414 Nicollet Mall
Minneapolis, MN 55401

March 10, 2023

—Via Electronic Filing—

Will Seuffert
Executive Secretary
Minnesota Public Utilities Commission
121 7th Place East, Suite 350
St. Paul, MN 55101

RE: REQUEST FOR INFORMATION – INDEPENDENT EXPERT REPORT
2020-2034 UPPER MIDWEST INTEGRATED RESOURCE PLAN
CERTIFICATE OF NEED FOR TWO GEN-TIE LINES FROM
SHERBURNE COUNTY TO LYON COUNTY, MINNESOTA
DOCKET NOS. E002/RP-19-368 and E002/CN-22-131

Dear Mr. Seuffert:

Northern States Power Company, doing business as Xcel Energy, submits to the Minnesota Public Utilities Commission a copy of the Independent Expert Report evaluating our Request for Information (RFI) results.[1] The RFI sought information about potential generation assets in development that may be candidates for interconnection to our planned gen-tie transmission lines interconnecting at the Sherburne County (Sherco) and Allen S. King substations. The RFI launched on June 3, 2022, and we are using its results to inform the routing of the MN Energy Connection gen-tie (from Sherco to Lyon County) and the King gen-tie line.

The Company retained an independent expert, Guidehouse Inc., to evaluate the RFI. Guidehouse completed its Final Report on December 29, 2022, which is included as Appendix A to this filing. The Report offered several conclusions, including a confirmation that the MN Energy Connection gen-tie is needed to make renewable resources in Lyon County viable.

[1] The Commission accepted the Company's offer to conduct this RFI and use an independent expert to "analyze the credibility of the proposals and their potential cost ranges." (See April 15, 2022 Order in Docket No. E002/RP-19-368 at page 15 and Order Point 4.)

On March 9, 2023, we submitted a Certificate of Need application for the MN Energy Connection gen-tie line. We discuss the Report and its conclusions further in that application.

We intend to acquire resources to interconnect to the gen-tie lines via Commission-approved competitive solicitation processes in the coming years.

We have electronically filed this document with the Commission, and copies have been served on the parties on the attached service lists. Please contact me at bria.e.shea@xcelenergy.com if you have any questions regarding our RFI, resource acquisition process, or this filing.

Sincerely,

/s/

BRIA E. SHEA
REGIONAL VICE PRESIDENT, REGULATORY STRATEGY

Encl

c: Service Lists

Xcel Energy

Northern States Power Company

2022 RFI Independent Expert Report

Prepared by Guidehouse, Inc. for:

Xcel Energy

Submitted by:

guidehouse.com

12/29/2022

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Executive Summary

Background

The Company's approved Upper Midwest Integrated Resource Plan (IRP) directs the procurement of approximately 600 MW of solar and 2,150 MW of wind – or an equivalent amount of energy and capacity from wind, solar and/or storage – between 2027 and 2032 to maximize the use of the Sherco gen-tie line. The IRP also allows 600 MW of Company-owned solar and/or storage resources to come online between 2028 and 2030 to maximize the use of existing King interconnection facilities

Subsequently, Northern States Power Company, an Xcel Energy operating company (Company) issued a 2022 request for information (RFI) to collect basic information about potential generation assets in development that may be candidates for interconnection to the Company's proposed transmission tie-lines routed back to the existing Sherco or King facilities for reuse of the Company's existing interconnection rights.

The Minnesota Public Utilities Commission (PUC) oversees and regulates public utilities, including the Company. The PUC required the Company retain an Independent Expert (IE), to analyze the credibility of the proposals received and their potential cost ranges. The Company contracted with Guidehouse, Inc. to perform the services of an IE for the RFI as required by appropriate regulations and guidelines. The information collected from the RFI will be evaluated by an IE and used to inform Company efforts to develop renewable generation collector transmission tie lines in support of cost effectively achieving the IRP approved capacity additions on a timely basis. In addition to IE services, the Company contracted with Guidehouse to analyze potential socioeconomic impacts of the RFI portfolio of projects which included workforce development, local economic impacts, landowner impacts and potential incremental tax revenues.

Inflation Reduction Act of 2022

The Inflation Reduction Act (IRA) of 2022 was signed into law after Guidehouse was contracted by the Company to perform IE services and the majority of report development was complete. However, it is important to acknowledge IRA provisions and incentives which are potentially impactful to the development of future energy infrastructure projects including solar, wind and energy storage resources. The IRA creates economic incentives in the form of extended Production Tax Credit (PTC) and Investment Tax Credit (ITC) provisions. Most relevant to the RFI portfolio of projects is the establishment of ITC and PTC for wind and solar projects that begin construction during 2024-2034 time period. Bonus tax credits are offered to projects that meet domestic equipment content requirements or are sited in specific communities including low income or Tribal areas. Additionally, the IRA extends the ITC and PTC incentives to standalone battery storage system which were not previously eligible under existing tax incentive programs unless certain battery charging requirements were met by project developers.

IRA provisions are an important factor to consider when evaluating the economic viability of the wind, solar and storage RFI responses. All RFI responses reviewed by the IE were proposed to be constructed during the 2026-2030 time range which would make them eligible for IRA incentives. If claimed by RFI respondents, the PTC and ITC incentives have the potential to put downward pressure on the LCOE ranges projected in this report. However, their net impact on LCOE ranges are dependent on numerous other future market conditions including inflation, cost of debt and supply chain strength. RFI respondents did not identify any Tribal lands as part of their siting plans and further analysis is required to determine RFI project potential for bonus tax credits due to siting new facilities in low income communities.

Summary of RFI Project Portfolio

This report (the "Xcel Energy 2022 RFI Final Report" or "Final Report") summarizes the analysis of Guidehouse Inc. as the Independent Expert ("IE"). Guidehouse found the RFI portfolio of projects, if brought online, are generally well suited to satisfy the Company's incremental capacity needs during the 2026-2030 period per the approved IRP. It is the IE's option that the projects proposed by RFI respondents are subject to known risks typically encountered by those seeking to develop renewable generating facilities and therefore the RFI portfolio is not inherently riskier than any other group of development stage projects. Additionally, the RFI portfolio faces low to moderate threat levels for the known risk criteria analyzed by Guidehouse.

Table 1: RFI Responses by Gen-Tie Region

Xcel/NSP Territory Location	Total Capacity by Generation Type			
	Solar (MW)	Storage (MW)	Storage (MWh)	Wind (MW)
Sherco/Lyon County Gen-Tie Region	2,300	2,000	7,600	4,214
King Gen-Tie Region	1,540	641	1,964	0
Other Gen-Tie Region	450	0	0	252
Total	4,290	2,641	9,564	4,466

- The RFI did not require respondents to provide evidence of site control, however most respondents were able to demonstrate some level of land acquisition success or indicated positive initial feedback from local landowners or stakeholders regarding the potential for renewable projects to be sited in their respective communities.
- The majority of projects provided indicative project siting plans that avoided the use of government and tribal lands. Additionally, most projects were proposed outside of areas identified as Wildlife Management Areas (WMA), sensitive species habitats or areas of environmental concern.
- The is some risk for scarcity or competition amongst developers seeking to acquire land in areas with known natural wind and solar resource potential. This risk is most prevalent for the larger, 500MW or greater projects, proposed in vicinity of Lyon County, Minnesota and may impact the commercial viability of these projects.
- The majority of developers were able to demonstrate relevant experience either as Develop-Transfer or Build-Transfer, based on descriptions of past project experience and lists of completed projects which correlated with the project data provided in their RFI response(s).

  - Renewable generation technologies for wind, solar and battery storage proposed by RFI respondents are industry standard equipment and have at least 5 years of operating history in the United States. All RFI respondents face the same equipment acquisition risks which may impact project commercial viability depending on market condition at the time of major equipment procurement.

- The RFI process also seeks to understand the relative cost effectiveness of interconnection options available to the RFI Project Portfolio. With respect to the location of projects proposed under the RFI, three distinct clusters of projects emerged (1) Sherco/Lyon County Gen-Tie Region (2) King Gen-Tie Region (3) Other Gen-Tie Region. The relative effort and feasibility to interconnect incremental renewable energy capacity in each area differs amongst the regions.
  - Analysis performed by Guidehouse for the Sherco/Lyon County Gen-Tie Region indicates that projects have historically encountered higher interconnection costs and experienced lower success rates based on MISO interconnection queue data.
  - Non-RFI projects seeking interconnection in the King Gen-Tie Region have relatively lower interconnection upgrade costs and high observed success rates, but fewer data points exist making this analysis unreliable until additional data is available. Absent incremental transmission network upgrades, interconnection costs for future projects will likely remain steady with average upgrades fees of approximately $73/kW of capacity connected to the system (see section 4.1 for details).
  - Guidehouse did not perform a MISO interconnection data analysis for non-RFI projects in the Other Gen-Tie Region as routing and siting of new transmission to collect and deliver this capacity to an existing Company POI, Sherco or King, was deemed uneconomic and therefore the MISO interconnection queue is the best default interconnection option for these projects.
  - Given the dense clustering of both wind, solar and storage projects in the Sherco/Lyon County Gen-Tie region and historically high regional interconnection costs, it is reasonable to assume that this development zone, with its potentially rich wind and solar resources, will remain untapped until new transmission network upgrades are implemented.
  - Further historical MISO queue analysis and cost-benefit analysis of transmission collector systems for RFI Projects in the King Gen-Tie region are necessary to determine the best interconnection option for solar and solar+storage projects in the area

- Renewable energy projects are resource intensive projects requiring significant amounts of equipment, land, construction materials and human capital to construct. Given the scale of renewable resource need demonstrated by the Company, a number of socioeconomic scenarios are likely to come into play during the procurement and implementation of these projects
  - All phases of project implementation will stimulate workforce development and staff utilization, both directly and indirectly. The development of renewable resources requires a large cross section of workers directly related to the project

including designers, engineers, environmental specialists, permitting agencies, construction labor and management staff. Indirect workforces such as state and local agency staff will also contribute meaningfully to the development of these renewable energy resources.

- Landowners and communities can be impacted in both positive and negative ways. Wind and solar projects require significant amounts of land which is either lease or purchased from owners. This can be a potential net benefit to some landowners who choose to pursue this economic opportunity. Non-landowners may also benefit through the collection of incremental tax revenues benefitting communities where new facilities are constructed. Business owners such as hoteliers, construction materials vendors and other service providers can potentially see increases in complementary economic activity due to prolonged development activity driven by the construction of Company procured renewable generating capacity.
- Other community stakeholders may consider these new resources a disruption to the status quo and have objections to the siting of new facilities due to their potential to obstruct landscapes. Stakeholders may also be concerned about the possibility of eminent domain authority being used to site renewable facilities, although this risk is largely perception based given the Company has no known history using this authority in the pursuit of renewable energy project.

This Final Report summarizes Guidehouse's review and findings as of the date of this report. We relied on documents, correspondence, analyses, and other information provided to us by the Company to perform our work. While we believe this information to be reliable, it has not been independently verified for either accuracy or validity, and no assurances are offered with respect thereto. Guidehouse makes no representations, warranties, or opinions concerning the enforceability or legality of the laws, regulations, rules, agreements, or other similar documents reviewed as part of its work. Guidehouse and its employees are independent contractors providing professional services to the Company and are not officers, employees, or agents of the Company.

1. Generation Technology Cost Trajectories

1.1 Current Generation Project Costs

Guidehouse developed a baseline cost set for the generation types targeted in the RFI. To evaluate the respective future Levelized Cost of Energy (LCOE)[1] of Project proposals received under the RFI, Guidehouse leveraged its internal model to develop long-term cost projections representative of location-specific price forecasts for each asset type in the RFI portfolio. For the purposes of utility resource planning, LCOE can be viewed as the baseline of a competitive power purchase agreement (PPA) benchmark because the LCOE value of a resource indicates the minimum price required for the project owner to recoup its investment while making a minimum target return. Therefore, while PPA price offerings can be expected to come at a premium to the LCOE of a new resource, the metric provides a conservative estimate of future value.

Guidehouse's LCOE model consists of a discounted cash flow analysis to calculate the levelized cost of ownership of an energy resource. The revenue-based analysis creates a power plant model representing a regionally appropriate representative project for the relevant technology and solving for the $/kWh value that results in a minimum levered IRR equal to the assumed cost of equity as well as meeting a minimum debt service coverage ratio (DSCR).
Table 2 through

[1] Guidehouse LCOE model and subsequent price data points do not include IRA economic assumptions.

Table 7 below provide the Guidehouse developed input streams to the LCOE model[2].

Table 2: Renewable Capacity Factors

Renewable Capacity Factors[3]			
Region	State	Type	Capacity Factor (%)
MISO - North	MN	Single Axis Tracker	25.5%
MISO - North	SW-MN	Onshore	41.6%

[2] In some instances Guidehouse's independent LCOE assumptions differ notably from Xcel Energy LCOE assumptions.

[3] Assumed 0.5% capacity degradation per year, Capacity Factor in kW-DC to kWh. Source: NREL System Advisory Model

Table 3: Financial Inputs

Financial Inputs	
Parameter	Value
Asset Life / Investment Horizon	25 yr.
Fixed O&M Escalator	0.5%
Target Equity IRR	10.0%
Minimum DSCR	1.30
Cost of Debt	6.0%
Debt Period	25 yr.
Federal Tax Rate	21%

Table 4: Incentives[4]

	Incentives	
	Investment Tax Credit (ITC)[5]	Production Tax Credit (PTC)[6]
2021	26.0%	$0.015/kWh
2022	26.0%	
2023	22.0%	
>2023	10.0%	

Table 5: Depreciation Assumptions

Depreciation Assumptions	
Depreciation Type	MACRS
MACRS Depreciation Life	5

Table 6: Capex[7]

	US	MISO	US	US
Year	Utility Solar	Onshore Wind	4-HR BESS	Solar + BESS
2022	$1.10	$1.52	$1.60	$2.70

[4] During the drafting of this report the Inflation Reduction Act (IRA) of 2022 was passed which could materially alter potential outcomes discussed herein. Guidehouse models do not include impacts of the IRA.

