rail, control system, traction/motor unit, lift cable, and step up pedal.

3.1.51 Approved Wind turbine and MET tower ADLS Radar suppliers:

- (1) Terma
- (2) DeTect

3.1.52 Approved ADLS Strobe Light System suppliers:

- (1) Techno Strobe

4.0 APPROVED SUBCONTRACTORS

4.1 The following is a list of approved suppliers for certain aspects of the Project. Any deviations from this list shall be explicitly approved by Owner. RFP Clarification: Bidder to supply a list of any subcontractors proposed for the Work with a contract total over \$100,000. Owner will explicitly approve or disapprove of Bidder's proposed list.

4.1.1 Electrical engineering:

- (1) Burns & McDonnell (Substation, Interconnection line)
- (2) HDR Engineering (Substation)
- (3) P&E Engineering (Wind Collection System)
- (4) Power Engineers (Substation, Interconnection Line)
- (5) Ulteig (Substation, Interconnection Line, Wind Collection System, Solar PV Array, BESS Collection System)
- (6) Westwood (Solar PV Array)
- (7) RRC (Solar PV Array)
- (8) RFP Clarification: Bidder to provide any additional subcontractors that are proposed

4.1.2 Electrical commissioning and testing:

- (1) CE Power
- (2) High Voltage Service
- (3) L&S Electric
- (4) EPS
- (5) RFP Clarification: Bidder to provide any additional subcontractors that are proposed

4.1.3 Civil and Geotechnical engineering:

- (1) Westwood
- (2) Barr
- (3) RRC
- (4) RFP Clarification: Bidder to provide any additional subcontractors that are proposed

4.1.4 Soil thermal resistivity testing:

- (1) Geotherm

4.1.5 Civil works:

- (1) Borneke
- (2) RFP Clarification: Bidder to provide any additional subcontractors that are proposed

4.1.6 Communications engineering:

- (1) RFP Clarification: Bidder to provide subcontractor list

4.1.7 Communications work:

- (1) RFP Clarification: Bidder to provide subcontractor list

EXHIBIT A.4

SCHEDULE REQUIREMENTS

1.0 GENERAL

- 1.1 Without limiting the information summarized herein, the purpose of this attachment is to summarize the minimum contents and requirements for the Contractor-prepared Project Schedule.

2.0 DEFINITIONS

- 2.1 Unless defined in this exhibit, terms that begin with an upper case shall have the meaning defined in Exhibit A.1 (*Scope of Work*).
- 2.2 For purposes of only this attachment, the following words shall have the respective meanings set forth below.
- (1) “**Activity**” means a discrete part of a contract that can be identified for planning, scheduling, monitoring, and controlling the construction Work. Activities included in a construction schedule consume time and resources but shall not include planned work stoppages. Activities shall not normally reflect the Work of more than one trade.
 - (2) “**Baseline**” schedule means the initial Project Schedule, as approved by Owner.
 - (3) “**Critical path**” means the longest sequence of activities in a project plan which must be completed on time for that project to complete by the stated due date.
 - (4) “**Critical path method**” or “**CPM**” means a method of planning and scheduling a construction contract where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Agreement.
 - (5) “**Float**” means the measure of leeway in starting and completing an activity. Float time (including total float) is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly-owned, expiring Project resource available to both parties as needed to meet schedule milestones and Agreement completion date.
 - (6) “**Predecessor activity**” means an activity that precedes another activity in the network.
 - (7) “**Resource loading**” means the allocation of manpower, equipment, or material necessary for the completion of an activity as scheduled.
 - (8) “**Successor activity**” means an activity that follows another activity in the network.
 - (9) “**Total float**” is the measure of leeway in starting or completing an activity without adversely affecting an intermediate deadline or the planned Agreement completion date.
 - (10) “**Milestone**” means the Guaranteed Milestone as defined in the Agreement.

3.0 GENERAL REQUIREMENTS

- 3.1 Contractor’s accepted Baseline schedule will be set forth in Exhibit G.3 (*Project Schedule*).
- 3.2 The Project Schedule shall take into consideration any limitations on certain work activities’ start

and/or stop time per any of the Applicable Permits or other requirements from any AHJ. Such limitations shall be explicitly called out and communicated to Project teams as necessary.

- 3.3 Contractor shall utilize Primavera Professional Project Management Software from Oracle for preparation of the Project Schedule. At a minimum, this shall be a version compatible with version 19.12.
- 3.4 Activities in the Project Schedule shall be defined so that no single construction activity is longer than 20 calendar days and no single other activity is longer than 30 calendar days, respectively, unless specifically allowed by Owner.
- 3.5 The Project Schedule shall include a clear and logical work breakdown structure, wherein all items are assigned a sensible activity number based upon the type of work being performed. Such work breakdown structure shall be subject to approval by Owner. Activity numbering shall be such that predecessor activity numbers are smaller numerically than successor activity numbers in the Baseline Project Schedule. Contractor shall use even-numbered activities for base Agreement Work, and odd-numbered activities for change order work. No activity number shall change after approval of the Baseline Project Schedule.
- 3.6 Procurement process activities shall be included for all long-lead and major items (as defined by Owner) as separate activities in the Project Schedule. Procurement cycle activities shall include, but not be limited to, submittals, approvals, purchasing, fabrication, and delivery.
- 3.7 The Project Schedule shall indicate important stages of construction for each major portion of the Work, including, but not limited to, the following: (a) preparation and processing of submittals; (b) mobilization and demobilization; (c) acquisition of key permits; (d) purchase, fabrication, and delivery of major equipment; (e) installation; (f) utility interruptions; (g) tests and inspections; (h) startup and initial operations; (i) work by Owner that may affect or be affected by Contractor's activities; and (j) training.
- 3.8 The Project Schedule shall include Milestones indicated in the Agreement. All major milestones shall be presented at the top of the Project Schedule.
- 3.9 The Project Schedule shall show the Work in Gantt chart format, on a sheet size of 11-inch by 17-inch, the scale and spacing shall allow room for notation and revisions, and the font shall be sized such that it is easily legible when printed.
- 3.10 Each revised or updated Project Schedule shall show actual progress compared to the originally-accepted Baseline schedule and any proposed changes in the schedule of remaining Work.
- 3.11 The Project Schedule shall clearly identify all critical path activities. Scheduled start and completion dates shall be consistent with Agreement milestone dates.
- 3.12 Contractor shall not use artificial activity durations, preferential logic, or other devices for sequestering Float. Owner retains the right to reject any schedule submittal in which Contractor has sequestered Float. Any activity with lag greater than two (2) days shall be identified in the activity description.
- 3.13 Constraint dates shall be kept to a minimum, and all constraints shall be identified with descriptive text in the activity description.

- 3.14 All activities shall have a predecessor activity and successor activity except for the first and last activities in the Project Schedule.
- 3.15 Each Project Schedule shall meet the minimum requirements for submittals set forth in Exhibit A.5 (Submittal Requirements) to this exhibit.
- 3.16 The Project Schedule shall include and identify allowances for delays that may be encountered for reasonably-expected weather conditions, non-working holidays, scheduled non-working days (e.g., Sundays), and other similar items.
- 3.17 The Project Schedule shall indicate the assumed working days, hours, and shifts per week.

4.0 REPORTING

- 4.1 Concurrent with each Project Schedule submittal, Contractor shall submit the following reports. Each such report shall contain, at a minimum, activity number, activity description, resource loading, original duration, remaining duration, early finish date, late start date, late finish date (or actual start date and/or actual finish date, as applicable), and total float in calendar days.
 - (1) General: electronic copies of the complete Project Schedule file in P6 executable (*.xer) format (including the Project-specific *.plf layout filters) and Adobe (*.pdf) format, respectively.
 - (2) Critical path report: list of all activities on critical path, sorted in ascending order by activity number.
 - (3) Activity report: list of all activities sorted by activity number and then start date, or actual start date if known. Within each activity, Contractor shall indicate estimated completion percentage in no greater than 10 percent (10%) increments.
 - (4) Logic report: list of preceding and succeeding activities for all activities, sorted in ascending order by activity number.
 - (5) Total float report: list of all activities sorted in ascending order by activity number and showing total float by activity.
 - (6) Three-week look ahead: list of all planned Work activities during the current week and the subsequent two-week interval, sorted in ascending order by activity number.
 - (7) Tabulated reports and/or schedule layouts showing the following: (a) identification of activities that have been added, deleted, or changed; (b) changes in activity durations in workdays; (c) changes in total float; (d) detailed schedule layout showing start and finish date variances; (e) critical path and near critical path (1 to 15 days float) layout with variances; (f) major milestone report with variances; and (g) activity constraints, including type.

EXHIBIT A.5

SUBMITTAL REQUIREMENTS

1.0 GENERAL

- 1.1 Without limiting the information summarized herein, the purpose of this exhibit is to summarize the minimum requirements for Contractor-provided submittals, including Contractor Deliverables.

