MINNESOTA
PUBLIC UTILITIES COMMISSION

Staff Briefing Papers

Meeting Date	April 18, 2019		Agenda Item 7**
Company	Xcel Energy		
Docket No.	**E002/M-19-29**		
	In the Matter of Appeal of Independent Engineer Report for the SunShare Linden Project		
Issues	Should the Commission strike from the record the statements identified with redline strikethrough in Xcel Energy's Motion to Strike, Attachment A? Should the Commission accept, modify or reject the findings and recommendation of the Independent Engineer (IE) and require Xcel Energy to act on these decisions?		
Staff	Michelle Rosier	Michelle.rosier@state.mn.us	651-201-2212
	Cezar Panait	Cezar.Panait@state.mn.us	651-201-2207

✓ **Relevant Documents**	**Date**
ORDER RESOLVING INDEPENDENT-ENGINEER APPEALS AND ESTABLISHING PROCEDURES FOR FUTURE DISPUTES (E002/M-13-867)	Nov. 1, 2016
Xcel Energy, Appeal to IE Linden Attachments Part 1 Attachments Part 2	Jan. 3, 2019
Xcel Energy, Errata Trade Secret	Jan. 4, 2019
Xcel Energy, Motion to Strike	Mar. 26, 2019
SunShare, Response to Xcel's Motion to Strike	Apr. 5, 2019

To request this document in another format such as large print or audio, call 651.296.0406 (voice). Persons with a hearing or speech impairment may call using their preferred Telecommunications Relay Service or email consumer.puc@state.mn.us for assistance.

The attached materials are work papers of the Commission Staff. They are intended for use by the Public Utilities Commission and are based upon information already in the record unless noted otherwise.

Contents

Attachments

Att. A: Timeline of Linden Project

Att. B: Index of Xcel's Appeal Attachments (Public and Non Public)

Att. C: Xcel Ratebook's Section 9; Sheets 68.5; 68.11-68.13

Att. D: Flicker vs. Rapid Voltage Change; the same, or different?

Statement of the Issues

Should the Commission strike from the record the statements identified with redline strikethrough in Xcel Energy's Motion to Strike, Attachment A?

Should the Commission accept, modify or reject the findings and recommendation of the Independent Engineer (IE) and require Xcel Energy to act on these decisions?

Background

The August 6, 2015 Order in Docket No. E002/M-13-867 adopted modifications to Xcel Energy and CSG developers' partial settlement agreement which established: 1) the Independent Engineer dispute resolution process, 2) $1 million material upgrade limit, and 3) allowance for co-location up to 5 MW for applications submitted before September 25, 2015.

The Commission's November 1, 2016 Order in the same docket approved revisions to Xcel Energy's Section 9 tariff describing the IE dispute resolution process and resolved several CSG disputes; including flicker review, application of the material upgrade limit, reasonableness of distribution upgrade costs, and restudy.

On January 3, 2017, SunShare and Xcel Energy entered into a Settlement Agreement related to several SunShare projects; including the Linden Project (1st dispute).

On April 26, 2017, Xcel Energy filed a compliance filing outlining revisions to the Company's IEEE 1453 methodology for engineering review (Simplified IEEE 1453 Method) which the Company adopted on April 1, 2017. The filing included a white paper and minutes from three stakeholder meetings on the subject.[1]

On March 16, 2018, SunShare submitted an Intake form requesting Independent Engineer dispute resolution for the current issues addressed in this docket.

On June 13, 2018, the Parties entered into a Community Solar Garden Dispute Resolution Services Agreement with the Independent Engineer (IE).

On December 24, 2018, the IE issued the report and recommendations.

On January 3, 2019, Xcel Energy filed an Appeal of the Independent Engineer's report and recommendations. On January 4, the Company filed a non-public Errata containing the January 3, 2017 Settlement Agreement.

On January 17, 2019, SunShare filed a response to Xcel Energy's Appeal.

On March 26, 2019, Xcel Energy filed a Motion to Strike with redlines to SunShare's Response.

[1] Xcel Appeal, Att. K, pp. 54 - 89

On April 5, 2019, SunShare filed a Response to the Motion to Strike with an amended version of Sunshare's January 17, 2019 Response agreed upon by the Parties according to SunShare. This is the version of SunShare's Response to Appeal used in these briefing papers.