[5] ITC incentives are based on Start of Construction

[6] PTC applies to projects that have started construction prior to January 1st, 2025. The PTC applies for the first 10 years of commercial operation.

[7] Units: Real 2020$/Wdc

Table 7: Baseline Renewable Generation Costs

	Utility-Solar	Wind	BESS	Solar + BESS
	Single Axis Tracker	Onshore	4-HR	4-HR
	$/MWh	$/MWh	$/MWh	$/MWh
2022	$37.7682	$32.9059	$149.5633	$122.5443

1.2 LCOE Influencing Factors

Solar

Guidehouse anticipates a slight decrease in the LCOE of single axis tracker, utility scale solar from 40.86 $/MWh in 2026 to 38.34 $/MWh in 2030[8]. The scale of production and scale of installation both impact the cost of single-axis utility scale solar. Solar panel production has increased continuously from 2000 to 2020.[9] Through 2030 Guidehouse assumes a continuation of the multi-decade growth trend of both supply and demand for solar. Even during the COVID-19 Pandemic, when certain the cost of components that are required to manufacture solar photovoltaics increased suddenly, production was maintained then increased substantially.

Table 8: Solar Photovoltaics Installation by Year (Global)

Year	Solar-GW Installed	Source
2019	115	NREL[10]
2020	107	IEA[11]
2021	173.5	International Energy Agency Photovoltaic Power Systems Programme (IEA PVPS)[12]
2022	260	International Energy Agency Photovoltaic Power Systems Programme (IEA PVPS) - forecast[12]

NREL estimates that for every doubling of cumulative PV shipments, the module price drops 23%.[13] However, it is important to note that this module price observation represents a cumulative historical trend and does not reflect recent price increases of solar modules due to global supply constraints and upward inflationary pressure. NREL also reports that the average system size of utility scale installations has trended upwards over the past 7 years.[14] Larger installations mean lower costs per MW, driving the cost down over time. Therefore, with rising scale we can anticipate falling cost. Economies of scale and the technological improvements that come with increased production, as well as falling manufacturing costs paired with supply chain vulnerability drive Guidehouse's forecast of a slight decrease in the LCOE of single axis tracker, utility scale solar between 2026 and 2030.

Policy and trade disruptions may continue to affect pricing through 2030 due to uncertainty across a number of economic indicators including inflation and energy policy adjustments made in response to emerging situations such as the war Ukraine. Manufacturing costs are projected

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[8] This future price range assumes that currently observed upward inflationary pressures reverse and solar module production matches pace to meet net global demand generated by an accelerating transition to renewable energy sources. If current trends continue into the future, LCOE forecasts will require adjustment to reflect actual market conditions for projects developed during the 2026-2030 period.

[9] Statista, Annual solar module production globally from 2000 to 2020, https://www.statista.com/statistics/668764/annual-solar-module-manufacturing-globally/

[10] NREL, Q4 2019/Q1 2020 Solar Industry Update. https://www.nrel.gov/docs/fy20osti/77010.pdf

[11] IEA, Solar PV 2020. https://www.iea.org/reports/renewables-2020/solar-pv

[12] PV Magazine, October 2022. https://www.pv-magazine.com/2022/10/19/global-installed-pv-capacity-could-hit-260-gw-in-2022/

[13] NREL, Spring 2022 Solar Industry Update, https://www.nrel.gov/docs/fy22osti/82854.pdf

[14] NREL, Spring 2022 Solar Industry Update, https://www.nrel.gov/docs/fy22osti/82854.pdf

to continue dropping through 2025 and beyond.[15] However, material costs have been vulnerable to recent supply chain disruptions and political rulings, greatly increasing production costs. Polysilicon, a key ingredient in solar production, has 50% of global production localized to the Xinjiang region in China. Therefore, it is highly exposed to variations in local affairs and shipping costs. During the COVID-19 pandemic, disruptions caused an over 200% rise in price for the material. Additionally, the Uyghur Force Labor Prevention Act (UFLPA) placed strict requirements on goods shipped to the US from the Xinjiang region due to concerns over forced labor.[16] The COVID-19 disruptions are considered short term and are unlikely to specifically affect prices from 2026-2030, however sustained growth in global demand for energy produced from solar PV has the potential to dampen long term price declines.

Wind

Guidehouse anticipates a decrease in the LCOE of onshore wind from 37.49 $/MWh in 2026 to 33.53 $/MWh in 2030. The forecast provided by Guidehouse is based off of two fundamental parts: the current LCOE values from the Department of Energy's land-based wind report[17] and the NREL Annual Technology Baseline forecast[18] (ATB). We extend Department of Energy's (DOE) current LCOE into the future using the percentage change from the ATB to obtain the most accurate future projection. The projected decrease is due to market expansion and manufacturing process improvements.

Guidehouse Insights expects a 2.1% compound global annual growth rate from the global wind power market from 2021-2030, with the dominant long term (8-10 year) factors being demand from "zero net carbon emissions policies in China," "investment in research for offshore wind implementation on the US coast," and "advancements in turbine design with better capacity factors for viable projects in areas with low wind speeds".[19] Regarding advancements in turbine design, wind power installations have experienced capacity factor performance gains due to higher hub heights and lower specific powers. Siting installations in areas with lower average wind speeds have caused some reductions in capacity factor but expanded the areas of possible installation.[20] Focusing on the market for just US, onshore wind – 13.4 GW of new capacity was added in 2021, slightly less than was installed in 2020 and following a four-year trend of increasing yearly additions.[21] US onshore wind capacity additions have not been consistent over time, a trend which is expected to continue. The US Department of Energy predicts that wind energy capacity additions will "generally decline through 2023 before rebounding" through 2025.[22]

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[15] NREL, Solar Manufacturing Cost Analysis, https://www.nrel.gov/solar/market-research-analysis/solar-manufacturing-cost.html

[16] PV Magazine, Polysilicon prices rise over 200% in 2022 amid supply shortages, https://pv-magazine-usa.com/2022/07/06/polysilicon-prices-rise-over-200-in-2022-amid-supply-shortages/

[17] US Department of Energy, https://www.energy.gov/eere/wind/articles/land-based-wind-market-report-2021-edition-released

[18] NREL, https://atb.nrel.gov/electricity/2022/data

[19] Guidehouse Insights, https://guidehouseinsights.com/reports/analyst-insight-wind-energy-update-and-forecast-insights

[20] US Department of Energy, https://www.energy.gov/sites/default/files/2022-08/land_based_wind_market_report_2202.pdf

[21] US Department of Energy, https://www.energy.gov/sites/default/files/2022-08/land_based_wind_market_report_2022_ppt.pdf

[22] US Department of Energy, https://www.energy.gov/sites/default/files/2022-08/land_based_wind_market_report_2202.pdf

Manufacturing processes for wind turbines have improved over time, driving down installation costs. Domestically, there are over 500 manufacturing facilities for wind turbine components and assembly. Advancements in "composite materials, automation, and more efficient manufacturing processes" have reduced the cost of production and thereby the cost of installations. Additionally, the construction of wind energy projects requires extreme logistics for the transportation of manufactured components. Improvements and experience have reduced transportation costs, further driving the decrease in price.[23] [24]

[23] US Department of Energy, https://www.energy.gov/eere/wind/wind-manufacturing-and-supply-chain

[24] US Department of Energy, https://www.energy.gov/sites/default/files/2022-02/Wind%20Supply%20Chain%20Report%20-%20Final%202.25.22.pdf

Battery Storage

The cost of energy storage is projected to notably decline by the end of the decade, with Guidehouse Insights anticipating a 41% reduction in lithium-ion cell prices by 2030.[25] Cost reductions are expected to be driven by several factors including expansion of manufacturing capabilities with increased demand in the electric vehicle (EV) market, advances in battery storage technologies, and improvement in material use and cell design.

The EV and stationary energy storage markets, growth trajectories, and cost curves are interconnected with notable overlap in required materials and manufacturing capabilities. Lithium-ion technology is one of the leading technologies for both markets, and the reduction in costs for this technology has been one of the largest contributors to cost declines for stationary energy storage.[26] Even with its importance to stationary energy storage, the EV market accounts for nearly 80% of lithium-ion batteries globally.[27] As such, growth within the EV market can yield concurrent benefits to stationary energy storage. Light-duty (LD) plug-in electric vehicle (PEV) sales are expected to grow from 3.5% of total North American LD vehicles to 31.4% by 2030.[28] Tesla, one of the leading EV OEMs, has seen 25% year-over-year (YoY) growth in LD PEV sales, and has continued to build new facilities as well as ramp production and manufacturing efficiency to new heights at existing factories within the U.S. and internationally. This growth in EV production to meet rising demand can help reduce costs for utility scale energy storage since greater emphasis will be placed on greater and more efficient lithium-ion battery production. The top 15 cell manufacturers by planned capacity implemented about 200 GWh in 2021 alone, and many more new facility announcements are expected industry wide.[29] Additionally, EV duty cycles can be strenuous on lithium-ion batteries, but after completing the decade or so operating life of a PEV, the battery can be repurposed to serve stationary energy storage applications. For energy storage applications that require less frequent battery cycling, on the magnitude of 100-300 cycles per year, reusing lithium-ion batteries may provide the most value. Battery reuse can yield costs around 30-70% less expensive than new battery alternatives.[30]

The cost of raw materials for battery manufacturing, such as lithium carbonate and cobalt, has notably increased. The increase in these costs has been attributed to pandemic-induced supply chain issues as well as an overall imbalance in supply of necessary raw materials with the demand for batteries in other markets, especially EVs. [31] The Federal Consortium for Advanced batteries has raised this as a key challenge and seeks to obtain reliable access to raw and refined materials for existing energy storage technologies, and further research alternatives to

[25] Guidehouse Insights, Market Data: Evolving Market Participation Models for Energy Storage. https://guidehouseinsights.com/reports/market-data-evolving-market-participation-models-for-energy-storage

[26] Guidehouse Insights, Market Data: EV Geographic Forecast- North America. https://guidehouseinsights.com/reports/market-data-ev-geographic-forecast-north-america

[27] Wood Mackenzie, Global lithium-ion battery capacity to rise five-fold by 2030. https://www.woodmac.com/press-releases/global-lithium-ion-battery-capacity-to-rise-five-fold-by-2030/

[28] Guidehouse Insights, Market Data: EV Geographic Forecast- North America. https://guidehouseinsights.com/reports/market-data-ev-geographic-forecast-north-america

[29] Wood Mackenzie, Global lithium-ion battery capacity to rise five-fold by 2030. https://www.woodmac.com/press-releases/global-lithium-ion-battery-capacity-to-rise-five-fold-by-2030/

[30] McKinsey & Company, Second-life EV batteries: The newest value pool in energy storage. https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/second-life-ev-batteries-the-newest-value-pool-in-energy-storage

[31] Guidehouse Insights, Market Data: Evolving Market Participation Models for Energy Storage. https://guidehouseinsights.com/reports/market-data-evolving-market-participation-models-for-energy-storage

mitigate supply chain impacts on the cost of stationary energy storage.[32] U.S. imports of lithium-ion batteries have been surging in 2021. There has been ~320,000 metric tons of imports, which is more than double that of 2020.[33] In response, the DOE is investing in enhancing the domestic battery manufacturing capabilities of the U.S. to minimize reliance on the supply chains of other countries.[34] Efforts will look to advance domestic material sourcing, mineral processing, and battery technology production at U.S. facilities.[35] Nonetheless, if material costs for lithium-ion batteries continue to rise, a significant opportunity may emerge for alternative stationary energy storage technologies that do not face the same type of raw material cost limitations. In particular, demand for long duration energy storage technologies, such as flow (e.g., zinc bromine, vanadium), thermal (e.g., latent heat, sensible heat), and mechanical (e.g., gravity, compressed air), continues to rise, but are currently held back by the technology development and wholesale market price signals.[36] Other challenges have rose for the energy storage supply chain, such as Tesla, which noted that declining energy storage deployments in Q2-2022 can largely be attributed to semiconductor challenges. However, rising cost of raw materials is still the most significant driver of recent challenges.

Lithium-ion battery technologies and cell design have advanced, improving system efficiency and cost effectiveness, and ultimately lead to reductions in LCOE. Considering all relevant factors, Guidehouse Insights expects that continued advancements in manufacturing efficiency and capacity and supply-chain improvements in conjunction with incremental research and development (R&D) progress in energy density will drive the additional 41% reduction in average lithium-ion cell prices through 2030.[37]

1.3 Generation Project Cost Forecast

Applying the LCOE model assumptions from Section 1.1 and forward-looking capital cost research detailed in Section 1.2, Guidehouse developed a set of future LCOE ranges for the renewable generation resource types which were included in developer responses to the RFI. Capital expenditures (capex) have a large influence on the forecasted LCOE of a particular resource type. Capex forecasts are subject to variability due to technology and economic parameters detailed in Section 1.2. These parameters are accounted for in Table 9 where low, base and high capex scenarios by generation resource type are presented. These capex scenarios are fed into Guidehouse's LCOE model to generate a range of potential future LCOEs by resource type. Additionally, financing and tax parameters defined in Section 1.1. may impact LCOE forecasts, but detailed sensitivity analyses outside the scope of this report would be required to measure their impact.