2.0 DEFINITIONS

- 2.1 Unless defined in this exhibit, terms that begin with an upper case shall have the meaning defined in Exhibit A.1 (*Scope of Work*).

3.0 SUBMITTAL REQUIREMENTS

3.1 General requirements:

- 3.1.1 Contractor shall name and label all submittals using an Owner-approved naming convention. Such naming convention shall be used consistently for all submittals, and the only filename modification for revised submittals shall be a change in revision number. Unidentifiable submittals will be returned for proper identification.
- 3.1.2 Submittals shall be accompanied by copies of native, electronic design files (e.g., AutoCAD .dwg file, PLS-CADD .bak file, electrical model files (PSS/E, EasyPower, ETAP, CYME), etc.), including for interim design transmittals (e.g., 30%, 90%, etc. as applicable) and As-Built Drawings.
- 3.1.3 All design submittals shall be provided in a common and consistent coordinate system. Such coordinate system shall be subject to Owner approval.
- 3.1.4 All design submittals (including product sheets, mix designs, verification procedures, installation procedures, testing procedures, etc.) shall be approved by the applicable engineer of record prior to submitting to Owner.

3.2 Quality requirements:

- 3.2.1 Scanned submittals are not acceptable. All submittal text shall be electronically recognizable and searchable.
- 3.2.2 Submittals to Owner shall be of suitable quality for legibility and reproduction purposes. Every line, character, and letter shall be clearly legible. Drawings shall be useable for further reproduction to yield legible hard copies.
- 3.2.3 Documents submitted to Owner that do not conform to specified requirements shall be subject to rejection by Owner, and upon request, Contractor shall resubmit conforming documents. If conforming submittals cannot be obtained, such documents shall be retraced, redrawn, or photographically restored as may be necessary to meet such requirements. Contractor's (or its subcontractor's) failure to initially satisfy the legibility quality requirements will not relieve Contractor (or its subcontractors) from meeting the required schedule for submittals, as prescribed in the submittal schedule in Exhibit G.1 (*Submittal Schedule*) or elsewhere in the Agreement.

3.3 Quantity requirements:

- 3.3.1 Contractor shall electronically transmit one (1) copy of all submittals to Owner, including modifications to submittals, except as otherwise specified herein or elsewhere in the Agreement.
- 3.3.2 Contractor shall transmit submittals as hard copy format (if required) in the quantities set forth herein or elsewhere in the Agreement.

3.4 Languages and dimensions:

- 3.4.1 All words shall be in the English language.
- 3.4.2 All dimensional units shall be in English units. When both metric and English units of measurement are presented, English dimensional units shall prevail.
- 3.4.3 All drawings and dimensions shall be to scale; not-to-scale (“NTS”) dimensions will not be permitted on scalable drawings. A scale bar shall be included to permit use following photo-reduction.

3.5 Submittal completeness:

- 3.5.1 Submittals shall be complete with respect to dimensions, design criteria, materials of construction, and other information specified to enable Owner to review the information effectively.
- 3.5.2 Where standard drawings are furnished which cover a number of variations of the general class of equipment, each drawing shall be annotated to indicate exactly which parts of the drawing apply to the equipment being furnished. Use hatch marks to indicate variations which do not apply to the submittal. The use of “highlighting markers” will not be an acceptable means of annotating submittals. Such annotation shall also include proper identification of the submittal permanently attached to the drawing.

3.6 Transmittal of submittals:

- 3.6.1 Submittals and Project documents shall be transmitted in (a) nonproprietary, native electronic format, incorporating any necessary reference files; and/or (b) *.pdf files created directly from native electronic format.
- 3.6.2 All electronic submittals shall be uploaded to Contractor’s web-based document management site.
- 3.6.3 All electronic submittals shall be clearly named and versioned (e.g., revision number, date appended to file name).
- 3.6.4 Each submittal shall be accompanied by a completed transmittal letter. Submittals that are not accompanied by a completed transmittal letter will not be accepted and will be returned to Contractor. All Contractor transmittal letters submitted to Owner shall contain the following information, at a minimum: (a) transmittal number; (b) date of transmittal; (c) Contractor’s name; (d) Project name; (e) Owner’s project number; (f) filename and revision number; (g) description of the information contained in the specific transmittal; and (h) purpose of transmitting to Owner (i.e., issued for information, issued for review, etc.), including applicable Agreement references.

- 3.6.5 Contractor shall provide a transmittal notification email to Owner at the time of each submittal. The completed transmittal letter shall be attached to the notification email.
- 3.6.6 Contractor shall, at the time of each submission, call to the attention of Owner in the letter of transmittal any deviations from the Requirements.
- 3.6.7 Contractor shall check and approve submittals of subcontractors and manufacturers prior to transmitting them to Owner. Contractor's submission shall constitute a representation to Owner that Contractor approves such submittal(s) and has determined and verified all information contained therein, and Contractor assumes full responsibility for doing so; and Contractor has coordinated each submittal with requirements of the Work and the Agreement.
- 3.6.8 Contractor shall cause the applicable engineer(s) of record to review and approve the submittal prior to transmitting it to Owner. An approval stamp from such engineer(s) of record shall be included on the submittal to indicate such approval.
- 3.7 Owner's review:
 - 3.7.1 Owner's review and approval of submittals will not relieve Contractor of responsibility for any deviation from the Requirements unless Contractor has in writing called Owner's attention to such deviation at the time of submission, and Owner has given written concurrence in and approval of the specific deviation. Approval by Owner shall not relieve Contractor from responsibility for errors or omissions in submittals.
 - 3.7.2 Contractor shall make all modifications noted or indicated by Owner and return the required number of revised submittals until approved. Direct specific attention in writing, or on revised submittals, to changes other than the modifications called for by Owner on previous submittals. After submittals have been approved, submit copies thereof for final distribution. Previously-approved submittals transmitted for final distribution will not be further reviewed and are not to be revised. If errors are discovered during manufacture or fabrication, correct the submittal and resubmit for review.
 - 3.7.3 Contractor shall submit equipment catalog cut sheets for Owner review and approval prior to procurement.
- 3.8 Design submittals:
 - 3.8.1 All design submittals shall bear the Project name, the status of the submittal (e.g., Preliminary, Issued for Bid, Issued for Construction, As Built), and shall be sequentially numbered with a unique identifier.
 - 3.8.2 Issued-for-construction drawings shall not be changed or substantially-deviated from without Owner approval.
 - 3.8.3 As-Built Drawings: As-Built Drawings shall be issued as the next sequential revision from previous releases. The revision block shall state "As Built". All clouds, revision diamonds, and other interim control markings shall be removed, and all information listed as "later" or "hold" shall be completed. The As-Built Drawings shall include a final bill of materials, and native copies of all drawings and layouts. As-Built Drawings shall be created in the latest version of AutoCAD, ETAP, etc. or in the version of the respective software utilized by Owner, as applicable.

- 3.8.4 All materials shall be fully identified by Contractor, and each engineering package shall include a bill of materials, including all equipment and materials to be procured. Every item in the bill of materials shall have a unique identifier (typically numerical). Each bill of materials shall list product name, manufacturer, unique product / part number, and quantity.
- 3.8.5 All engineering shall be performed under the supervision of and stamped by the engineer(s) of record, who shall be a registered professional engineer with a current license in the Project jurisdiction. Such professional engineer(s) shall be registered in the applicable discipline for the drawings being signed and sealed.

EXHIBIT A.6
APPLICABLE PERMITS

1.0 GENERAL

- 1.1 Without limiting the information summarized herein, the purpose of this document is to summarize the *minimum* requirements for the Owner-acquired and Contractor-acquired Applicable Permits. For the avoidance of doubt, any permit, certification, or authorization required for the performance of the Work and not explicitly noted herein shall be the responsibility of Contractor.
- 1.2 Owner and Contractor shall coordinate and support each other as may be required to acquire and maintain the Applicable Permits as may be necessary for the performance of the Work.

2.0 DEFINITIONS

- 2.1 Unless defined in this Exhibit A.6, terms that begin with an upper case shall have the meaning defined in Exhibit A.1 (*Scope of Work*).

3.0 APPLICABLE PERMITS

- 3.1 Contractor is required to apply for and obtain all required permits, certification, or authorization required for performance of the work. This includes but is not limited to all permits granted by various entities at the Federal, State, County, or Township level.
- 3.2 Contractor to develop a list of permits for the project and submit to Owner for review.

EXHIBIT A.7
BESS ENERGY MANAGEMENT SYSTEM (EMS) SCOPE OF WORK

The Work shall include the following:

1. All Work required to design, furnish, install, test, and commission a complete Energy Management System (EMS) for the battery energy storage plant in compliance with the Authorities Having Jurisdiction (AHJ), MISO, Public Utilities Commission, all relevant LGIAs and off-taker agreements.