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[32] DOE, National Blueprint for Lithium Batteries. https://www.energy.gov/sites/default/files/2021-06/FCAB%20National%20Blueprint%20Lithium%20Batteries%200621_0.pdf

[33] S&P Global, US lithium-ion battery imports surge as auto, energy sectors race to meet demand. https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/us-lithium-ion-battery-imports-surge-as-auto-energy-sectors-race-to-meet-demand-69048550

[34] DOE, Energy Storage Grand Challenge Roadmap. https://www.energy.gov/articles/department-energy-releases-energy-storage-grand-challenge-roadmap

[35] NREL, Battery Policies and Incentives Database Contributes to U.S. Efforts to Build a Secure Electric Vehicle Battery Supply Chain. https://www.nrel.gov/news/program/2022/battery-policies-and-incentives-database-contributes-to-us-efforts-to-build-a-secure-electric-vehicle-battery-supply-chain.html

[36] Lazard, Levelized Cost of Storage Analysis. https://www.lazard.com/media/451882/lazards-levelized-cost-of-storage-version-70-vf.pdf

[37] Guidehouse Insights, Market Data: Evolving Market Participation Models for Energy Storage. https://guidehouseinsights.com/reports/market-data-evolving-market-participation-models-for-energy-storage

The scenario forecasts below were formulated in a manner specific to each resource. For utility solar and battery storage, Guidehouse relied on industry knowledge and information from past engagements that fed into its estimates of capital components, as well as the expected rate of cost declines. These values were benchmarked against publicly available figures. As for wind, due to a lack of internally available information, Guidehouse opted to develop its forecasts based on a blend of data acquired from outside publications, including the DOE and NREL.

Table 9: Renewable Generation Capex Forecast

	US			MISO			US		
	Utility Solar $/W-DC			Onshore Wind $/W-DC			4-HR BESS $/W-DC		
Year	Low	Base	High	Low	Base	High	Low	Base	High
2026	$0.89	$1.00	$1.10	$1.12	$1.29	$1.33	$1.14	$1.24	$1.79
2027	$0.87	$0.98	$1.08	$1.04	$1.24	$1.28	$1.10	$1.20	$1.77
2028	$0.85	$0.96	$1.05	$0.96	$1.18	$1.23	$1.08	$1.17	$1.75
2029	$0.83	$0.94	$1.03	$0.87	$1.12	$1.17	$1.07	$1.16	$1.74
2030	$0.81	$0.92	$1.02	$0.79	$1.07	$1.12	$1.04	$1.13	$1.72

Table 10: Guidehouse Renewables LCOE Forecast[38]

	Utility-Solar			Wind			Solar + BESS[39]		
	Single Axis Tracker			Onshore			4-HR		
Year	$/MWh Low	$/MWh Base	$/MWh High	$/MWh Low	$/MWh Base	$/MWh High	$/MWh Low	$/MWh Base	$/MWh High
2026	$37.18	$40.86	$44.16	$33.51	$37.30	$38.05	$112.76	$122.12	$158.70
2027	$36.51	$40.17	$43.42	$31.64	$36.03	$36.93	$110.37	$120.04	$156.94
2028	$35.87	$39.51	$42.71	$29.76	$34.80	$35.80	$108.72	$118.09	$155.54
2029	$35.29	$38.92	$42.02	$27.85	$33.53	$34.65	$107.63	$116.91	$154.16
2030	$34.71	$38.34	$41.39	$25.95	$32.27	$33.54	$105.80	$115.20	$152.62

Company Cost Projections

As an IE, Guidehouse was tasked with developing the forecasted LCOE ranges (Table 10) for the three resource types the Company is seeking to procure under its approved IRP. These independent LCOE forecasts are compared against the Company's forecasts, which are included in the Company's regulatory filings, for the 2026-2030 period in Table 11. There are some notable differences between the two sets of forecasts, the greatest difference occurring for wind projects under the high cost scenario with the Company forecasting an increase in prices while Guidehouse suggesting a future cost decline. The same trend is true for the solar high price scenario with the Company indicating a price increase over time while Guidehouse projects a cost decline, albeit at a lesser rate of decline than the base or low price projections.

[38] LCOE forecasts do not include interconnection costs

[39] Solar + BESS LCOE forecasts driven by additive solar and BESS capex costs

Table 11: Company Cost Projections[40] [41]

	Utility-Solar			Wind		
	Single Axis Tracker			Onshore		
Year	$/MWh Low	$/MWh Base	$/MWh High	$/MWh Low	$/MWh Base	$/MWh High
2026	$28.98	$40.38	$49.20	$26.98	$33.67	$43.27
2027	$27.96	$40.14	$50.18	$26.12	$33.38	$44.14
2028	$26.90	$39.87	$51.19	$25.27	$33.09	$45.02
2029	$25.81	$39.58	$52.21	$24.45	$32.79	$45.92
2030	$24.69	$39.28	$53.25	$23.65	$32.49	$46.84

Table 12: Cost Forecast Comparison

			Utility-Solar			Wind		
			Single Axis Tracker			Onshore		
		Year	$/MWh Low	$/MWh Base	$/MWh High	$/MWh Low	$/MWh Base	$/MWh High
A	**Xcel/NSP Price Forecasts**	**2026**	$28.98	$40.38	$49.20	$26.98	$33.67	$43.27
		2027	$27.96	$40.14	$50.18	$26.12	$33.38	$44.14
		2028	$26.90	$39.87	$51.19	$25.27	$33.09	$45.02
		2029	$25.81	$39.58	$52.21	$24.45	$32.79	$45.92
		2030	$24.69	$39.28	$53.25	$23.65	$32.49	$46.84
B	**Guidehouse Price Forecasts**	**2026**	$37.18	$40.86	$44.16	$33.51	$37.30	$38.05
		2027	$36.51	$40.17	$43.42	$31.64	$36.03	$36.93
		2028	$35.87	$39.51	$42.71	$29.76	$34.80	$35.80
		2029	$35.29	$38.92	$42.02	$27.85	$33.53	$34.65
		2030	$34.71	$38.34	$41.39	$25.95	$32.27	$33.54
C = B - A	**Difference**	**2026**	$8.20	$0.48	-$5.04	$6.53	$3.63	-$5.22
		2027	$8.55	$0.03	-$6.76	$5.52	$2.65	-$7.21
		2028	$8.97	-$0.36	-$8.48	$4.49	$1.71	-$9.22
		2029	$9.48	-$0.66	-$10.19	$3.40	$0.74	-$11.27
		2030	$10.02	-$0.94	-$11.86	$2.30	-$0.22	-$13.30

[40] Xcel Energy, Northern States Power Company. UPPER MIDWEST INTEGRATED RESOURCE PLAN 2020-2034 Reply Comments. Table 24: Sherco and King Gen-tie Renewable Levelized Costs by Year.

[41] Company LCOE forecasts cited in table 10 do not include interconnection costs

1.4 RFI portfolio Potential Total Investment (Capital Expenditures)

Applying the forecasted capital expenditure costs for the 2026-2030 period from Table 9, total potential capital investment for the entire RFI portfolio is estimated. Commercial Operation Dates (COD) for individual projects vary across the RFI portfolio, but all responses reviewed by the IE were compliant with the Company's requested COD range of 2026-2030. The total nameplate capacity of all RFI responses far exceeds the total capacity needed to fully reutilize the Company's existing interconnection rights at the Sherco and King generating stations. The exact mix of RFI project CODs and the associated costs for projects going into service across the compliant range of years is difficult to predict so the total investment potential for all RFI responses in aggregate is estimated using an average capital cost across the range.

It is important to consider that the projects proposed by RFI respondents are predominantly early-stage developments, most do not have existing interconnection study requests or sufficient land rights necessary to complete the project and therefore are not certain to reach commercial operations. Over the 2000-2016 period approximately 24% of projects seeking interconnection to the MISO region actually achieved commercial operations.[42] With this in mind, it is reasonable to expect the final total capital investment across the RFI Gen-Tie regions to be up to 75% less than the total solar, wind and solar + storage capital investment amounts shown in Table 13. Alternative interconnection options, such as the re-powering of existing generating resources or repurposing existing interconnection capacity for the delivery of net new renewable capacity, will likely enable a higher percentage of projects to achieve commercial success. Additionally, projects that use alternative interconnection methods are more likely to maintain their construction schedules and connect to the transmission system at lower cost than similar projects seeking to use the formal MISO interconnection process.

Table 13: Total Potential RFI Capital Expenditures

		US	MISO	US
	Year	Utility Solar	Onshore Wind	Solar + BESS
	2026 ($/MW)	$999,566	$1,291,474	$2,235,569
	2027 ($/MW)	$978,385	$1,235,750	$2,178,338
	2028 ($/MW)	$958,881	$1,179,884	$2,129,739
	2029 ($/MW)	$940,379	$1,123,876	$2,098,590
	2030 ($/MW)	$922,964	$1,067,727	$2,053,377
	2026-2030 Avg ($/MW).	$960,035	$1,179,742	$2,139,123
	King Gen-Tie Region (MW)	1,540	0	1,964
	Sherco Gen-Tie Region (MW)	2,300	4,214	2,000
	Other Region (MW)	450	0	252
Total Potential Capex	**King Gen-Tie Region**	$1,478,453,723	$0	$4,201,236,647
	Sherco Gen-Tie Region	$2,208,080,235	$4,971,432,699	$4,278,245,058
	Other Region	$432,015,698	$0	$539,058,877
	Total	$4,118,549,656	$4,971,432,699	$9,018,540,583

[42] LBNL, April 2021. Queued Up: Characteristics of Power Plants Seeking Transmission Interconnection as of End of 2021. https://emp.lbl.gov/sites/default/files/queued_up_2021_04-13-2022.pdf

2. Credibility of RFI Project Responses

2.1 Project Risks Analyzed

In alignment with the PUC requirement that the IE analyze credibility of RFI proposals achieving commercial operations, Guidehouse and the Company established the following analysis parameters to evaluate the relative implementation risk of each RFI project proposal. In order to facilitate analysis of the agreed upon parameters Guidehouse disseminated RFI information geographically using information provided by respondents.

2.1.1 Geographic Distribution of Projects by Resource Type

Stand-alone solar and solar + storage project proposals received during the RFI were distributed relatively even across three geographic Gen-Tie regions as summarized in Table 1. With the exception of 450MW proposed in the Northern portion of MISO Zone 1 (see 'Other Gen-Tie Region' projects), all solar or solar + storage projects fall within either the Lyon County/Sherco or King Gen-Tie region. This natural clustering of RFI projects enables transmission planners to conceive potential projects to aggregate this future capacity and deliver energy to existing Company POIs.

Wind projects received under the RFI were predominantly proposed in the Lyon County/Sherco Gen-Tie Region, with only one respondent proposing 252MW of wind in the Other Gen-Tie Region. Although this particular project was very low risk due to the experience of the developer, demonstrated land acquisition position and fully executed MISO interconnection agreement, the project's distant physical location was a notable barrier preventing this particular from cost effectively utilizing existing Company POIs. Putting this exception aside, wind projects proposed in the Lyon County/Sherco Gen-Tie region were also conducive to planning new transmission assets to leverage existing company POIs.

2.1.2 Definition of RFI Geographic Regions

The Company's RFI defined four illustrative geographic areas for RFI respondents to indicate a general region where their project may be located. The RFI geographic areas allowed Guidehouse evaluators to group RFI projects within relative proximity to determine if new transmission assets could be planned in such a way as to efficiently collect and deliver the incremental renewable capacity to Company POIs with existing interconnection rights as a means to lower the overall delivered cost of energy to customers. Indicative maps were included in the RFI Main Text and the four areas were defined by the Company as:

1. Figure 2a. Entire Sherco Gen-Tie project region. Contains Sherco County End Point (Figure 2b), Lyon County Area End Point (Figure 2c), and all areas in between these endpoints
2. Figure 2b. Close up of Sherco County End Point (northeast endpoint region of Sherco Gen-Tie project region)
3. Figure 2c. Close up of Lyon County Area End Point (southwest endpoint region of Sherco Gen-Tie project region)
4. Figure 2d. King Gen-Tie project region

After reviewing all RFI responses received by the Company, Guidehouse determined that for the purposes of evaluating the viability of RFI responses and potential for routing for new transmission facilities, it made sense to group the projects geographically into three categories:

1. Lyon County/Sherco Gen-Tie Region
2. King Gen-Tie Region
3. Other Gen-Tie Region

RFI responses naturally clustered into these three district regions and generally aligned with the illustrative maps provided by the Company as part of the RFI. Projects included in a particular RFI Gen-Tie region were conducive to being collected at a central point within the cluster and transferred to either the King or Sherco reuse-POIs by a new transmission line. Projects with no distinct geographic clustering or significant distance between projects were determined to be in the Other Gen-Tie Region and had no reasonable path back to an existing Company POI.

2.1.3 Interconnection Risk

Connecting a renewable generation project to a regional transmission network is an essential step in the development process. The feasibility and cost of interconnection typically critical to a project's ability to proceed in development. To estimate the impact of interconnection issues on RFI projects seeking to come online during the 2026-2030 time period Giudehouse analyzed the interconnection risks summarized in Table 14.