2. Functional Description and Requirements:

The primary function of the EMS will be to dispatch real and reactive power from the Battery Energy Storage System (BESS) based on signals or schedules issued by the system operators or the Main Plant Controller (MPC). The EMS will be designed to provide for automatic, unattended operation of the BESS equipment.

The system will provide automatic operation, remote operation, and dispatch of the BESS equipment from local HMI and web portal. All modes of operation and associated setpoints can be remotely adjustable. Interfaces will allow changes in settings and control modes and will provide access to necessary BESS system data.

The EMS will communicate directly with the battery containers and Power Conversion System (PCS). The EMS will receive signals from the site SCADA systems, including Substation RTAC, TSO Equipment, MISO Meters Equipment, Owner provided equipment, MPC, and will monitor and send control signals as necessary to operate the BESS equipment.

3. Engineering and Design

A. Engineering and Design will incorporate the following features:

- i. The EMS will be designed to operate the resource and will receive control setpoints from the MPC for plant output.
- ii. Compliance with all necessary MISO/NERC/Transmission Operator/Scheduling Coordinator/off-taker requirements.
- iii. Contractor shall follow all applicable NERC CIP cybersecurity standards and ensure all equipment and systems provided comply with the NERC CIP requirements.
- iv. The EMS shall be designed to manage and control the plant voltage, real & reactive power, and respond to local measurements to ensure plant output matches the MPC setpoints.
- v. EMS will receive all AGC (Area Generation Control) commands for each resource through the MPC.
- vi. Designed to provide for automatic, unattended operation of the BESS.
- vii. Designed to provide remote manual operation or automatic operation.
- viii. All modes of operation and associated setpoints to be remotely adjustable.
- ix. Integration with any necessary entities that require control for command signals to the BESS equipment via the EMS.

- x. Allow changes in settings and control modes and have access to all necessary BESS system data and have the ability to be the block controller for the real and reactive power commands.
- xi. Manage system operation including issuing commands to the individual PCS & BMS units.
- xii. Aggregate and record all necessary data points from the equipment listed in “Table 1: Device Integration” within the project historian at 1 second sampling rates
- xiii. System controls for battery charging, discharging, and managing a state of charge. The ramp rate of charging/discharging and maintaining a specific state of charge of the BESS will be programmable via manual entry into the BESS HMI.
- xiv. Contractor shall be responsible to design a unit and site level fast stop function.. This fast stop function is not equivalent to an emergency stop.
- xv. The plant should control to the request MW value at the Meter Point to within 2% after a 4 second settlement period.

B. Engineering & Design deliverables include the following items. Contractor to provide design deliverables in PDF format, and will provide applicable design deliverables in CAD format upon request:

- i. Control Narrative
- ii. Network System Architectural Diagram, including all relevant IP addresses, corresponding IP Address site map, and VLAN infrastructure
- iii. Equipment Bill of Material and equipment outline drawings
 - i. Product data sheets must be provided for all Contractor provided equipment
- iv. Electrical One Line diagrams (for the EMS system/equipment).
- v. Communication Block Diagram
 - i. Support and coordinate with all necessary parties to ensure the EMS is integrated with the system wide diagrams/design.
- vi. Communication Connection Diagrams
- vii. EMS Points List, incorporating and consolidating necessary data points pulled from the devices listed in “Table 1: Device Integration”.
- viii. EMS RTAC Points List – Develop the points list and necessary configuration files for the EMS RTAC
- ix. Factory Acceptance Testing for site and unit controller equipment
- x. Commissioning plans, including the following:
 - i. EMS Unit Commissioning Test Plan
 - ii. EMS Site Acceptance Test Plan

C. Integration Process

- i. The EMS shall interface with the devices listed in Table 1. All device communication shall typically occur over Ethernet, CanBus or Serial, using DNP3 or Modbus.

Table 1: Device Integration

Device	Supplier	Description

Batteries and container	OEM Name	Enclosure housing batteries and all the associated subcomponents (BMS, HVAC Controller, FSS, etc)
Power Conversation Skids	OEM Name	PCS acts as a bidirectional AC/DC converter the allow the batteries to charge and discharge from the grid.
Substation RTAC	OEM Name	Substation RTAC acts as the interface for the substation equipment including MPT, LTC, Cap Banks, breakers, etc.
Meters	OEM Name	Meters in the substation. Used for metering settlement, EMS controls, and MPC controls
RTU	OEM Name	Transmission Operators remote terminal unit for monitoring and logging data.
MPC	OEM Name	Utilized for monitoring and controlling the site MW/MVAR setpoints between the separate resources to maintain POI MW/MVAR requirements from MISO.
Fire Alarm Aggregate Panel	OEM Name	Aggregate monitoring and reporting system that reports to the local AHJ.

- ii. Contractor is responsible for integrating the EMS with the devices listed in “Table 1: Device Integration”, Contractor will require cooperation from the device manufacturers/vendors. Contractor will require device documentation including points lists, manuals, and spec sheets to properly work through the integration process and will need Owner or Owner representatives to provide support for acquiring these in a timely fashion.
- iii. Contractor will work with the vendors to ensure that the device integration will allow the EMS to control the ESS such that it meets the system performance requirements set forth in this Scope of Work. While it is not in Contractor’s scope to ensure vendor compliance with performance requirements, Contractor will notify Owner of any specific device issues it identifies that may impede Contractor’s ability to meet performance requirements. Owner will either require the device vendor/manufacturer to make changes to their device to meet the requirement or will remove the requirement from the Contractor’s Scope of Work.

D. Contractor will be responsible for the software engineering, development, and integration services of the following items:

- i. Network configuration and communication, including:
 - i. EMS site level networking equipment to EMS field level network equipment
 - ii. EMS Equipment to all devices listed in Table 1: Device Integration
- ii. On-Site EMS equipment installation and integration
- iii. Cloud configuration and setup
- iv. Web Based User Interface (WebUI) for EMS controls and operation
- v. EMS RTAC configuration, development and integration

E. Contractor to provide any necessary support to ensure completion of telemetry testing with Owner, MISO, Qualified Scheduling Entities, Transmission Service Operations, and any other necessary parties per the project PPAs and LGIAs

F. Contractor will be required to attend a coordination meeting on a weekly basis to discuss engineering progress, design deliverables, project schedule, and any other items relative to the project. As it pertains to Contractor's Work, additional meetings may be necessary to coordinate with other project design teams, suppliers, or trouble shoot issues through the course of the project, and the Contractor is expected to participate in these meetings.

4. EMS Data Retention

EMS WebUI is a hybrid local and cloud-based service that stores telemetry from devices in the field and/or in the cloud. The design of the EMS Web HMI has built-in security measures. Under a separate services agreement, relevant data will be stored for the life of the project, while there is a services agreement in place, and accessible to the Owner via Contractor supplied Web HMI. The HMI will have four levels of user access: "Read Only", "Operations", "Engineer" and "User Administrator". Under a separate services agreement, Contractor will provide an HMI with embedded reporting for viewing of key performance indicators (the data can also be download to a csv file). The authorization to the HMI is managed by an Owner's representative.

The EMS will store data in the following format:

- A. Timestamp field with all times in UTC, with devices synced to 1ms resolution using NTP or a GPS clock (by others)
- B. Description of the object (e.g., Site Controller, unit, battery string, etc.)
- C. Unit number with the device's unique ID
- D. Parameter value

Data is stored in one (1) second intervals and includes:

- A. Device metrics for MISO and LGIA telemetry
- B. Grid measurement and metering devices
- C. EMS operating mode history
- D. Current and historical alarm information
- E. PCS information including, but not limited to, inverter alarms and fault codes, AC & DC current, and AC & DC voltage
- F. All necessary control and warranty data from the battery vendor

Data will be stored either on-site or off-site in the cloud-based service systems that can be downloaded via the EMS WebUI.

The Contractor's on-site data storage will provide means to store at least 30 days of operational data locally assuming 1s logging interval for all data. The Contractor's on-site data storage will also be used in the case of a communications outage to the project site, and when communications are restored to site all local data will be uploaded into the cloud-based storage systems.

5. Controller Operation

A. Operating modes

- i. The EMS shall include the operating modes as described in Table 2. These modes will be configurable via the HMI.

Table 2. EMS Operating Modes

Mode	Behavior
Real Power	Sets the real power output of the ESS to meet a specified target within 2% after a 4 second settlement period.
Reactive Power	Sets the reactive power output of the ESS to meet a specified target.
Automatic Generation Control (AGC)	Charges or discharges the ESS at a real power level received from the MPC.
SOC Management	Returns batteries to a target state of charge (SOC) if the SOC exceeds specified limits. Can also be set to enable and disable on a 24-hour clock cycle.
Add specific ancillary services, energy, capacity or other applications and definitions	

B. Control Modes

- i. To safely coordinate control of the system, the EMS will provide two control modes: Manual and Automatic.
- i. Manual Control enables operators to control the system in response to conditions in the larger electrical network. This includes placing equipment in a manual stop that prevents remote control/operation of the equipment during operation's maintenance of the equipment.
- ii. Automatic Control enables the EMS to following commands from the MPC.