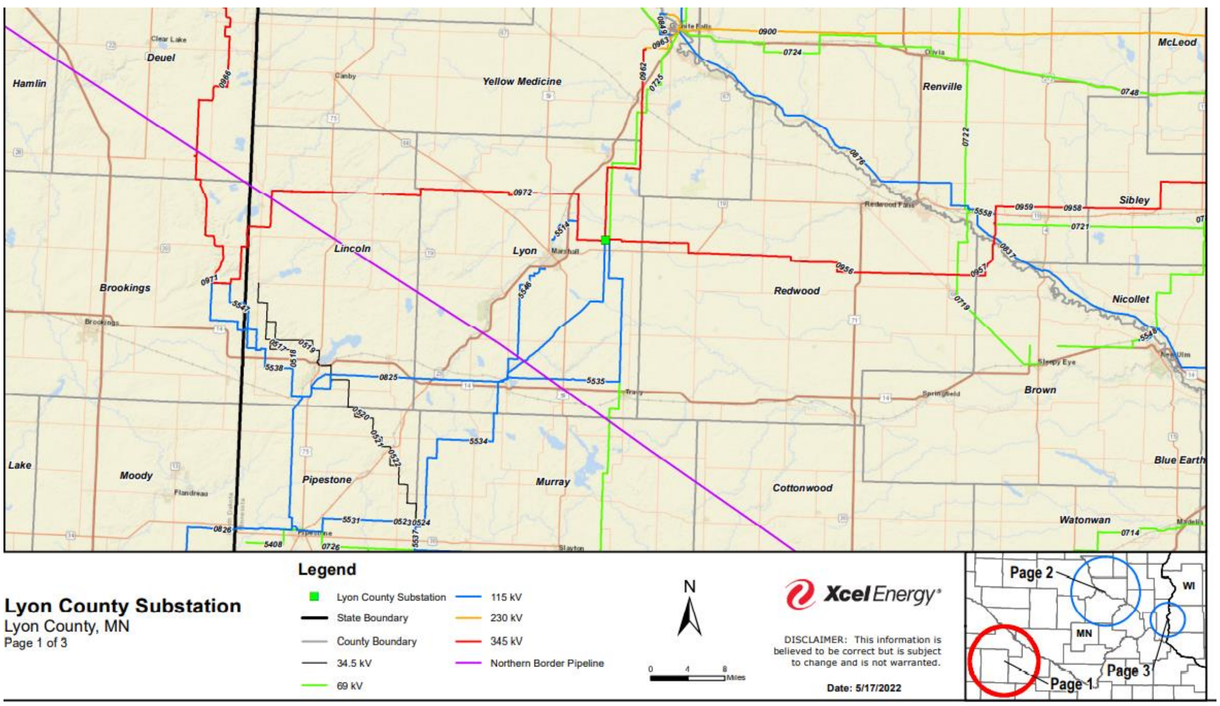
Table 14: Interconnection Risks Analyzed

• Risk	• Analysis Parameter
• **1. Proximity to NSP reuse-POI(s) and ROW(s) needed to deliver energy to the NSP transmission system**	• RFI portfolio distance to NSP's Sherco and King reuse-POIs The Company provided guidance to respondents that projects in proximity to the following are preferred: • Lyon County, MN • Sherco site • All areas in between Sherco and Lyon County, MN • King site • Western Wisconsin
• **2. Feasibility of alternative MISO interconnection options**	• i. Number of projects competing for transmission capacity near identified project site • ii. Anticipated length of interconnection study process and construction of network upgrades
• **3. Ultimate project capacity compatibility with NSP reuse-POI(s)**	• Design of existing NSP facilities can integrate ultimate planned capacity of RFI portfolio

2.1.4 Lyon County/Sherco Gen-Tie Region

RFI responses in the Lyon County area had the greatest resource diversity by generation type with some respondents proposing novel combinations of solar, wind and storage for a single project. With 4,214MW proposed in the area, this clustering of RFI responses represent a relatively high level of new project development density. Projects proposing to come online in this area are approximately 100-120 miles away from the Sherco reuse-POI depending on their exact location within the Lyon County/Sherco Gen-Tie Region. Based on Figure 1, the Lyon County/Sherco Gen-Tie region has a number of existing Company transmission assets with 345kV, 115kV and 69kV right of ways within approximately 35 miles of all proposed projects. These existing rights of way could be expanded for the purposes of delivering incremental capacity through a new transmission asset. Additionally, the Company's existing Lyon County substation site is suitable for expansion to accommodate a separate collector substation given rural and agricultural[43] adjacent land use.

Figure 1: Lyon County Company Asset Map

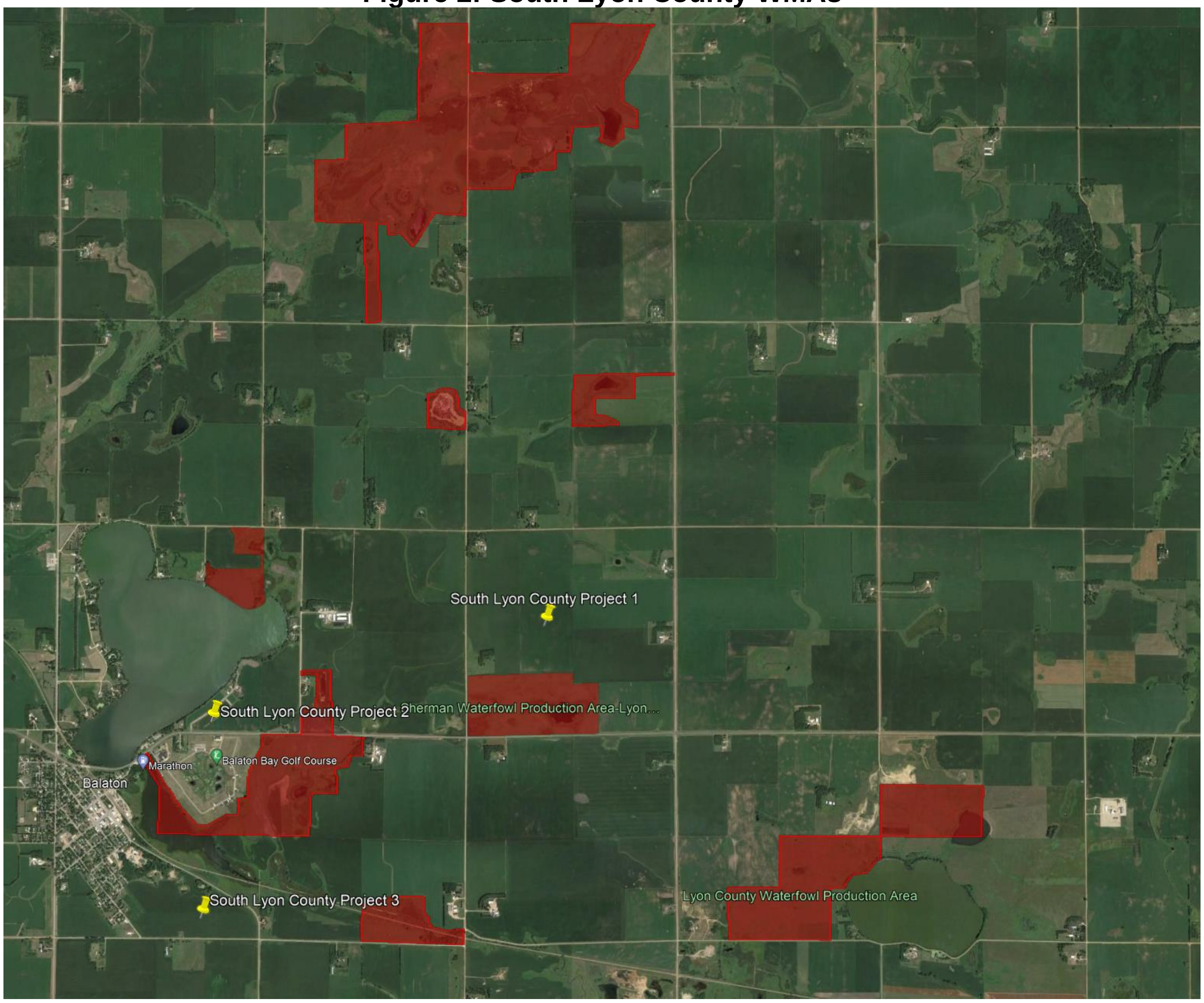


Projects in the northern portion of Lyon County are situated a reasonable distance from populated areas including Minnesota, and Marshall. These projects are also likely to have many transmission routing options due to sparse population density in the area and agriculture as the predominant current land use. However, three RFI portfolio projects around 1,000MW in size each (combined generation types) in the southern portion of Lyon County are proposed near the town of Balaton, MN which has a number of known WMAs (Figure 2, shown in red) within the immediate project areas. Generation interconnection tie lines to connect RFI portfolio projects to a future substation location, which will ultimately interconnect to the Sherco site, may require

[43] Agricultural land means prime farmland but also less desirable and/or fallow areas.

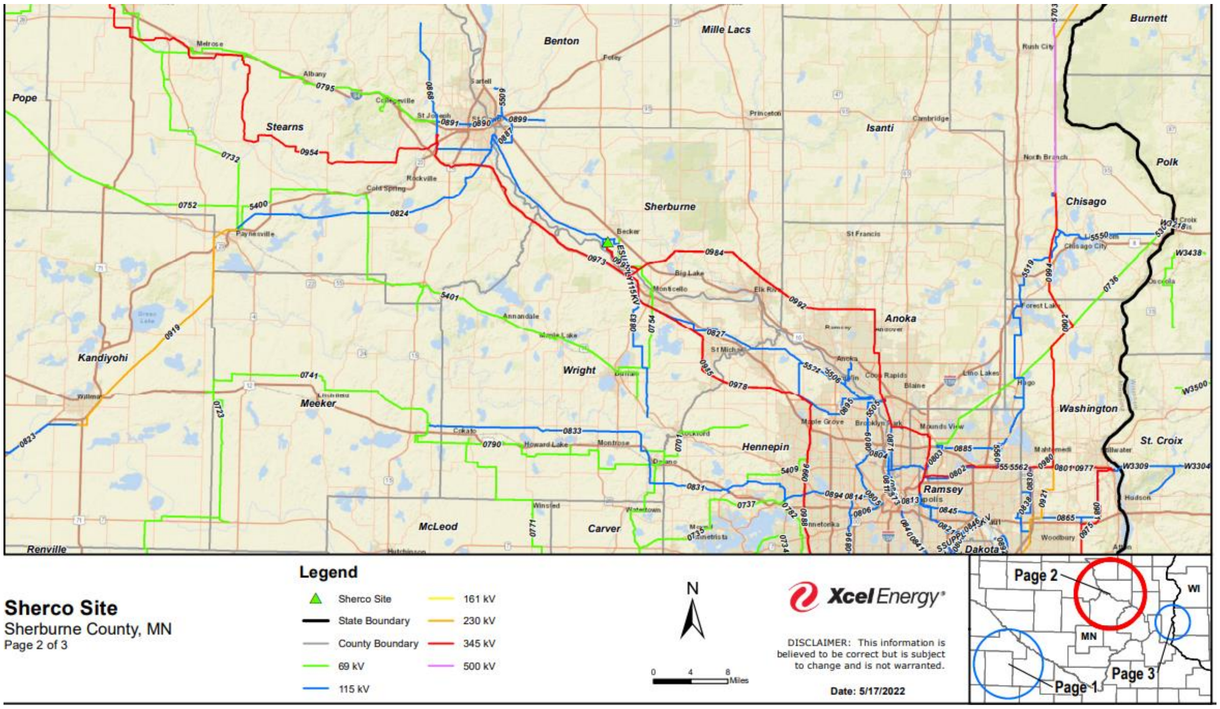
additional study and cost for routing around these environmental sensitivities which introduces interconnection risk specific to these projects.

Figure 2: South Lyon County WMAs



Of the 4,214MW proposed in Lyon/Sherco Gen-Tie Region, three projects totaling 950MW of solar PV generation, 200MW of wind power and 3,200MWh of storage capacity were proposed by RFI respondents outside the Lyon County area. These projects varied in distance from the existing Sherco site from 40 miles to 75 miles. These proposed projects were within 20 to 50 miles of each other and roughly 60 miles from the main cluster of projects scattered around the center of Lyon County. Each projects is located a reasonable distance away from population centers and no material transmission interconnection siting risks were identified. Company provided asset maps indicate these projects are located within 20-30 miles of 69kV transmission lines and within 50-75 miles of an existing 230kV route (Figure 3). Compared to projects close to Lyon County, projects sited in this outer portion of the Gen-Tie region are likely to have higher interconnection costs given their distance from the tighter grouping of projects in the immediate Lyon County area. Carefully planned routing and siting of future Company transmission assets, for the purpose of enabling the economic integration of renewables, can accommodate this physical distance potentially mitigating some of these proximity issues.

Figure 3: Broader Lyon/Sherco Gen-Tie Region Company Asset Map



Per MISO interconnection queue data as of September 2022, a single 200MW solar project is proposed in Lyon County with a proposed COD of September 2023 indicating relatively low natural demand for transmission transfer capacity in the immediate area. However there are approximately 1,800MW proposed projects in the MISO interconnection queue (wind, solar, and storage) in nearby counties including Brown, Murray, Pipestone, Renville, and Wright. Projects pursuing interconnection in these areas may face delays and increase transmission network upgrades costs due to the number of projects in the vicinity. Formal transmission load flow studies are necessary to confirm the magnitude and timing of such upgrades.

One RFI respondent indicated a potential solar project in the Closest to Sherco region as defined by the Company, however the location information provided by the respondent indicated that the project was likely not inside any of the specified RFI regions and was more appropriately located in an 'Other' RFI region category. This 150MW solar project was evaluated is evaluated as being in an Other RFI region in 2.1.6.