C. Response Time

- i. The EMS shall have a total response time of less than 100 ms. The EMS response time will be measured from the time of a control trigger is issued to the EMS until the time the unit controllers deliver the command to the PCS/BMS. The control trigger is any mechanism which drives the EMS to dispatch commands to the unit controllers and may be a setpoint issued to the EMS Site Controller, locally measured deviation which prompts a change, a user change to local operating mode setpoint, or others.

D. Alarms

- i. The EMS shall provide a means of displaying and providing details on active alarms that identify out-of-specification conditions and malfunctions in the BESS equipment, and any available internal software alarms.
- ii. System level and vendor-specific alarms will be displayed. Alarms will be displayed visually in the HMI and will be made available externally via SCADA. Alarm notifications will include alarm priority (i.e., Warning/Fault/Status/Fire), description of alarm conditions, and location of alarm in the BESS. Alarms can be configured to take automatic action in the BESS based on safety conditions or be informational only.

E. HMI/User Interface EMS HMI

- i. An HMI or WebUI will provide local or remote interaction with the BESS. Through the HMI, operators will be able to change operating modes, change system settings, review and clear alarms, and review system data. User logins can be created for the HMI that limit the control and data available to specific operators.
- ii. The HMI shall show Unit Authority Status and MISO Reg Set Point (4-second market), AGC set points and current selected market: Reg or ADS

6. Security Framework

The Contractor will be responsible to collaborate and integrate the Owner's security requirements for the project equipment, including VPN access, monitor parameters & tools, and security checks.

7. Hardware Installation and Integration

Contractor will be responsible to furnish, install, program, configure, and integrate the following hardware:

A. EMS site controller equipment – Contractor to provide the following:

- i. EMS Site Controller
- ii. Industrial Managed Ethernet Switches (EMS Site Switches)
- iii. Project Local Server & Historian – Dell server or equivalent
- iv. SEL 3530-4 RTAC
- v. Rack Mount UPS (3000VA)
- vi. 19' Server Rack to mount/house the EMS site controller equipment
- vii. All necessary terminal blocks, fuses, fuse holders, power supplies, AC/DC converters, power cables, communication cables, and mounting hardware required to assemble all the EMS site controller equipment as a functional system.

B. EMS unit controller equipment – Contractor to provide the following:

- viii. (xx) - Outdoor unit controller enclosures
- ix. (xx) - Unit network switches (Hirschmann BOBCAT BRS40-20TX/4SFP-EEC or equivalent) & all necessary SFP modules to connect the site communications fiber (one per outdoor unit enclosure)
- x. (xx) - 30-minutes enclosure mountable Uninterruptable Power Supply (UPS) (one per outdoor unit enclosure)
- xi. (xx) – EMS unit controllers (one per PCS)

- xii. All necessary terminal blocks, fuses, fuse holders, power supplies, AC/DC converters, power cables, communication cables, and mounting hardware (internal to the cabinet and to the H-frame structure) required to ensure the EMS unit controller equipment's functionality.
 - C. The EMS unit controller equipment shall meet 50-year ASHRE temperature conditions.
 - D. Contractor provided Uninterruptable Power Supplies within the EMS unit controller enclosures shall power the EMS unit controllers and unit network switches in their respective enclosures.
 - E. Contractor provided equipment must be UL compliant. Contractor is responsible for receiving, unloading, storage, and protection the hardware when it arrives at their facilities prior to shipping to the project site. When the Contractor equipment is shipped to the Project, it will be CONTRACTOR's responsibilities to receive, unload, store, and provide adequate protection for the equipment. If damage is found from the shipment of the Contractor equipment, CONTRACTOR must notify the Contractor of the damage. Any damage to the work while in CONTRACTOR's custody is not the responsibilities of the Contractor given all the equipment has been shipped with adequate protection.
 - F. Contractor provided EMS unit controller enclosures will be shipped with all terminal blocks, fuses, fuse holders, power supplies, AC/DC converters, internal power cables, internal communication cables, and mounting hardware assembled and mounted within the enclosure. The remaining components, including the EMS unit controller, unit network switch, and 2-hour UPS will be shipped to the project site separately. Contractor shall install the components that were shipped separately in the Unit controller enclosures after the enclosures have been mounted at the project site.
 - G. Contractor shall install an H-Frame structure to mount the EMS unit controller enclosures.
 - H. Contractor shall mount the EMS unit controller enclosures, install the below ground conduit into the enclosure using appropriate fittings, and pull all necessary external fiber and power cable to support the functionality of the EMS equipment.
 - I. Contractor shall install the EMS site controller equipment at the project site as required to ensure the cabinet is functional and can communicate with all the necessary external devices. Contractor shall provide the external power to each of the EMS site controller racks as required per the design to power the equipment.
8. Commissioning
- A. Contractor will provide any necessary on-site support for initial energizations and participate in the energization procedure specific to Contractor scope. This includes but is not limited to any necessary LOTO of the BESS equipment, operation of the EMS system, and troubleshooting.
 - B. Contractor shall coordinate with Owner while controlling, operating, and commissioning any equipment at the project site to ensure proper coordination with any site activities, and that all work is performed in compliance with all site safety requirements.

- C. Contractor shall provide off-site commissioning test support and equipment operation required for the Work, with 24/7 availability during the entire duration of the commissioning process. The Contractor shall provide on-site commissioning and troubleshooting support if required to ensure the project schedule is maintained.
- D. Contractor shall provide engineering and technical services after business hours and weekends.
- E. Contractor shall closely monitor, troubleshoot as needed, and maintain system visibility and communication of Contractor's Work through project Final Completion.
- F. Contractor is responsible to program, configure, and functionally verify all EMS networking equipment, including switches, firewalls, and cradle points, to ensure the EMS networking is functional and ready for commissioning activities.
- G. Contractor to shall coordinate with Owner to perform the startup & commissioning of the EMS network during the installation of the communication cables to ensure the network is functional, communicating, and ready for commissioning of the PCS & battery equipment. This support will be provided remotely but if required the Contractor will provide on-site support to ensure the network functionality and connectivity.
- H. Contractor to remotely attend the daily POD meetings during commissioning to ensure the site team and Contractor commissioning support staff are aligned on the daily commissioning activities.

9. Unit Commissioning

See Appendix A for the Unit Commissioning Test Plan. The Unit Commissioning must be completed for all operable Units, but EMS Site Commissioning may begin before all Units have completed Unit Commissioning.

10. Substantial Completion

See Appendix B for the Site Acceptance Test Plan

11. Turnover

- A. Contractor to provide electronic copies of the manuals for all EMS equipment and software.
- B. Contractor to provide up to 16 hours of operational training to the Owner's operational team members.
- C. Contractor shall record and document as-built conditions on the design documents and drawings on a weekly basis during execution of the Work. These documents must be a form acceptable to Owner and will only need to be provided if requested by Owner, or at the end of the project during the project turnover. If CONTRACTOR is responsible for the changes the relevant redlines and updates must be conveyed to ensure it is incorporated into the as-built documents.

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Appendix A

Unit Commissioning Test Plan

Definitions/Acronyms

Battery System	Set of Battery Racks connected to a single PCS
BMS	Battery Management System
RBMS	Rack level BMS – for each Battery Rack
BBMS	Bank level BMS – System level BMS for Battery System
BOP	Balance of Plant
CT	Current Transformer
CPR	Cardio Pulmonary Resuscitation
MV-01	Switchboard 480 volts
ESS	Energy Storage System
JHA	Job Hazard Analysis
LOTO	Lock Out / Tag Out
Owner	Buyer
PCS	Power Conversion System, i.e., bi-directional grid connected power converter
Plant Controller	Master controller for the ESS
PPE	Personal Protective Equipment
PTP	Performance Test Procedure
PU	Power Unit; a combination of a single PCS with associated Battery System, and associated Control System
Reference Meter	Calibrated meter such as Fluke 435
RTAC	Real Time Automation Controller – SEL 3530 device
SCADA	Supervisory Control And Data Acquisition
SOC	State of Charge
SOH	State of Health
VT	Voltage Transformer
XFMR	Transformer
WebUI	ESS Graphical Web User Interface

Purpose

The Commissioning Procedure is conducted at the Buyer's Battery Energy Storage System site. Tests are conducted in a grid -tied configuration or islanded configuration based on the test. Equipment configuration during the test will be managed as is expected during commercial operations subsequent to successful completion of this test. The enclosures will be installed on concrete slabs at the site. The system is monitored by internal instrument transformers, external instrument transformers, and metering functionalities to monitor and record voltages, currents, power disturbances, etc.