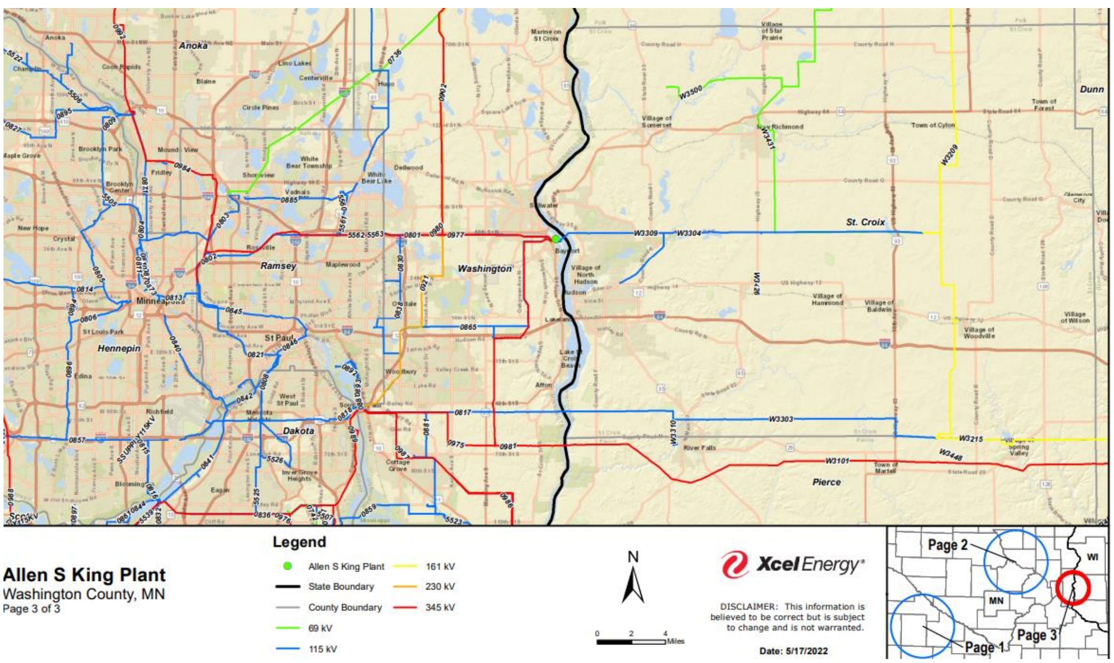
2.1.5 King Gen-Tie Region

Within the King Gen-Tie Region, two projects are within 25 miles and two more are within 60 miles of existing King interconnection facilities. Projects located within 25 miles of King face relatively low risk to connect given their proximity to the Company reuse-POI and an existing 115kV transmission path saddling the two projects whose right of way could potentially be expanded to accommodate future transmission projects. Additionally, there are fewer populations centers between the projects and the King reuse-POI. All projects face similar 'last mile' ROW challenges when approaching King as they are proposed east of the St. Croix River and will have to cross the body of water to connect at King as seen in Figure 4.

The projects within 60 miles require at least one additional water crossing increasing their relative risk but given their relative proximity to each other, new collector systems and transmission paths could be reasonably planned to align these projects to the resources planned within 25 miles of King while avoiding populated areas near the Lake Menomin area. With a combined total of 700MW of solar capacity and 904MWh of storage capacity these four projects exceed King's existing transmission interconnection rights of approximately 600MW and can fulfill the need to reutilize this capacity.

Two additional projects are located within 120 miles of King. The two projects within 120 miles of King represent the highest interconnection risk given their range from the Company reuse-POI, surrounding terrain, which appear to be rolling hills, approximate 60-mile distance between the two respective projects, in addition to multiple townships between the projects and King. Combined these two projects propose 490MW of solar generation and 1,060MWh of storage capacity.

Figure 4: King Gen-Tie Region Company Asset Map



2.1.6 Other-Gen Tie Region RFI Responses

Four projects (three solar and one wind) responding to the RFI either did not fall inside an area specified by the Company in the RFI Main Body document, were situated at least 75 miles from the nearest Company identified reuse-POI or had no discernable natural geographic clustering which would enable the Company to develop new high voltage assets to collect and deliver this incremental renewable capacity to existing POIs at Sherco or King. Additionally, two of the four solar projects proposed in an Other RFI region were proposed by companies with no demonstrated solar PV development experience putting them at relatively higher execution risk. Given the location of these two particular solar projects at the extreme north of the RFI regions indicated in Company asset maps, developing Company owned high voltage assets to deliver renewable capacity from these projects to Sherco or King would be relatively high risk from an interconnection perspective with a potential for stranded transmission assets should these two projects fail to reach commercial operations. The remaining solar and wind project in the Other RFI region, proposed by developers with demonstrated experience, had extreme geographic distances between them (200+ miles) resulting in likely low-cost efficacy for reutilizing interconnection rights at the nearest company reuse-POI, Sherco, and are best served by the standard MISO interconnection process

2.1.7 Land Acquisition and Site Development Risks

The ability to acquire and develop land in accordance with applicable development standards (environmental, cultural and is essential to the success of a renewable generation project. Guidehouse and the Company established the following key risks and evaluation criteria to assess the applicable land and siting risks facing RFI Projects:

Table 15: Land Acquisition and Site Development Risks

Risk	Analysis Parameter
1. Sufficient land identified to meet project capacity	• Solar power density: approximately 5 acres per MWdc[44] • Wind power density: 0.02 MW/acre[45] • Storage power density: 180MWh/acre[46]
2. Ability to acquire additional land to expand site	• Identification of parcel targeted or availability of land adjacent to project
3. Probability for land scarcity due to project demand	• Number of developers proposing projects in close proximity to each other
4. Area environmental, cultural, and biological site sensitivities	• Projects proposed near known wildlife management areas, sensitive species habitats or environmental hazards
5. Potential for wind turbine waking	• Distance between separate proposed wind projects

When viewed as a portfolio, RFI responses demonstrated relatively low levels of land acquisition and development risk given their predominately rural surroundings and relatively low-density population centers for projects proposed near to cities or towns. According to information provided by RFI respondents no tribal or government lands are required for the development of projects to come online in the 2026-2030 timeframe. One RFI respondent noted that "increases in agricultural commodity prices that have made it more difficult to obtain land agreements" have become a major challenge for renewable energy projects in the Lyon County. This issue very likely applicable to other RFI project areas, and potentially all energy projects seeking to use land currently under cultivation, given their respective surroundings and currently land use. This increase in agricultural commodity prices put both initial development and phased

[44] LBNL, February 1 2022. Land Requirements for Utility-Scale PV: An Empirical Update on Power and Energy Density. https://eta-publications.lbl.gov/sites/default/files/land_requirements_for_utility-scale_pv.pdf

[45] von Krauland, Anna-Katharina, et al. 2021. Onshore wind energy atlas for the United States accounting for land use restrictions and wind speed thresholds. https://www.sciencedirect.com/science/article/pii/S2666955221000460

[46] Guidehouse 2022 estimate based on 2021 installations of utility scale storage capacity.

project expansions at risk, but this risk will likely normalize as the COVID-19 Pandemic recovery progresses into the 2026-2030 timeframe, renewable incentives come into effect, such as the Inflation Reduction Act, and market pressures increase the value of renewable projects due to demand which will increase the ability of developers to compensate landowners effectively. With a few minor exceptions, nearly all RFI responses have not completed any meaningful environmental or sensitive species studies which could create schedule impacts particularly for areas in Lyon County near Wildlife Management Areas (WMA).

Lyon County/Sherco Gen-Tie Region

The Lyon County/Sherco RFI area, which stretches several counties, received the largest quantity of proposed renewable projects with 2,300MW of solar, 7,600MWh of energy storage and 4,214MW of wind capacity. The southern portion of the Lyon County RFI area has the highest potential for land development risks due to a number of issues:

- High concentration of proposed projects near the town of Balaton, including wind and solar which may trigger design and permitting issues due to their proximity to population centers

- Presence of nine WMAs including Gadwall State WMA, Lake Yankton WMA, Sherman Waterfowl Production Area, Garvin State WMA, and others within 4 miles of proposed project GPS coordinates in Lyon County area

- Higher probability for land scarcity due to three projects proposing 1,000MW or greater capacities through phased development; if all three projects in southern Lyon County attempted commercial development at least 100,000 acres could be required when the energy density assumptions in Table 15 are applied to the proposed project capacities

Projects at the northern end of Lyon County do not face the same environmental or land scarcity issues but are proposed to be sited within 15 miles of Marshall the most populous City in the County. The towns of Minneota and Ghent are also within less than 10 miles, although their respective populations are relatively lower than that of Marshall.

A number of wind projects proposed in the Lyon County area demonstrated meaningful land acquisition and development progress with significant acreage secured in addition to formal environmental studies either underway or nearly complete. However, one project proposing over 1,000MW of hybrid renewable capacity (some combination of wind, solar and storage) in the area plans on securing the first tranche of land to support 400MW of wind before transferring the project to the Company. Given the potential for land scarcity in this area and land acquisition success indicated by other RFI respondents some projects carry higher land acquisition risks than others. Additionally, all proposed wind projects in the Lyon County area have GPS coordinates within approximately 20 miles of each other which creates the potential for decreased efficiency of wind turbines due to proximity waking effects from neighboring projects[47]. Given the amount of land required to develop these projects in their proposed locations it is not very likely all projects reach commercial operations which would limit the potential waking impact of neighboring projects, but as proposed the wind turbine waking impact is a factor that may impact the LCOE of these projects.

[47] NREL, January 21 2022. Reducing Wind Turbine Wakes Could Save Wind Farms Millions. https://www.nrel.gov/news/program/2022/reducing-wind-turbine-wakes.html

King Gen-Tie Region

The six RFI portfolio projects proposed within the King Gen-Tie region were clustered within three distinct distances from the existing King power plant: 20 miles, 60 miles and 100+ miles. With 300MW proposed within 20 miles of King, the probably for land scarcity is present but not severe. RFI respondents in this cluster have not secured land easements or initiated contract negotiations but have started early-stage landowner outreach. Based on a desktop scan of the geography the ability for developers to acquire and clear land to expand the proposed projects in later years can likely be achieved at relatively low risk. One solar project in the 20 mile range from King was within 2 miles of two known Waterfowl Production Areas (WPA), Kerber and Risberg, with a 3rd WPA located approximately 4 miles from the project site. Projects located in the 60 mile and 100+ mile distances from King had a minimum 10 mile distance from identified WPAs or WMAs.

The two projects within 60 miles have a higher likelihood of experienced land scarcity and expansion difficulty as both responses are located within one mile of each other. Additionally, the amount of suitable land for solar and storage resources is relatively limited as the project area is bordered by the Chippewa River in the south and relatively higher density vegetation compared to the other 3 RFI regions. Given the proposed solar capacity in close geographic proximity to each other, the risk to acquire or expand projects in this cluster is moderate.

Other RFI Region

As described in Section 2.1.6, four RFI responses (three solar and one wind) responding to the RFI were deemed to be located in an Other RFI Region. The two northern most solar PV projects proposed demonstrated successful land acquisition efforts reporting that approximately 65%-75% of the acreage required for both projects had been secured. The likelihood of securing the remaining land is high given low levels of residential development and commercial activity in near or mid-range proximity to these proposed projects. However, two known WPAs (Aasen and Winger) were located within 3 miles one project and a WMA located within 5 miles of another. Additional research is required to fully understand the permitting and schedule impacts, and respective mitigations, of these wildlife consideration areas, but is reasonable to expect an additional degree of effort required to develop these projects as proposed.

The remaining solar PV project in the Other RFI region indicated nearly all the land required for the project had been acquired which significantly lowers the site development risk for this particular project which is located within 5 miles of a small town and is surrounded by land under cultivation. The nearest WMA area is approximately 6 miles away and preliminary site maps indicate this area is avoided by the project.

Competition for land and availability of land for these solar PV projects do not represent a risk for projects in the Other RFI Region category as they have significant distance between respective projects and ample land has been proactively acquired by the RFI respondents.

A single wind generation project was prosed in the Other RFI Region by a developer with significant applicable development experience and a history of transferring successful projects to counterparties. The respondent indicated 100% of land required for the project had been secured and no environmental or wildlife issues were identified through a desktop review of the surrounding areas. This project is proposed approximately 3 miles away from the City of Wishek North Dakota which may require local discretionary permitting process to apply in addition to

North Dakota Public Service Commission (NDPSC) Wind Facility Siting in North Dakota standards.

2.1.8 RFI portfolio Schedule Risks

A number of execution risk factors face nearly all projects proposed in the RFI portfolio. The most experienced developers will be able to anticipate these risks and plan accordingly during the planning and execution phases of their projects. Depending on the relative development maturity of the project at the time of acquisition, either the Company or the developer will be responsible for mitigating these potential risks in order to reduce or eliminate schedule impacts.

RFI portfolio Schedule Compatibility with Company IRP

The compatibility of RFI responses with the Company's approved IRP schedule is an important part of assessing the overall credibility of the RFI portfolio of projects. Table 16 captures the Company's annual capacity targets by year and reuse-POI as approved in the IRP.

Table 16: Company IRP Capacity Addition Plan

Cumulative Total MW Delivered to POI	Resource Type	2026	2027	2028	2029	2030
Sherco Interconnection	Solar	850	1,450	1,450	1,450	1,450
	Wind	-	-	200	400	1,350
King Interconnection	Solar	-	-	150	550	650
	Storage	-	-	-	-	-

In order to assess the RFI portfolio's relative schedule compatibility with the IRP capacity targets, Guidehouse compared proposed CODs of RFI responses against the values shown in Table 16. For the Sherco Interconnection, the Company plans to add 600MW of additional solar by 2027 and 1,350MW of incremental wind capacity by 2030 with additions starting in 2028. In order to achieve the final 2030 capacity goals 63% of the proposed RFI solar capacity and 32% of RFI wind capacity would need to reach commercial operations. There is some notable misalignment between the desired wind capacity online dates in the IRP and the RFI portfolio which has 60% of the proposed wind capacity coming online in the 2026-2027 range and the balance in the later years of 2028-2029. The proposed online dates for RFI solar projects are reasonably aligned with Company IRP goals but require a much high rate of project success in order to achieve the overall capacity targets. This high rate of success is the most prominent RFI portfolio risk in terms of alignment with the stated capacity addition schedule of the Company's IRP.