This is a field test grid conditions can dominate the output of the system and as such, if it can be documented that grid conditions cause a result that appears to not meet the Pass/Fail Criteria, an exception may be taken. Seller and the Buyer will determine modified criteria or decide to re-run the test when the grid conditions have improved. Each test has a section for Notes/Test Conditions. Test conditions such as extreme weather or abnormal grid conditions should be noted.

Because of the amount of time required to run the entire test suite, some of the tests may not be witnessed by the customer. In such cases, Seller will run the tests in advance and provide test data. Any testing to be run prior to witness testing shall be confirmed with the customer in advance.

A Power Unit (PU) consists of a single Power Conditioning System (PCS, bi-directional grid-connected power electronic converter) connected to a battery pack and associated control system. The Energy Storage System (ESS) installed at the Project Site is composed of six (6) PU's. The ESS is monitored by internal instrument transformers, external instrument transformers, and power quality meters to monitor and record voltage, current, power disturbances, and harmonics.

Reference - Drawing **XXX-XX** (Drawing will be from Seller drawing set, official drawing number will be finalized after contract signing).

Safety

The use of Personal Protective Equipment (PPE) during the performance of procedures outlined in this document is required.

Only authorized personnel will be allowed in the test area, and all authorized personnel and equipment operators will wear PPE in accordance to the arc flash labels relevant to that gear.

Authorized personnel will isolate and LOTO all energy sources feeding a device to verify zero energy.

Before starting any procedure, be certain correct policies are identified and adhered to including but not limited to appropriate training, approach distances, safety equipment, Job Hazard Analysis (JHA), and Lock-Out/Tag-Out (LOTO).

At no time during the energizing, shall any personnel be within a distance of 50 feet of pad mount transformers and Switch Gear being energized, and covered under this procedure.

All personnel shall maintain this distance until specifically released by the Project Engineer.

Seller will have personnel trained in CPR and proper PPE required for electrical installations including MV electrical equipment during the project installation. In the event of a medical emergency, arc flash and/or fire, site personnel should call 911 or local emergency responders.

Lock Out/Tag Out (LOTO)

LOTO is an acronym for Lock Out/Tag Out. A Lockout Device is a physical device which can be opened or removed only by means of a key.

A lockout hasp is designed to accept additional locks where multiple locks are required. If there is no space on a lockout hasp for additional padlocks, an additional lockout hasp must be attached.

Locks which can be opened by the same key shall not be used unless such locks are under the sole control of the individual who applied the lock(s).

Combination locks or locks with master keys shall not be used. Lockout devices shall be singularly identified by a Lockout Tag and shall not be used for other purposes.

A Lockout Tag is a distinctive durable tag (red and white in color), attached to the lock, that identifies it as a lockout device and identifies the individual who placed the lock.

The tag must be of standard shape, color, and size. Lockout tags shall be singularly identified (signed) and shall not be used for other purposes.

Conditions Precedent to Performance Testing Procedure

Factory Acceptance Testing

Factory Acceptance Testing (FAT) of all relevant equipment including PCS, battery racks, auxiliary equipment, etc. have been successfully completed by Seller at their facility as per Exhibit BB Factory Acceptance Test Plan.

Control System Functionality

The Control System shall be successfully configured to receive data from the Battery System BMS, exchange DNP3 data with the Customer device, transfer data to the Database Server for the calculation, recording and archiving of data points.

Communications

RTU testing should be successfully completed during the commissioning process. The interface between Owner's RTU and ESS SCADA system should be fully tested and functional prior to starting the rest of the Performance Test Procedure. This includes verification of data transmission pathway between the Owner Remote Terminal Unit (RTU) and Seller control system interface i.e. SEL 3530 Real Time Automation Controller (RTAC).

Points of Contact

Item	Description	Company
1		
2		
3		
4		
5		

Site Access

Item	Description	Notes
1	Site Physical Address.	
2	Site Access Instructions	

Site Emergencies

Item	Description	Notes
1	Emergency Response plan for site.	Phone No. - TBD
2	Site Local Fire Dispatch Number.	911 and Buyer contact
3	Emergency meet site.	Substation Front Entrance
4	Enclosure fire alarm horn and strobe locations.	Exterior of BESS enclosures

Testing

1. Unit Startup

Purpose:

Demonstrate the start-up of each PU. This test will be performed on each individual PU.

Procedure:

1. Verify on the WebUI that the PU AC input terminals are energized and voltage values are correct.
2. Verify on the WebUI that the PU DC input terminals are energized and voltage values are correct.
3. Verify that Operational State is “Off”, as read on the WebUI view.
4. Start the PU from the WebUI as follows:
 - a. Set the Control Mode to “HMI Control”.
 - b. Set zero real / reactive power setpoints and provide an “Run PQ” command on the command window.

Pass/Fail Criteria		
PU starts with no errors as demonstrated by PCS Unit state changing to “RunPQ” on WebUI.		
Passed	Failed	Date:
Test Performed by:		
Test Witnessed by:		

Notes/Test Conditions

2. Unit Shutdown

Purpose:

Demonstrate the shut-down sequence of the PU. This test will be performed on each individual PU.

Procedure:

1. Verify PU is running as demonstrated by PCS Unit state being “RunPQ” on the WebUI.
2. Stop PU from the WebUI.

Pass/Fail Criteria		
PU performs shutdown with no errors. PCS Unit state shall be in “Off” state on the WebUI after step 2.		
Passed	Failed	Date:
Test Performed by:		
Test Witnessed by:		

Notes/Test Conditions:

3. PCS Emergency Shutdown (or Fast Stop) and Restart

Purpose:

Demonstrate the emergency shut-down (or Fast Stop) and restart sequence of the PU.

Procedure:

1. Verify PU is running as demonstrated by PCS Unit state being “RunPQ” on the WebUI.
2. Stop PU by issuing an electron E-Stop.
3. Verify that the system has stopped.
4. Attempt to start the PU.
5. Reset the electronic E-stop and reset the system fault from the WebUI.
6. Attempt to start the PU from the remote terminal.

Pass/Fail Criteria		
PU stops immediately and opens PU main AC and DC contactors upon completion of step 2, PU state on WebUI goes to “Fault” state. PU does not restart upon completion of step 3 (PU is in a latched fault state). PU starts successfully upon completion of steps 5 & 6 as demonstrated by a PU state of “RunPQ”.		
Passed	Failed	Date:
Test Performed by:		
Test Witnessed by:		

Notes/Test Conditions:

4. Battery Metering Verification

Purpose:

Verify battery metering and monitoring system on WebUI. This test will be performed on each individual PU.

Procedure:

1. Verify battery current readings are present and refreshing on WebUI.
2. Verify battery voltage readings are present and refreshing on WebUI.
3. Verify battery temperatures readings are present and refreshing on WebUI.

Pass/Fail Criteria			
Continually updating data for battery current, voltage and temperature on WebUI.			
Unit	Passed	Failed	Date:
1			
2			
3			
Test Performed by:			
Test Witnessed by:			

Notes/Test Conditions:

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5. Enclosure Unit Smoke Detection

Purpose:

Verify smoke detection circuit operates correctly and shuts down the PCS Units when smoke is introduced in the enclosure. The fire suppression agent tank will be temporarily disconnected from the firing pin assembly during this test. It will be reconnected for normal operations once the entire ESS system has been commissioned.

Procedure for Enclosure 1:

Item	Description	Comments/Notes	Initials	
			Buyer	Seller
1	Verify all PU are running as demonstrated by PCS Unit state being “RunPQ” on the WebUI.			
2	Locate the smoke detector on the inside ceiling of Enclosure 1.			
3	Use canned smoke sprayed on the orange sniffer tube connected to the smoke detector to activate the detector.			
4	Verify the PUs have shutdown, only in Enclosure 1 and not in the other Enclosures.			
5	Verify that the fire suppression tank pin has fired out of its housing.			
6	Verify that the alarm has been reported with a Fire Suppression Alarm to the WebUI.			
7	Open the Enclosure1 doors to clear out the smoke.			
8	Reset the firing pin for the fire suppression tank.			
9	Reset the system fault from the WebUI.			

Pass/Fail Criteria					
All units fire suppression systems performed as stated in items 4, 5, & 6 of the procedure.					
Unit	Passed	Failed	Date	Initial Buyer Seller	
1					
2					
3					
Test Performed by:					
Test Witnessed by:					

Notes/Test Conditions:

6. Remote Power Setpoint Tracking

Purpose:

Demonstrate the capability of the BESS to follow remote active and reactive power setpoints.
This test will be performed one each individual BESS.

Procedure

1. Verify BESS is running as demonstrated by all PCS Unit states being “RunPQ”.
2. Set control system state to manual mode via user interface (UI).
3. Write active power values -100%, -50%, 0%, 50%, and 100% to manual active power input.
4. Write reactive power values -100%, -50%, 0%, 50%, and 100% to manual reactive power input.
5. Record power levels as measured by reference meter and displayed in WebUI in the below table.