In the case of the King Interconnection, the company plans to add 650MW of new solar capacity by 2030. The RFI portfolio is aligned to achieve Company solar IRP goals early in the analyzed time frame with 1,540MW proposed by RFI respondents in the 2026-2027 period. Additionally, relatively low project success rates, 29% for solar and 31% for storage, amongst RFI projects would be necessary to achieve the 2030 goal for the King Gen-Tie Area. Relying on the RFI portfolio of projects to achieve the Company's solar capacity addition goals as determined in the IRP appear to be relatively low risk in terms of schedule compatibility.

Table 17: RFI Response Indicative Schedules

Cumulative Total MW Delivered to POI	Resource Type	2026	2027	2028	2029	2030	Total
Sherco-Lyon County POI	**Solar (MW)**	800	700	-	300	500	2,300
	Storage (MW)	600	600	-	300	500	2,000
	Wind (MW)	814	1700	1100	600	-	4,214
King Gen-Tie Area	**Solar (MW)**	490	1050	-	-	-	1,540
	Storage (MW)	176	465	-	-	-	641
Other POI	**Solar (MW)**	150	300	-	-	-	450
	Wind (MW)	252	-	-	-	-	252

Developer Track Record

Overall, RFI respondents were predominately nationally active developers of renewable energy projects and were able to demonstrate recent (within the last 5 years) project experience relevant to the renewable generation technology proposed. Additionally, approximately half of the developers submitting projects into the RFI provided project references that had achieved commercial operations in either the upper Midwest territory or MISO Zone 1 which increases the overall credibility of the responses provided in the RFI. The majority of RFI respondents proposed renewable technology in alignment with their actual project experience which also supports the overall credibility of the RFI portfolio. However, there was a notable lack of battery storage experience across RFI respondents with a smaller subset of the most experienced respondents providing examples of storage or solar + storage projects either transferred to acquiring parties or in service. This is does not reflect poorly on the overall viability of solar + storage projects given the relative early stage at which utility scale adoption of this technology.

It is worth nothing that there were two developers with limited or no demonstrated experience who provided responses to the RFI. One of these developers proposed projects in the Other RFI Region representing 600MW out of 4,290MW of solar PV which significantly limits the track record risk these projects contribute to the overall credibility of the RFI portfolio. Another development company with a proposed a solar + storage project in the King region was not able to demonstrate significant experience as a recently established company but provided specific team references and their respective accomplishments developing similar projects. Given that this particular developer's RFI response makes up roughly 20% of total capacity proposed in the region the uncertainty regarding this early-stage organization contributes some execution risk to projects in the King Gen-Tie Area but has marginal impact on the overall credibility of the RFI portfolio.

Labor Risk[48]

The availability of skilled and unskilled labor can have a significant impact on project schedule especially given the potential for high demand due to concurrent projects under development to meet the competing needs of utility IRPs and energy commitments of large-scale commercial companies. Given the relatively rural location of projects within the RFI portfolio, proximity to urban and suburban population groups, which supply labor, materials, and equipment, can have an impact on the ability of a developer to complete a project on schedule. Projects proposed in the King Gen-Tie Region (within 60 miles of King) are within reasonable commuting proximity to Minneapolis and the numerous suburban zones with populations of 70,000 or more people surrounding it. Projects proposed in the Lyon County/Sherco Gen-Tie Region benefit from their approximate 60-mile proximity from Sioux Falls South Dakota, but has a comparably smaller population than the Minneapolis metro area. Projects proposed in the Other Gen-Tie region are able to pull upon labor resources from either Fargo or Bismarck North Dakota as both are within approximately 60 miles of the proposed projects. King and Lyon County/Sherco Gen-Tie Regions face low to moderate levels of labor sufficiency risk due to their proximity to population centers but are aided by a high likelihood of continuous work given the projected quantity of renewable energy projects in the Midwest territory driven in part by the Company's IRP and a highly congested MISO interconnection queue. Projects in the Other Gen-Tie Region face slightly higher labor risk due to a lower number of RFI projects proposed and relatively lower population groups to supply labor within a reasonable commuting distance.

Technology Commercial Track Record

All RFI responses proposed to deploy generation equipment, solar PV modules and wind turbines, with well-established commercial operating history in the United States. Additionally, the majority of RFI responses specified at least one manufacturer for both power generation and power inverter equipment. However, the demand for this equipment is expected to grow significantly during the 2026-2030 period as significant sectors of the broader energy economy have announced transitions plans heavily reliant on renewable sources of electricity such as onshore wind and solar PV. An imbalance between supply and demand increased the installed cost of wind by 7% and fixed axis solar 14% between during the June 2021 to June 2022 period.[49] The COVID 19 pandemic is likely the biggest contributor to these factors with international supply chains disrupted in addition to domestic labor issues and inflationary pressures.

Energy storage equipment availability and price is another realistic commercial risk facing the RFI Project Portfolio. All respondents provided prudent storage equipment assumptions most importantly citing the use of 4-hour duration rated lithium ion-based systems that currently make up the greatest percentage of global deployment of utility scale stationary storage worldwide. NCM and LFP were mentioned as likely battery cell options, both of which are produced at large scale with numerous companies such as Samsung SDI, LG Chem and CATL reporting investment in expanded global manufacturing capacity through 2030.[50] Additionally, the long-term reliability of bi-directional inverters used in solar + storage applications is relatively

[48] During the drafting of this report the Inflation Reduction Act (IRA) of 2022 was passed which could materially alter potential outcomes discussed herein. Guidehouse models do not include impacts of the IRA which include union apprenticeship provisions.

[49] BNEF, 30 June 2022. Cost of New Renewables Temporarily Rises as Inflation Starts to Bite https://about.bnef.com/blog/cost-of-new-renewables-temporarily-rises-as-inflation-starts-to-bite/

[50] Wood Mackenzie, 22 March 2022. Global lithium-ion battery capacity to rise five-fold by 2030. https://www.woodmac.com/press-releases/global-lithium-ion-battery-capacity-to-rise-five-fold-by-2030/

unknown at this stage. The overall impact on the long-term reliability and availability of these assets due to inverter failures will likely be less of an issue than it has been for legacy solar PV assets that were impacted by the consolidation of the solar PV equipment manufacturing which has created minor supply chain issues for owners of solar inverters whose manufacturers are no longer in business or have discontinued supporting legacy product lines.

3. Potential Socioeconomic Risks and Benefits of RFI portfolio

After contracting with Guidehouse to perform the RFI IE scope of work, Xcel and Guidehouse agreed to analyze potential socioeconomic impacts of the RFI portfolio of projects which included workforce development, local economic impacts, landowner impacts and potential incremental tax revenues. Table 18 captures the socioeconomic criteria Xcel and Guidehouse agreed to study.

Table 18: Socioeconomic Factors and Analysis Criteria

Socioeconomic Analysis Factor	Evaluation Criteria
Local/Regional Workforce Development	• Assess relative workforce creation potential by resource type in terms of initial construction and ongoing job creation • Determine potential for phased projects to support medium to long term skilled labor migration vs nomadic construction workforce
Local/Regional Tax Revenues	• Assess potential for tax revenue increases at the RFI portfolio level by resource type
Landowner benefits	• Determine relative alternative value or opportunity cost of repurposing identified sites for RFI Projects
Landowner impacts / proximity to urban centers	• Impacted natural surrounding and views • Community impacts from long term construction projects (traffic congestion, dust, etc.)

3.1 Socioeconomic Analysis

3.1.1 Workforce Development and Local Economic Impacts

The construction of renewable power generation facilities is dependent on skilled and unskilled labor. A broad spectrum of trades are involved throughout the construction process from initial land clearing through final completion and testing of the facility. Early stages of all solar, wind and storage projects require skilled equipment operators and civil constructors who can be pulled from either the local labor pool or may relocate to the RFI Gen-Tie regions for the construction of these projects. These labor trend holds true for other essential trades including electricians, iron workers, carpenters, and other specialized technicians with subject matter expertise in wind, solar and energy storage equipment.

In addition to the labor required for the project, regional construction materials and heavy equipment suppliers will likely experience a short to medium term increase in overall business volume as developers or the Company implement RFI portfolio projects. Beyond materials and equipment, providers of essential services such as housing or hotel, food and entertainment will also potentially benefit from increased sales as the nomadic construction workforce patronizes local businesses and vendors throughout the project lifecycle. This trend could continue throughout the 2026-2030 timeline and beyond as the Company seeks to achieve its IRP goals in addition to other developers executing projects in renewable energy resource rich areas similar to the geographic areas identified by the RFI portfolio. The potential for these economic impacts are most likely in the Lyon County/Sherco Gen-Tie area as RFI projects have proposed significant quantities of capacity throughout the Company's current IRP implementation cycle. Given the sustained projected capacity build out in this zone, Lyon County stands to benefit over a longer period and may experience permanent growth if projects are successful in this region. However, permanent direct job growth attributable to RFI projects is likely limited to small crews of maintenance staff, likely 2-6 full time employees per 200MW-500MW of nameplate capacity installed. This effect is likely less strong in the King Gen-Tie region as the majority of capacity is proposed to come online by 2027 and additional capacity beyond 600MW is not available at the Company reuse-POI for additional expansion. However, 2 of the 6 RFI projects in the King Area indicated some potential for expansion, so incremental temporary economic activity through during the 2028-2030 period is possible. In addition to the direct economic activity driven by new investment in renewable generation, complementary multi-year construction of capital intense high voltage transmission interconnection facilities are likely to occur in parallel driving additional indirect economic benefits for the respective Gen-Tie Regions.

3.1.2 Landowner Impacts

The development of new renewable generation facilities can impact communities in which they are sited. The impacts of renewable development can be positive or negative with subjective public perception determining how these impacts are ultimately judged by those in proximity to project sites. Negative issues associated with the development of renewable energy projects are typically held by landowners who view wind or solar projects as either visually unappealing, disruptive to status quo economic activity, or a perceived eminent domain threat for either the generating facilities or complementary transmission facilities to deliver the energy produced. The risk of disrupting agricultural economic activity is highest for solar projects proposed in southwest Minnesota as considerable portion of this region is defined by the USDA as either prime Farmland, farmland of state or local importance and prime farmland if drained.[51] Solar projects proposing to be developed on Prime Farmland are exposed to schedule risk due to incremental Environmental Assessment criteria and must justify the use of this land for the siting of solar facilities in alignment with the criteria for awarding exemption or variances to the MPUC rule that prohibits the development of energy generating installations on prime farmland.[52] The Company RFI did not specifically require respondents to describe potential project sites using USDA classifications such as Prime Farmland and the potential impact to specific special interest areas is not assessed in this report.

There is a potential economic opportunity cost for landowners either selling or leasing property to developers of renewable energy projects. One RFI respondent noted that recent increases in agriculture commodity costs had it made it more difficult to obtain land agreements in the Lyon County area. This trend is consistent with recent increases in the prices paid and received for

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[51] USDA, November 16 2015. Farmland Classification for Minnesota. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd1095806.pdf

[52] MPUC, May 19 2020. Solar Energy Production and Prime Farmland: Guidance for Evaluating Prudent and Feasible Alternatives. https://mn.gov/eera/web/doc/13929/#:~:text=In%20general%2C%20prime%20farmlands%20have,permeable%20to%20water%20and%20air.

agriculture products as reported by the USDA-NASS.[53] If agriculture commodity prices remain high, owners of productive farmland may be economically better off continuing to cultivate their land instead of leasing or selling to RFI respondents. This trend would impact the implementation risk of the RFI portfolio from a land acquisition perspective.

Visual impacts are most prevalent for solar and wind projects given the potential for glare effects and the typical 80 meter height of wind turbines. The relative impact of these effects are subjective, however the majority of projects are proposed at least 5 miles away from major population centers which limits the overall quantity of people potentially exposed to these issues. Energy storage assets are generally less invasive given their high energy density, which reduces the need for land, and visual impacts similar to that of a typical utility substation.

Positive landowner impacts can include socially beneficial city and county revenues through taxation, diversification of citizen income potential through land leases or sales, and increased local economic activity as described in Section 3.1.1 benefitting owners of business catering to the needs of temporary and permanent workers assigned to renewable energy projects. The potential economic impact to landowners is difficult to measure as land lease or sale prices are typically not made available to the public. It is important to note that the Company has used voluntary agreements the secure land in the past indicating a mutually beneficial transaction in support of renewable energy projects. Land lease or sale prices received for solar projects may be higher on prime farmland as a greater percentage of land is taken out of production for solar projects whereas wind projects allow shared land use with agriculture.

3.1.3 Incremental Tax Revenues

Renewable energy projects and their complementary high voltage interconnection facilities are capital intense investments which have the potential to contribute incremental tax revenues to localities. The approach to taxation of renewable energy projects varies by state with taxes levied on either production, capacity or some combination of both. Taxes by state were provided to Guidehouse by the Company and are documented in Table 19. The potential revenues shown in Table 20 assume all RFI projects achieve commercial operations. Guidehouse does not provide tax, legal or accounting advice. The following tax assumptions and forecasts were prepared for informational purposes only of the RFI analysis of potential incremental tax revenues for the RFI portfolio in aggregate.

Table 19: RFI portfolio Production and Applicable Tax Rates

Project State	RFI Production by Generation Type (Annual)			Tax Rates		
	Solar (MWh)	Wind (MW)	Wind (MWh)	Solar ($/kWh)	Wind Production ($/kWh)	Wind Capacity ($/kW)
Minnesota	5,137,740	4,214	15,356,490	$ 0.00120	$ 0.00120	N/A
Wisconsin	4,445,262	0	0	N/A	N/A	N/A
North Dakota	0	252	918,328	N/A	$ 0.00050	$ 2.50

[53] USDA-NASS August 31st, 2022. Prices Paid and Received: All Farm Index by Month, US. https://www.nass.usda.gov/Charts_and_Maps/Agricultural_Prices/allprpd.php

Table 20: Potential RFI Portfolio Annual Tax Revenues

Total Potential Tax Revenues (Annual, All States)		
State	**Solar**	**Wind**
Minnesota	$ 6,165,288	$ 18,427,788
Wisconsin	N/A	N/A
North Dakota	$ -	$ 1,089,164

4. Additional RFI Portfolio Analysis

4.1 RFI Project Portfolio Compared to MISO Queue

Reviewing the existing MISO queue provides insights into projects looking to develop in the RFI Gen-Tie Regions. Searching the active MISO queue for solar, wind, storage, and solar + storage resources sited in Minnesota, Wisconsin, North Dakota, and South Dakota allows reasonable comparison to the resources that responded to Xcel's RFI. Table 21 reiterates the MW responses to the RFI for 2026-2030. Table 22 shows the MW in the active MISO queue. Resources in the queue are likely in later stages of planning and development, so do not stretch out to 2030. Looking at the MW values, far more solar relative to other resources is in the queue relative to the resources that responded to the RFI.

Table 21. RFI Cumulative Total MW Delivered to POI

Cumulative Total MW Delivered to POI	Resource Type	2026	2027	2028	2029	2030	Total
Sherco-Lyon County POI	Solar (MW)	800	700	-	300	500	2,300
	Storage (MW)	600	600	-	300	500	2,000
	Wind (MW)	814	1700	1100	600	-	4,214
King Gen-Tie Area	Solar (MW)	490	1050	-	-	-	1,540
	Storage (MW)	176	465	-	-	-	641
Other POI	Solar (MW)	150	300	-	-	-	450
	Wind (MW)	252	-	-	-	-	252

Table 22. Summer MW in MISO Active Queue for MN, WI, ND, SD (September 2022)

Total Summer MW Active in MISO queue	Resource Type	2021	2022	2023	2024	2025	2026	Total
MN, WI, ND, SD	Solar (MW)	414	1,888	2,972	4,598	2,068	640	12,582
	Storage (MW)		300	150	2,090	255	325	3,120
	Wind (MW)	190	250	298	2,417	1,061	190	4,407
	Hybrid (MW)			150	700	148		998

With a baseline level of potential new capacity found in the MISO queue, it is important to examine what percentage of resources in the queue could potentially reach commercial operations within the Company's RFI Gen-Tie Areas. The Lyon County/Sherco Gen-Tie Region, was identified based on the clustered area of RFI responses received that were sited around the Lyon County substation. Table 23 shows that out of all projects in the MISO queue, only 25% made it through in the target area. Table 24 shows that 31.3% of projects make it through for the entirety of Minnesota. It is clear that projects in Lyon County/Sherco Gen-Tie Region have greater difficulty reaching commercial operations through the MISO interconnection study process.

Table 23. Queue Progress for Lyon County/Sherco Gen-Tie Region

Queue Progress for Minnesota Target Area	Resource Type	All 2004-2021	Done 2004-2021	% Completed 2004-2021
Lyon, Murray, Cottonwood, Redwood, Renville, Lincoln, McLeod, Wantonwan, Pipestone, and Yellow Medicine Counties	Solar (MW)	1,182.35	245	20.7%
	Storage (MW)	35	20	57.1%
	Wind (MW)	5,626.78	1,445.94[54]	25.7%
	Hybrid (MW)	0	0	-
	Total (MW)	6,844.13	1,710.94	25.0%

Table 24. Queue Progress for All Minnesota

Queue Progress for All Minnesota	Resource Type	All 2004-2021	Done 2004-2021	% Completed 2004-2021
All Counties	Solar (MW)	4,360.83	775.98	17.8%
	Storage (MW)	155	20	12.9%
	Wind (MW)	1,3305.2	4,782.42	35.9%
	Hybrid (MW)	0	0	-
	Total (MW)	1,7821.03	5,578.4	31.3%

The King Gen-Tie Region was also identified based on the clustered area of RFI responses received. Table 25 shows that out of all projects in the MISO queue, 50.3% made it through in the target area, and 42.1% made it through in the entirety of Wisconsin as shown in Table 26. These values show that it is relatively easier for projects to complete the interconnection

[54] Almost all of the wind capacity shown has been brought online in the last 10 years; since 2010 1,231.94 MW of wind projects were completed. Since 2010, 3,830.42 MW of wind projects were added to the MISO queue. This indicates a wind project completion rate of 32.16% since 2010.

process in the King Gen-Tie Region. However, the lack of projects in the target area that had submitted to the MISO queue makes these values and the conclusions drawn from them unreliable.

Table 25. Queue Progress for Wisconsin Target Area

Queue Progress for Wisconsin Target Area	Resource Type	All 2020-2021	Done 2020-2021	% Completed 2020-2021
St. Croix, Dunn, Trempealeau, and Clark Counties	Solar (MW)	101.28	101.28	100%
	Storage (MW)	0	0	-
	Wind (MW)	99.9	0	0%
	Hybrid (MW)	0	0	-
	Total (MW)	201.18	101.28	50.3%

Table 26. Queue Progress for all Wisconsin

Queue Progress for All Wisconsin	Resource Type	All 2020-2021	Done 2020-2021	% Completed 2020-2021
All Counties	Solar (MW)	3878.05	2098.92	54.1%
	Storage (MW)	197.5	20	10.1%
	Wind (MW)	1186	95	8.0%
	Hybrid (MW)	0	0	-
	Total (MW)	5261.55	2213	42.1%

4.2 Potential Impact of Future Transmission Expansion Projects

4.2.1 MISO Interconnection Queue

MISO Definitive Planning Phase (DPP) interconnection study results for projects seeking network resource interconnection service (NRIS) provide a sense of existing or excess transmission transfer capacity for a particular region of the MISO transmission system. In order to determine proxy costs for RFI projects to obtain access to the MISO market outside of existing Company POIs, Guidehouse reviewed past DPP study results for solar and wind projects seeking interconnection to substations in the vicinity of the RFI Gen-Tie Regions. Prior DPP study results indicate that projects RFI projects in the Lyon County/Sherco Gen-Tie Region likely face considerable interconnection costs and longer processing time (including load flow study, generator interconnection agreement negotiation, design and construction of interconnection facilities) time to achieve commercial operations. Projects seeking NRIS in the King Gen-Tie Region were exposed to a range of costs, however the higher end of the cost range for King was similar to the lowest recent cost observed for the Lyon County/Sherco Gen-Tie Region. Based on these macro observations, the approach of collecting and delivering capacity from the Lyon County/Sherco Gen-Tie Region projects to the Sherco POI has a higher likelihood of delivering economic efficiencies, while a similar approach for the King area RFI projects would require detailed economic assessments to understand the potential cost-benefit tradeoffs of such a project.

Table 27: Interconnection Costs for Comparable Projects in RFI Gen-Tie Regions

MISO Project Number	Proposed POI	Resource Type/MWs	Interconnection Cost Share (Self-Funding)[55]	MISO Study Cycle
Sherco/Lyon County Gen-Tie Region				
J1106[56]	Lyon County - Cedar Mountain 345 kV Circuit 2 Line	Wind, 414MW	$145,123,579	DPP-2019-Cycle
J1315[57]	Lyon County - Cedar Mountain 345 kV Line Tap	Wind, 600MW	$12,545,869	DPP-2019-Cycle
J901[58]	Lyon County - Cedar Mountain Line	Wind, 200MW	$116,752,575	DPP-2017-AUG
J1149[59]	Hazel Creek 230 kV Substation	Solar, 200MW	$9,242,456	DPP-2018-APR
King Gen-Tie Region				
J1474[60]	Pine Lake - Eagle Point 115kV Line	Solar, 200MW	$3,183,312	DPP-2019-Cycle
J1314[60]	Apple River 161 kV Substation	Solar, 100MW	$3,412,665	DPP-2019-Cycle
J1092[56]	Three Lakes 115 kV Substation	Solar, 100MW	$10,962,721	DPP-2018-APR

[55] All Interconnection cost shares reflect current estimated cost as of the study date referenced for each project. These costs are subject to future revision based due to the iterative nature of the MISO interconnection study process.

[56] Siemens PTI, 02/16/2021. MISO DPP 2018 April West Area Phase 2 Study. https://cdn.misoenergy.org/GI-DPP-2018-APR-West-Phase2_System_Impact_Report_Public523356.pdf

[57] https://cdn.misoenergy.org/GI-DPP-2019-West-Phase1_System_Impact_Report_PUBLIC528746.pdf

[58] Siemens PTI 01/11/2021. MISO DPP 2017 August West Area Study Phase 2 Final Report. https://cdn.misoenergy.org/GI-DPP-2017-AUG-West-Phase2_System_Impact_Report_PUBLIC511211.pdf

[59] Siemens PTI 03/18/2020. MISO DPP 2018 April West Area Phase 1 Study. https://cdn.misoenergy.org/GI-DPP-2018-APR-West_Phase1_System_Impact_Report_Public_Rev437652.pdf

[60] Siemens PTI, 03/02/2021. MISO DPP 2019 West Area Phase 1 Study. https://cdn.misoenergy.org/GI-DPP-2019-West-Phase1_System_Impact_Report_PUBLIC528746.pdf

J926[58]	Pine Lake - Apple River 161 kV Line	Solar, 101.28MW	$13,315,742	DPP-2017-AUG

4.2.2 MISO Long Range Transmission Planning (LRTP)

MISO's LRTP is the RTO's regional transmission planning effort aimed towards expanding the transmission system in order to address reliability, economic, and public policy needs. In July 2022, MISO approved the first of four tranches of planned transmission facilities in MISO. MISO states that the LRTP portfolio are needed "to integrate new generation resources outlined in MISO member and states…"[61] The approved 18 projects in the portfolio are expected to enable 53[62] GW of new generation capacity to interconnect to the grid. MISO staff assumes that all the projects will be built by the year 2030. Assuming that the projects are built by the anticipated timeline, the Tranche 1 portfolio may provide benefits to the set of projects for the RFI portfolio projects seeking interconnection during the same timeframe. LRTP projects within Western and Eastern Dakotas[63], northern Minnesota[64] and Minnesota - Wisconsin[65] lie within the general areas of the RFI portfolio.

[61] MISO, MISO Board Approves $10.3B in Transmission Projects, https://www.misoenergy.org/about/media-center/miso-board-approves-$10.3-in-transmission-projects/,

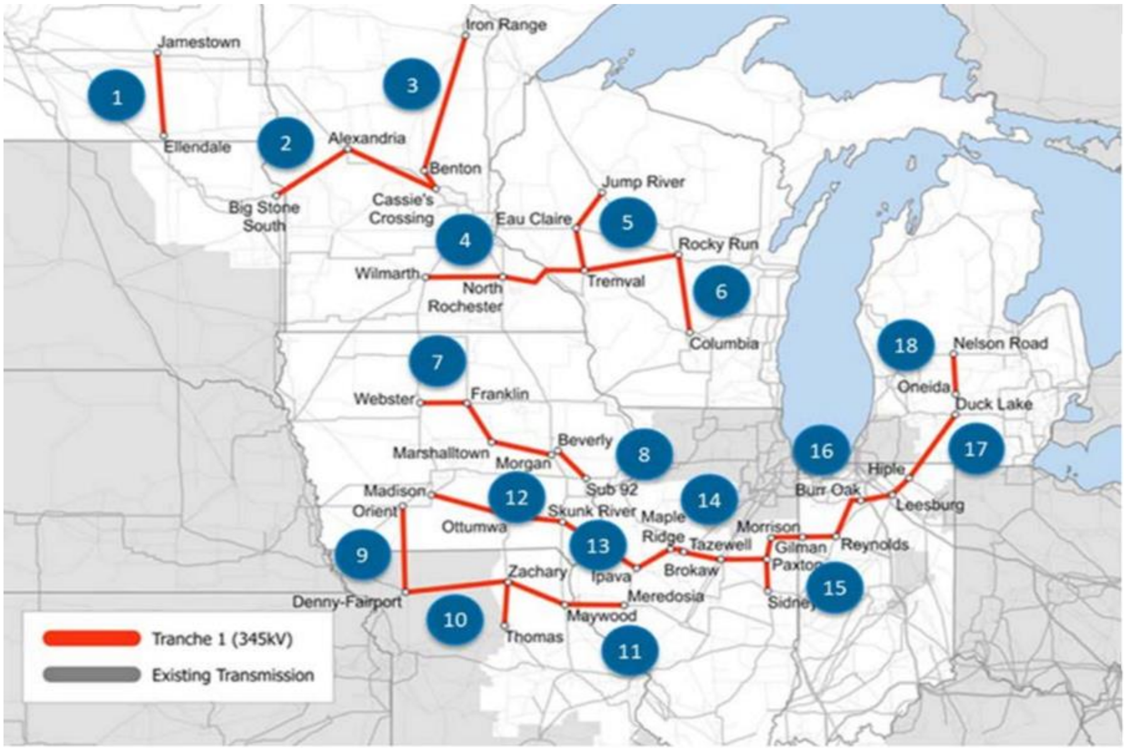
[62] Clean Grid Alliance, https://cleangridalliance.org/_uploads/_media_uploads/_source/RE_and_Jobs_impacts_-_MISO_Tranche_1-converted.pdf, https://cleangridalliance.org/_uploads/_media_uploads/_source/RE_and_Jobs_impacts_-_MISO_Tranche_1-converted.pdf

[63] Includes LRTP Project #2: Big Stone -- Alexandria -- Cassie's Crossing 345 kV

[64] Includes LRTP Project #3: Iron Rnage - Benton - Cassie's Crossing

[65] Includes LRTP Project #4: Wilmarth - North Rochester – Tremval, #5: Tremval - Eau Claire - Jump River 345 kV, #6: Tremval - Rocky Run - Columbia

Figure 5: MISO Long Range Transmission Planning Map[66]



The LRTP projects are expected to address public policy and economic needs and improve reliability. From the LRTP study process MISO anticipates that these projects will improve the system by addressing thermal and voltage issues, relieve N-1 contingencies/outages, and relieve constraints from high renewable flow. With the in-service dates for these projects being between 2028 - 2030, the upgrade and expansion of the transmission facilities may help in reliving congestion and allow for a higher penetration of renewables on the grid.