Active Power Command (kW)	Active Power Response (kW)	Reactive Power Command (kVAR)	Reactive Power Response (kVAR)
-100%		-100%	
-50%		-50%	
0%		0%	
50%		50%	
100%		100%	

Pass/Fail Criteria			
BESS measured response level shall be within the greater of $\pm 5\%$ of the expected response level.			
Unit	Passed	Failed	Date:
1			
2			
3			
Test Performed by:			
Test Witnessed by:			

Notes/Test Conditions:

Appendix B

Site Acceptance Test Plan

Battery System	Set of Battery Racks connected to a single PCS
BMS	Battery Management System
RBMS	Rack level BMS – for each Battery Rack
CT	Current Transformer
CPR	Cardio Pulmonary Resuscitation
MV-01	Switchboard 480 volts
ESS	Energy Storage System
LOTO	Lock Out / Tag Out
PCS	Power Conversion System, i.e., bi-directional grid connected power converter
Plant Controller	Master controller for the ESS
PPE	Personal Protective Equipment
PU	Power Unit; a combination of a single PCS with associated Battery System, and associated Control System
Reference Meter	Calibrated meter such as Fluke 435
RTAC	Real Time Automation Controller – SEL 3530 device or equivalent
SCADA	Supervisory Control and Data Acquisition
SOC	State of Charge
SOH	State of Health

1. **Discharge Capacity Test**

- **Purpose:** This test will demonstrate the discharge capacity; the requirement is to achieve nameplate output within 1s and hold for 10 minutes. This capability is representative of the maximum active power levels.
- **Procedure:**
 - A. System Starting State: The BESS will be in the on-line state with each Battery Subsystem at approximately 50% usable SOC and at an initial active power level of 0 MW and reactive power level of 0 MVAR.
 - B. Record the BESS active power level at the reference meter.
 - C. Command the BESS to follow a full discharge nameplate power signal.
 - D. Record and store the BESS active power response. Measurements will be made at the POI and by the BESS control system with a recording in the BESS historian.
 - E. System End State: The BESS will be in the on-line state and at a commanded active power level of 0 MW.

Pass/Fail Criteria		
The difference between the BESS active power response and the commanded level shall be no less than $\pm 3\%$ as measured by the sum of values at the POI. The time to full output shall be less than 1s. The hold period of such active power value shall be no less than 10 minutes as recorded in the BESS control system historian.		
Passed	Failed	Date:

Test Performed by:		
Test Witnessed by:		

Notes/Test Conditions:

2. Charge Capacity Test

- Purpose: This test will demonstrate the BESS charge capacity; the requirement is to achieve full nameplate charge within 1s and hold for 10 minutes.
- Procedure:
 - A. System Starting State: The BESS will be in the on-line state with each Battery Subsystem at approximately 50% usable SOC and at an initial active power level of 0 MW and reactive power level of 0 MVAR.
 - B. Record the BESS active power level at the reference meter.
 - C. Command the BESS to follow a full nameplate charge signal.
 - D. Record and store the BESS active power response. Measurements will be made at the POI and by the BESS control system with a recording in the BESS historian.
 - E. System End State: The BESS will be in the on-line state and at a commanded active power level of 0 MW.

Pass/Fail Criteria		
The difference between the BESS active power response and the commanded level shall be no less than $\pm 3\%$ as measured at the POI. The time to full output shall be less than 1s. The hold period of such active power value shall be no less than 10 minutes as recorded in the BESS control system historian.		
Passed	Failed	Date:
Test Performed by:		
Test Witnessed by:		

Notes/Test Conditions:

3. Reactive Power Test

- Purpose: This test will demonstrate the Reactive Power Production capability of the facility.
- System starting state: The Facility will be in the on-line state with each Battery Subsystem at approximately 50% usable SOC and at an initial active power level of 0 MW and reactive power level of 0 MVAR. The Facility control system will be configured to follow a predefined

reactive power profile (see below).

- Procedure:
 - Record the Facility reactive power level at the Reference Meter.
 - Command the Facility to provide half the nameplate MVAR rating for 10 minutes.
 - Command the Facility to absorb half the nameplate MVAR rating for 10 minutes.
 - Record and store the Facility reactive power response. Measurements will be made at the POI and by the Facility control system with recording in the Facility historian.
- System end state: The Facility will be in the on-line state and at a commanded reactive power level of 0 MVAR.

Pass/Fail Criteria		
The Facility reactive power response and the commanded levels shall be within $\pm 3\%$ as measured by the sum of values at the POI. The time to full output shall be less than 1 second. The hold period of such reactive power value shall be no less than 10 minutes as recorded in the Facility Control System historian.		
Passed	Failed	Date:
Test Performed by:		
Test Witnessed by:		

Notes/Test Conditions:

4. Data Resolution Test

- Purpose: This test will demonstrate the capability of the BESS control system to independently detect and record BESS data. The BESS control system must be able to measure and record BESS data with a resolution of no less than 15 samples per minute.
- Procedure:
 - A. System Starting State: The BESS will be in the on-line state with each Battery Subsystem at approximately 50% usable SOC.
 - B. Discharge the BESS at 25% nameplate power for 5 minutes.
 - C. Retrieve the data logs from the on-site database.
 - D. Verify values for timestamps, data resolution, system frequency and BESS MW output.
 - E. System End State: The BESS will be in the on-line state and at a commanded active power level of 0 MW.

Pass/Fail Criteria
BESS MW active power response to deployment and system frequency will be recorded in the database with a recording rate of no less than 15 samples per minute.

Exhibit **Error! Reference source not found.**
Xcel Draft (rev A), 20240427

Passed	Failed	Date:
Test Performed by:		
Test Witnessed by:		

Notes/Test Conditions:

5. AGC Test

- Purpose: This test will demonstrate the AGC following capability. This capability is representative of the service profile.
- System starting state: The Facility will be in the on-line state with each Battery Subsystem at approximately 50% usable SOC and at an initial active power level of 0 MW and reactive power level of 0 MVAR. The Control System will be configured to follow a predefined active power profile (see below).
- Procedure:
 - Record the Facility active power level at the Facility Meter.
 - Command the Facility to follow a simulated ISO discharge signal of 25% nameplate power of for 10 minutes.
 - Command the Facility to follow a simulated ISO charge signal of 25% nameplate power of for 10 minutes.
 - Record and store the Facility active power response. Measurements will be made at the POI and by the Control System with recording in the Facility historian.
- System end state: The Facility will be in the on-line state and at a commanded active power level of 0 MW.

Pass/Fail Criteria		
The Facility active power response and the commanded levels shall be within $\pm 3\%$ as measured by the sum of values at the POI. The hold period of such active power value shall be no less than 10 minutes as recorded in the Facility Control System historian.		
Passed	Failed	Date:
Test Performed by:		
Test Witnessed by:		

Notes/Test Conditions:

EXHIBIT C.4

JOB BOOK REQUIREMENTS

1.0 GENERAL

- 1.1 Without limiting the information summarized herein, the purpose of this document is to provide an outline for the minimum contents of the Job Books to be prepared by Contractor by the date set forth in the Submittal Schedule.
- 1.2 The Job Books shall meet the minimum requirements for submittals set forth in Exhibit A.5 (*Submittal Requirements*).

2.0 DEFINITIONS

- 2.1 Unless defined in this exhibit, terms that begin with an upper case shall have the meaning defined in Exhibit A.1 (*Scope of Work*). [RFP Clarification: items noted as “TBD” will be finalized as part of Agreement negotiations.]

3.0 OUTLINE OF GENERAL JOB BOOK

- 3.1 Table of contents
- 3.2 Contracting:
 - (1) Copy of Agreement
 - (2) Copies of Change Orders
 - (3) List of Subcontractors used on the Project
 - (4) Summary of all work performed by Subcontractors
 - (5) Copies of all subcontracts for construction services (non-priced)
 - (6) Copies of purchase orders for major equipment supplied (non-priced) including PV panels, inverters, Wind Turbines, BESS, main-power transformers, substation equipment, etc.
- 3.3 Project Schedule:
 - (1) Final, actualized Project Schedule, including actual delivery schedule of Owner-Supplied Equipment
- 3.4 Contractor plans:
 - (1) HSSE Plans
 - (2) Quality Assurance Plan
 - (3) Project execution plan
- 3.5 Health and safety statistics:
 - (1) Project construction Work hours and statistical information

- (2) Incident reports, including accidents, thefts, injuries, and near misses
- 3.6 Permits:
 - (1) Copies of Applicable Permits
- 3.7 Training:
 - (1) Project construction training records
 - (2) Copies of training manuals
- 3.8 Reporting:
 - (1) Plan of the day reports
 - (2) Weekly progress reports
 - (3) Monthly progress reports
- 4.0 OUTLINE OF CIVIL WORKS JOB BOOK**
- 4.1 Table of contents
- 4.2 Engineering documents:
 - (1) As-built coordinates
 - (2) Issued for construction drawings
 - (3) As-Built Drawings
 - (4) SWPPP
 - (5) Aggregate job mix formula
- 4.3 Product data for permanently-installed equipment and materials (including manuals, data sheets, and warranty agreements):
 - (1) Not used
- 4.4 Quality assurance documents:
 - (1) Inspection documentation: roadway, subgrade, drainage structures
 - (2) Testing results: sieve analysis, proctors, moisture density, DCP, proof roll, and other required tests set forth in Exhibit A.1 (*Scope of Work*)
 - (3) Non-conformance and corrective action reports
 - (4) Photographs of Project Site restoration
- 4.5 Forms and certificates:

- (1) Certificate of Access Road Completion

5.0 OUTLINE OF PV STRUCTURAL COMPONENTS AND INSTALLATION JOB BOOK

5.1 Table of contents

5.2 Engineering documents:

- (1) Final geotechnical engineering report
- (2) Issued for construction drawings, including structural calculations
- (3) As-Built Drawings, including structural calculations
- (4) Concrete mix design, as applicable
- (5) Grout mix design or product sheet, as applicable

5.3 Product data for permanently-installed equipment and materials (including manuals, data sheets, and warranty agreements):

- (1) Equipment: not used
- (2) Materials: reinforcing steel, embedment ring, and anchor bolt mill certificates

5.4 Quality assurance documents:

- (1) Inspection documentation: grounding, forms (if any), concrete placement (if any), etc.
- (2) Testing results: pile test results, concrete strength (if applicable), and other required tests set forth in Exhibit A.1 (Scope of Work)
- (3) Concrete batch tickets and pour logs (if applicable)
- (4) Non-conformance and corrective action reports

5.5 Forms and certificates:

- (1) Certificates of PV Structural Completion

6.0 OUTLINE OF COLLECTION SYSTEM CIRCUIT JOB BOOK

6.1 Table of contents

6.2 Engineering documents:

- (1) Issued for construction drawings
- (2) As-Built Drawings
- (3) Bore plan / log

6.3 Product data for permanently-installed equipment and materials (including manuals, data sheets, and warranty agreements):

- (1) Equipment: medium-voltage cabling, fiber optic cabling, junction boxes, splice kits, fiber splice box, medium-voltage transformers, inverters, DC cabling, DC wiring harnesses, combiner boxes, switchgear (if any), cable management systems (if any), etc.
- (2) Materials: grounding, etc.

6.4 Quality assurance documents:

- (1) Inspection documentation: trench, cable installation, splice inspections (including coordinates of splice locations), terminations, directional boring, junction boxes (including coordinates of cabinets), medium-voltage transformer and inverter installation inspection, etc.
- (2) Testing results: compaction, cable jacket integrity, splice backfill, circuit phase verification, partial discharge (if applicable), VLF, OTDR, voltage and phase rotation, and other required tests set forth in Exhibit A.1 (*Scope of Work*)
- (3) Energization and commissioning results, including commissioning checklists
- (4) Training certifications, including splice training
- (5) Tooling calibration records and testing certificates
- (6) Non-conformance and corrective action reports

6.5 Forms and certificates:

- (1) Certificate of Collection System Circuit Completion

7.0 OUTLINE OF PROJECT SUBSTATION JOB BOOK

7.1 Table of contents

7.2 Engineering documents:

- (1) Issued for construction drawings
- (2) As-Built Drawings
- (3) Rebar shop drawings
- (4) Concrete mix design

7.3 Product data for permanently-installed equipment and materials:

- (1) Equipment: breakers, transformers (main power, station service, CT, PT), switches, pre-cast trench, surge arrestors, capacitor bank, buswork, control cable, relays, meters, batteries, etc.
- (2) Materials: reinforcing steel and anchor bolt mill certificates

7.4 Quality assurance documents:

- (1) Inspection documentation: foundations and flat work (pre- and post-pour), concrete placement, ground grid, conduit, trench, steel, equipment installation (breakers, bus, switches, transformers), control building, control cable, terminations, cap bank, fencing
- (2) Testing results: torque records, ground grid resistivity, concrete strength, transformer settings, cable insulation, continuity checks, breaker functions, polarity, relay functions, and other required tests set forth in Exhibit A.1 (*Scope of Work*)
- (3) Factory testing records, including breakers, transformers, control house, relays, and meters at a minimum
- (4) Concrete batch tickets and pour logs
- (5) Energization and commissioning results, including commissioning checklists
- (6) Training certifications, including welding
- (7) Tooling calibration records and testing certificates
- (8) Non-conformance and corrective action reports

7.5 Forms and certificates:

- (1) Certificate of Project Substation Completion

8.0 OUTLINE OF INTERCONNECTION LINE JOB BOOK

8.1 Table of contents

8.2 Engineering documents:

- (1) Issued for construction drawings
- (2) As-Built Drawings
- (3) Concrete mix design

8.3 Product data for permanently-installed equipment and materials:

- (1) Equipment: conductor, OPGW, ground rods
- (2) Materials: not used

8.4 Quality assurance documents:

- (1) Inspection documentation: foundations (pre- and post-pour), concrete placement, grounding, equipment installation (structures, conduit, OPGW), terminations
- (2) Testing results: torque records, ground grid resistivity, concrete strength, and other required tests set forth in Exhibit A.1 (*Scope of Work*)
- (3) Concrete batch tickets and pour logs
- (4) Energization and commissioning results, including commissioning checklists

- (5) Training certifications, including welding
- (6) Tooling calibration records and testing certificates
- (7) Non-conformance and corrective action reports

8.5 Forms and certificates:

- (1) Certificate of Interconnection Line Completion

9.0 OUTLINE OF METEOROLOGICAL STATIONS JOB BOOK

9.1 Table of contents

9.2 Engineering documents:

- (1) Issued for construction drawings
- (2) As-Built Drawings
- (3) Concrete mix design

9.3 Product data for permanently-installed equipment and materials:

- (1) Equipment: instruments, data logger, cabling, lighting
- (2) Materials: not used

9.4 Quality assurance documents:

- (1) Inspection documentation: foundations (pre- and post-pour), concrete placement, grounding, equipment installation (instruments, data logger, lighting, etc.), terminations, operable communications
- (2) Testing results: torque records, ground grid resistivity, concrete strength, and other required tests set forth in Exhibit A.1 (*Scope of Work*)
- (3) Concrete batch tickets and pour logs
- (4) Energization and commissioning results, including commissioning checklists
- (5) Training certifications, including welding
- (6) Tooling calibration records and testing certificates
- (7) Non-conformance and corrective action reports

9.5 Forms and certificates:

- (1) Certificate of meteorological station completion

10.0 OUTLINE OF O&M BUILDING JOB BOOK

10.1 Table of contents

10.2 Engineering documents:

- (1) Issued for construction drawings
- (2) As-Built Drawings

10.3 Product data for permanently-installed equipment and materials:

- (1) Equipment: Yes
- (2) Materials: Yes

10.4 Quality assurance documents:

- (1) Non-conformance and corrective action reports

10.5 Forms and certificates:

- (1) Certificate of O&M Building Completion

11.0 SOLAR PV JOB BOOK

11.1 Table of contents

11.2 Engineering documents:

- (1) Solar PV Array as-built designs

11.3 Product data for permanently-installed equipment and materials:

- (1) Equipment: PV Panels, mounting systems, tracking systems, inverters,
- (2) Materials: Yes

11.4 Quality assurance documents:

- (1) PV supplier quality documents
- (2) Offload inspection checklists
- (3) PV supplier assembly checklists
- (4) Tooling calibration records and testing certificates

11.5 Forms and certificates:

- (1) Certificate of PV Array Completion

EXHIBIT C.5
PROGRESS REPORT CONTENTS

1.0 GENERAL

- 1.1 Without limiting the information summarized herein, the purpose of this document is to provide an outline for the minimum contents of the plan of the day, weekly, and monthly Progress Reports to be prepared by Contractor by the dates set forth in the Submittal Schedule.
- 1.2 The Progress Reports shall meet the minimum requirements for submittals set forth in Exhibit A.5 (Submittal Requirements).

2.0 DEFINITIONS

- 2.1 Unless defined in this exhibit, terms that begin with an upper case shall have the meaning defined in Exhibit A.1 (Scope of Work).

3.0 PLAN OF THE DAY REPORT OUTLINE

3.1 Cover sheet:

- (1) Project name and address
- (2) Date of report

3.2 Executive summary:

- (1) High-level summary delineating Project status, milestones, and issues.
- (2) Weather forecast including:
 - (a) Rainfall accumulation, including monthly total to date
 - (b) Temperature
 - (c) Wind speed
 - (d) Cloud cover
 - (e) Severe weather concerns
- (3) Safety statistics: briefly describe any issues, near misses, recordable, or other similar issues that occurred during the reporting period.
- (4) Environmental issues: briefly describe any issues, citations, or other similar issues that occurred during the reporting period.
- (5) Permitting issues: briefly describe any issues concerning permitting that occurred during the reporting period.
- (6) Landowner issues: briefly describe any issues concerning landowners that occurred during the reporting period.