It is important to contrast the goals of the LRTP Tranche 1 portfolio which seeks to support the integration of 53GW of new generation capacity with emerging data points regarding new interconnection requests. As of the September 15th 2022 MISO DPP-2022-Cycle deadline 170.80GW of incremental generation has requested to be studied for interconnection to the MISO system[67]. Assuming a success rate of 30% for DPP-2022-Cyle projects, approximately 51GW of new capacity for the 2022 cycle year alone could potentially consume nearly all of the 53GW of renewable integration capability indicated by MISO for the LRTP Tranche 1 projects[68]. This high level analysis seems to indicate that the Tranche 1 LRTP process alone is not sufficient to integrate the planned level of renewables seeking interconnection to the MISO system and that alternative methods to interconnection new projects warrant further study.

[66] MISO, MTEP21 Report Addendum: Long Range Transmission Planning Tranche 1 Executive Summary, https://cdn.misoenergy.org/MTEP21%20Addendum-LRTP%20Tranche%201%20Report%20with%20Executive%20Summary625790.pdf

[67] 2022 Cycle is the first study cycle to incorporate LRTP Tranche 1.

[68]Including 3.4 GW of renewables in SW MN for MTEP Future 1

Glossary of Acronyms

Term	Definition
ATB	Annual Technology Baseline
COD	Commercial Operation Date
COD	Commercial Operation Date
DCSR	Debt Service Coverage Ratio
DOE	Department of Energy
DPP	Definitive Planning Phase
EV	Electric Vehicle
IE	Independent Expert
IRA	Inflation Reduction Act of 2022
IRP	Integrated Resource Plan
ITC	Investment Tax Credit
kW or kWh	Kilowatt or Kilowatt hour
LCOE	Levelized Cost of Electricity
LD	Light Duty
LRTP	Long Range Transmission Plan
MACRS	Modified Accelerated Cost Recovery System
MISO	Midcontinent Independent System Operator
MW or MWh	Megawatt or Megawatt hour
NDPSC	North Dakota Public Service Commission
NRIS	Network Resource Interconnection Service
OEM	Original Equipment Manufacturer
PEV	Plug-In Electric Vehicle
POI	Point of Interconnection
PPA	Power Purchase Agreement

PTC	Production Tax Credit
PUC	Minnesota Public Utilities Commission
R&D	Research and Development
RFI	Request for Information
ROW	Right of Way
UFLPA	Uyghur Force Labor Prevention Act
WMA	Wildlife Management Area
WPA	Waterfowl Production Area
YoY	Year over Year

CERTIFICATE OF SERVICE

I, Christine Schwartz, hereby certify that I have this day served copies or summaries of the foregoing documents on the attached list(s) of persons.

xx by depositing a true and correct copy thereof, properly enveloped with postage paid in the United States Mail at Minneapolis, Minnesota

xx electronic filing

Docket No. E002/RP-19-368

Docket No. E002/CN-22-131

Dated this 10th day of March 2023

/s/

____

Christine Schwartz
Regulatory Administrator

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James	Canaday	james.canaday@ag.state.mn.us	Office of the Attorney General-RUD	Suite 1400 445 Minnesota St. St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_19-368_19-368_Official
Thomas	Carlson	thomas.carlson@edf-re.com	EDF Renewable Energy	10 2nd St NE Ste. 400 Minneapolis, Minnesota 55413	Electronic Service	No	OFF_SL_19-368_19-368_Official
John	Coffman	john@johncoffman.net	AARP	871 Tuxedo Blvd. St, Louis, MO 63119-2044	Electronic Service	No	OFF_SL_19-368_19-368_Official
Generic Notice	Commerce Attorneys	commerce.attorneys@ag.state.mn.us	Office of the Attorney General-DOC	445 Minnesota Street Suite 1400 St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_19-368_19-368_Official
Jean	Comstock	jean.comstock.dbcc@gmail.com	St. Paul 350	729 6th St E St. Paul, MN 55106	Electronic Service	No	OFF_SL_19-368_19-368_Official
Riley	Conlin	riley.conlin@stoel.com	Stoel Rives LLP	33 S. 6th Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-368_19-368_Official
George	Crocker	gwillc@nawo.org	North American Water Office	PO Box 174 Lake Elmo, MN 55042	Electronic Service	No	OFF_SL_19-368_19-368_Official
James	Denniston	james.r.denniston@xcelenergy.com	Xcel Energy Services, Inc.	414 Nicollet Mall, 401-8 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_19-368_19-368_Official
J.	Drake Hamilton	hamilton@fresh-energy.org	Fresh Energy	408 St Peter St Ste 350 Saint Paul, MN 55101	Electronic Service	No	OFF_SL_19-368_19-368_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Adam	Duininck	aduininck@ncsrcc.org	North Central States Regional Council of Carpenters	700 Olive Street St. Paul, MN 55130	Electronic Service	No	OFF_SL_19-368_19-368_Official
Scott F	Dunbar	sdunbar@keyesfox.com	Keyes & Fox LLP	1580 Lincoln St Ste 880 Denver, CO 80203	Electronic Service	No	OFF_SL_19-368_19-368_Official
Brian	Edstrom	briane@cubminnesota.org	Citizens Utility Board of Minnesota	332 Minnesota St Ste W1360 Saint Paul, MN 55101	Electronic Service	No	OFF_SL_19-368_19-368_Official
Catherine	Fair	catherine@energycents.org	Energy CENTS Coalition	823 E 7th St St Paul, MN 55106	Electronic Service	No	OFF_SL_19-368_19-368_Official
John	Farrell	jfarrell@ilsr.org	Institute for Local Self-Reliance	2720 E. 22nd St Institute for Local Self-Reliance Minneapolis, MN 55406	Electronic Service	No	OFF_SL_19-368_19-368_Official
Sharon	Ferguson	sharon.ferguson@state.mn.us	Department of Commerce	85 7th Place E Ste 280 Saint Paul, MN 551012198	Electronic Service	No	OFF_SL_19-368_19-368_Official
Mike	Fiterman	mikefiterman@libertydiversified.com	Liberty Diversified International	5600 N Highway 169 Minneapolis, MN 55428-3096	Electronic Service	No	OFF_SL_19-368_19-368_Official
Jolene	Foss	jolenef@wrightpartnership.org	Wright County Economic Development Partnership	1405 3rd Ave NE Buffalo, MN 55313	Electronic Service	No	OFF_SL_19-368_19-368_Official
Lucas	Franco	lfranco@liunagroc.com	LIUNA	81 Little Canada Rd E Little Canada, MN 55117	Electronic Service	No	OFF_SL_19-368_19-368_Official
Amy	Fredregill	afredregill@environmental-initiative.org	Environmental Initiative, MN Sustainable Growth Coalition	211 First St N Ste 250 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_19-368_19-368_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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Janet	Gonzalez	Janet.gonzalez@state.mn.us	Public Utilities Commission	Suite 350 121 7th Place East St. Paul, MN 55101	Electronic Service	No	OFF_SL_19-368_19-368_Official
Todd J.	Guerrero	todd.guerrero@kutakrock.com	Kutak Rock LLP	Suite 1750 220 South Sixth Street Minneapolis, MN 554021425	Electronic Service	No	OFF_SL_19-368_19-368_Official
Kim	Havey	kim.havey@minneapolismn.gov	City of Minneapolis	350 South 5th Street, Suite 315M Minneapolis, MN 55415	Electronic Service	No	OFF_SL_19-368_19-368_Official
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Annete	Henkel	mui@mnutilityinvestors.org	Minnesota Utility Investors	413 Wacouta Street #230 St.Paul, MN 55101	Electronic Service	No	OFF_SL_19-368_19-368_Official
Kristin	Henry	kristin.henry@sierraclub.org	Sierra Club	2101 Webster St Ste 1300 Oakland, CA 94612	Electronic Service	No	OFF_SL_19-368_19-368_Official
Michael	Hoppe	lu23@ibew23.org	Local Union 23, I.B.E.W.	445 Etna Street Ste. 61 St. Paul, MN 55106	Electronic Service	No	OFF_SL_19-368_19-368_Official
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First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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Carmel	Laney	carmel.laney@stoel.com	Stoel Rives LLP	33 South Sixth Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-368_19-368_Official
Peder	Larson	plarson@larkinhoffman.com	Larkin Hoffman Daly & Lindgren, Ltd.	8300 Norman Center Drive Suite 1000 Bloomington, MN 55437	Electronic Service	No	OFF_SL_19-368_19-368_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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Alan	Muller	alan@greendel.org	Energy & Environmental Consulting	1110 West Avenue Red Wing, MN 55066	Electronic Service	No	OFF_SL_19-368_19-368_Official
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First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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Generic Notice	Residential Utilities Division	residential.utilities@ag.state.mn.us	Office of the Attorney General-RUD	1400 BRM Tower 445 Minnesota St St. Paul, MN 551012131	Electronic Service	Yes	OFF_SL_19-368_19-368_Official
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First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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Edyta	Sitko	esitko@ucsusa.org	Union of Concerned Scientists	1 N Lasalle Ave CHICAGO, IL 60602	Electronic Service	No	OFF_SL_19-368_19-368_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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James M	Strommen	jstrommen@kennedy-graven.com	Kennedy & Graven, Chartered	150 S 5th St Ste 700 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-368_19-368_Official
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First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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Emily	Ziring	eziring@stlouispark.org	City of St. Louis Park	5005 Minnetonka Blvd St. Louis Park, MN 55416	Electronic Service	No	OFF_SL_19-368_19-368_Official
Patrick	Zomer	Pat.Zomer@lawmoss.com	Moss & Barnett PA	150 S 5th St #1200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-368_19-368_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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David	Bell	david.bell@state.mn.us	Department of Health	POB 64975 St. Paul, MN 55164	Electronic Service	No	OFF_SL_22-131_CN-22-131
Generic Notice	Commerce Attorneys	commerce.attorneys@ag.state.mn.us	Office of the Attorney General-DOC	445 Minnesota Street Suite 1400 St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_22-131_CN-22-131
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Adam	Duininck	aduininck@ncsrcc.org	North Central States Regional Council of Carpenters	700 Olive Street St. Paul, MN 55130	Electronic Service	No	OFF_SL_22-131_CN-22-131
Bret	Eknes	bret.eknes@state.mn.us	Public Utilities Commission	Suite 350 121 7th Place East St. Paul, MN 551012147	Electronic Service	No	OFF_SL_22-131_CN-22-131
Kate	Fairman	kate.frantz@state.mn.us	Department of Natural Resources	Box 32 500 Lafayette Rd St. Paul, MN 551554032	Electronic Service	No	OFF_SL_22-131_CN-22-131
Annie	Felix Gerth	annie.felix-gerth@state.mn.us		Board of Water & Soil Resources 520 Lafayette Rd Saint Paul, MN 55155	Electronic Service	No	OFF_SL_22-131_CN-22-131

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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Chad	Konickson	chad.konickson@usace.army.mil	U.S.Army Corps of Engineers	180 5th St # 700 Saint Paul, MN 55101	Electronic Service	No	OFF_SL_22-131_CN-22-131
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Stacy	Kotch Egstad	Stacy.Kotch@state.mn.us	MINNESOTA DEPARTMENT OF TRANSPORTATION	395 John Ireland Blvd. St. Paul, MN 55155	Electronic Service	No	OFF_SL_22-131_CN-22-131
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Dawn S	Marsh	dawn_marsh@fws.gov	U.S. Fish & Wildlife Service	Minnesota-Wisconsin Field Offices 4101 American Blvd E Bloomington, MN 55425	Electronic Service	No	OFF_SL_22-131_CN-22-131

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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Stephen	Rakow	stephen.rakow@state.mn.us	Department of Commerce	Suite 280 85 Seventh Place East St. Paul, MN 551012198	Electronic Service	No	OFF_SL_22-131_CN-22-131
Generic Notice	Residential Utilities Division	residential.utilities@ag.state.mn.us	Office of the Attorney General-RUD	1400 BRM Tower 445 Minnesota St St. Paul, MN 551012131	Electronic Service	Yes	OFF_SL_22-131_CN-22-131
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First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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Cynthia	Warzecha	cynthia.warzecha@state.mn.us	Minnesota Department of Natural Resources	500 Lafayette Road Box 25 St. Paul, Minnesota 55155-4040	Electronic Service	No	OFF_SL_22-131_CN-22-131
Alan	Whipple	sa.property@state.mn.us	Minnesota Department Of Revenue	Property Tax Division 600 N. Robert Street St. Paul, MN 551463340	Electronic Service	No	OFF_SL_22-131_CN-22-131
Jonathan	Wolfgram	Jonathan.Wolfgram@state.mn.us	Office of Pipeline Safety	445 Minnesota St Ste 147 Woodbury, MN 55125	Electronic Service	No	OFF_SL_22-131_CN-22-131