(7) Training: briefly describe any training that occurred on during the reporting period including length of and who participated in such training.

(8) Limit to less than one (1) page.

3.3 Progress summary and plan of the day:

(1) Provide a plan of the day for each major area and sub-area of the Work, including the last working day, current day, and next working day plans.

(2) Provide graphical indicators of current construction progress.

(3) Provide a brief description of the Project progress within each of the following fields:

(a) Engineering

(b) Procurement / manufacturing

(c) Receiving

(d) Construction

(e) Testing

(f) Commissioning

(g) Staffing levels – present and future projections

3.4 Issues and concerns:

(1) Briefly describe any issues that occurred during the reporting period pertaining to the execution of the Project that were not otherwise covered in the sections above.

4.0 WEEKLY PROGRESS REPORT OUTLINE

4.1 Cover sheet:

(1) Project name and address

(2) Time span covered

(3) Date of report

4.2 Executive summary:

(1) High-level summary delineating Project status, milestones, and issues

(2) Limit to less than one (1) page.

4.3 Health, safety, and environmental:

- (1) Provide a table of the following safety statistics. Each statistic listed below shall be presented as a weekly total, year-to-date total, and Project-to-date total, respectively, in each report. Each statistic listed below, including the aforementioned subtotals, shall be presented for Contractor and each major subcontractor, respectively, in each report.
 - (a) Hours worked
 - (b) Lost-time incidents
 - (c) Total recordable cases
 - (d) Recordable incident rate
 - (e) First aid cases
 - (f) Near misses
- (2) Safety issues: briefly describe any issues, near misses, recordable, or other similar issues that occurred during the reporting period.
- (3) Environmental issues: briefly describe any issues, citations, or other similar issues that occurred during the reporting period.
- (4) Permitting issues: briefly describe any issues concerning permitting that occurred during the reporting period.
- (5) Landowner issues: briefly describe any issues concerning landowners that occurred during the reporting period.
- (6) Training: briefly describe any training that occurred on during the reporting period including length of and who participated in such training.

4.4 Progress summary:

- (1) Provide graphical indicators of weekly construction progress.
- (2) Provide a brief description of the Project progress within each of the following fields:
 - (a) Engineering
 - (b) Procurement / manufacturing
 - (c) Construction
 - (d) Testing
 - (e) Commissioning
 - (f) Staffing levels – present and future projections

4.5 Personnel:

- (1) Provide a summary of Contractor personnel that were on-Site during the reporting period, including total hours worked.
- (2) Provide a brief, bulleted list of each subcontractor that was on-Site during the reporting period.

4.6 Project schedule:

- (1) Provide overview of Work relative to current Project Schedule, including critical path schedule and recovery schedule (if applicable). Include a copy of the current Project Schedule.
- (2) Provide summary of all weather delays.

4.7 Issues and concerns:

- (1) Briefly describe any issues that occurred during the reporting period pertaining to the execution of the Project that were not otherwise covered in the sections above.

4.8 Submittals and RFIs:

- (1) Listing of open transmittals, including open issues (if any)
- (2) Listing of open RFIs, including open issues (if any)

4.9 Change orders:

- (1) Listing of approved change orders
- (2) Listing of pending change orders, including open issues (if any)

4.10 Job site pictures:

- (1) Include representative photographs of the Work performed during the reporting period. Each picture should include a brief description of the picture's contents, including the location where it was taken and the date when it was taken.

5.0 MONTHLY PROGRESS REPORT OUTLINE

5.1 Cover sheet:

- (1) Project name and address
- (2) Time span covered
- (3) Date of report

5.2 Executive summary:

- (1) High-level summary delineating Project status, milestones, and issues
- (2) Limit to less than one (1) page.

5.3 Health, safety, and environmental:

- (1) Provide a table of the following safety statistics. Each statistic listed below shall be presented as a monthly total, year-to-date total, and Project-to-date total, respectively, in each report. Each statistic listed below, including the aforementioned subtotals, shall be presented for Contractor and each major subcontractor, respectively, in each report.
 - (a) Hours worked
 - (b) Lost-time incidents
 - (c) Total recordable cases
 - (d) Recordable incident rate
 - (e) First aid cases
 - (f) Near misses
- (2) Safety issues: briefly describe any issues, near misses, recordable, or other similar issues that occurred during the reporting period.
- (3) Environmental issues: briefly describe any issues, citations, or other similar issues that occurred during the reporting period.
- (4) Permitting issues: briefly describe any issues concerning permitting that occurred during the reporting period.
- (5) Landowner issues: briefly describe any issues concerning landowners that occurred during the reporting period.
- (6) Training: briefly describe any training that occurred on during the reporting period including length of and who participated in such training.

5.4 Progress summary:

- (1) Provide graphical indicators of weekly construction progress.
- (2) Provide a brief description of the Project progress within each of the following fields:
 - (a) Engineering
 - (b) Procurement / manufacturing
 - (c) Construction
 - (d) Testing
 - (e) Commissioning
 - (f) Staffing levels – present and future projections

5.5 Personnel:

- (1) Provide a summary of Contractor personnel that were on-Site during the reporting period, including total hours worked.
- (2) Provide a brief, bulleted list of each subcontractor that was on-Site during the reporting period.

5.6 Project schedule:

- (1) Provide overview of Work relative to current Project Schedule, including critical path schedule and recovery schedule (if applicable). Include a copy of the current Project Schedule.
- (2) Provide summary of all weather delays.

5.7 Issues and concerns:

- (1) Briefly describe any issues that occurred during the reporting period pertaining to the execution of the Project that were not otherwise covered in the sections above.

5.8 Submittals and RFIs:

- (1) Listing of open transmittals, including open issues (if any)
- (2) Listing of open RFIs, including open issues (if any)

5.9 Change orders:

- (1) Listing of approved change orders
- (2) Listing of pending change orders, including open issues (if any)

5.10 Job site pictures:

- (1) Include representative photographs of the Work performed during the reporting period. Each picture should include a brief description of the picture's contents, including the location where it was taken and the date when it was taken.

EXHIBIT D.2
PROJECT SITE DATA

The following table of site conditions shall be determined by Contractor through appropriate studies and investigations and approved by Owner.

Description	Value
Site Elevations	
PV Array, Range	[TBD] to [TBD] masl
Interconnection Line, Range	[TBD] to [TBD] masl
Project Substation, Range	[TBD] to [TBD] masl
Climate	
Extreme Ambient Temperature Range	[TBD]°C to [TBD]°C
Max/Min Dry Bulb Temperature Range	[TBD]°C to [TBD]°C
Extreme Max Wet Bulb Temperature	[TBD]°C
Average Annual Precipitation	[TBD] to [TBD] mm
Isokeraunic Level	Engineer to determine through Project Site-specific study, as necessary
Solar Radiation Level	[TBD] kWh/MxM/day
Lightning Density	[TBD] strikes/km ² /year
Mean Relative Humidity	[TBD]
Wind Loading	
Maximum Recorded Wind Speed	[TBD] m/s
Basic Wind Speed (3-Second Gust)	[TBD] m/s
Ground Surface Roughness	[TBD]
Occupancy Category	[TBD]
Exposure Category	C or stricter
Importance Factor	[TBD]
Seismic Loading	
Occupancy Category	[TBD]
Site Class	[TBD] (IBC, 2006)
Seismic Importance Factor	[TBD]
0.2 Second Spectral Response Acceleration, S_s	[TBD] g
1.0 Second Spectral Response Acceleration, S_1	[TBD] g
Snow Loading	
Occupancy Category	[TBD]
Ground Snow Load, P_g	Engineer to determine through Project Site-specific study, as necessary

Description	Value
Terrain Category	[TBD]
Exposure Factor, C_e	[TBD]
Snow Importance Factor	[TBD]
Ice Loading	Engineer to determine through Project Site-specific study, as necessary

EXHIBIT D.3
PRELIMINARY DESIGN DOCUMENTS

The following exhibits are included in this Exhibit D.3:

- Exhibit D.3.1 – Indicative Drawings
 - Exhibit D.3.1.1 – Renewable Substation Oneline and Bill of Material
 - Exhibit D.3.1.2 – Renewable Substation M&R Diagrams
 - Exhibit D.3.1.3 – Renewable Substation Physical Layout
 - Exhibit D.3.1.4 – Renewable Substation Electrical Details
 - Exhibit D.3.1.5 – Renewable Substation Relay Panels
 - Exhibit D.3.1.6 – Solar Collection System Details
 - Exhibit D.3.1.7 – Renewable Collection System Onelines
 - Exhibit D.3.1.8 – Renewable Communication Diagram