See **Attachment A** of these briefing papers for a staff summary of the complete timeline of this dispute and interconnection application as described by parties in this docket. **Attachment B** to staff briefing papers includes an index of the Attachments in Xcel Energy's Appeal which include many of the documents listed in the background.

Overview

When a Community Solar Garden (CSG), or any Distributed Energy Resource (DER) operated in parallel with the grid, submits an interconnection application, the utility performs engineering review to ensure the CSG (i.e. DER) can be interconnected safely and reliably. The utility will provide the interconnection customer with a cost estimate for any distribution upgrades necessary to allow the DER to interconnect to the grid. These costs, especially for larger DER like CSG, can impact whether or not the project is economic.

The Commission's August 6, 2015 Order adopted sections of a partial settlement agreement which, in part, established a $1 million material upgrade limit for existing interconnection applications for co-located 1 MW CSG up to 5 MW. The material upgrade limit applies to the costs to upgrade Xcel Energy's distribution system to allow the CSG's interconnection; in other words, regardless of the interconnection customer's willingness to pay, Xcel limits the amount of distribution upgrades in the indicative cost estimate during engineering review for any co-located project eligible under this Order to $1 million. The interconnection customer is expected to pay the actual interconnection costs which may differ from this cost estimate. This applies to SunShare's Linden Project because the application was for up to 5 MW and submitted on May 5, 2015.

The Linden Project has been subject to a number of studies to-date; however, only those performed after the January 2017 Settlement Agreement are part of this docket (see table below). In the most recent engineering review (Revision 3), the project was reduced to 3 MW capacity based on a steady state voltage (high voltage) limit and the $1 million material upgrade limit. To approve the 3 MW capacity, Xcel Energy provided an indicative cost estimate up to the $1 million material upgrade limit for reconductoring of existing lines and other distribution upgrades.

Xcel Studies Performed for SunShare's Proposed 5 MW Linden Project After January 2017 Settlement[2]					
Study Number	**Completion Date**	**Date Presented to SunShare**	**MW Approved**	**Limiting Factor**	**Location in Record**
Revision 1	1/11/17	Upon IE order	1.7	Steady State Voltage, Voltage Fluctuation	
Revision 2	4/14/17	4/14/17	3	Steady State Voltage, Voltage Fluctuation	Xcel Att. E-Pt 1, IE Response, Att. J (pdf pp. 226-255)
Revision 3	6/27/17	6/27/17	3	Steady State Voltage	Xcel Att. E-Pt 1, IE Response, Att. L (pdf pp. 308-328)

Xcel Energy's Community Solar Garden Program includes an Independent Engineer (IE) Dispute Resolution process which involves the Department of Commerce referring a dispute to an IE who reviews the dispute, develops a record (if necessary), and issues a Report with recommendations to resolve the dispute(s) as described in Xcel Energy's tariff.[3] SunShare requested the IE dispute resolution process for issues related to Xcel Energy's treatment of the Linden project interconnection application. The IE Report found in favor of SunShare on a number of the disputed issues (see **Independent Engineer's Report** below for more details.) Xcel's appeal of the IE report opened this docket.

Staff Summary of the Disputed Issues in this Docket

After addressing the Motion to Strike, these briefing papers will use this order of disputed items throughout with the subheadings as noted in bold below:

The first disputed issue is the Independent Engineer authority or charter in dispute resolution. Xcel Energy claims the IE recommendations go beyond the IE's authority; whereas, SunShare argues the IE's recommendation are within the IE's authority and should be binding until the Commission overturns them. (**IE Authority or Charter**)

The second issue is whether or not the January 3, 2017 Settlement Agreement is binding on the Linden Project. Xcel argues the terms are binding and use it as the rationale for the motion to strike; whereas, SunShare argues the Service Agreement both parties signed and the Department referred the issue to the IE who determined the Settlement Agreement is not binding on this dispute. (**Settlement Agreement)**

[2] Staff compiled chart using: IE Report, Table 1, p. 38 and Xcel Appeal, Table 1, pp. 14-15

[3] Section 9; Sheet Nos. 68.11-68.13. This process remains for existing CSG applications, but will be phased out as the Company transitions to the updated statewide interconnection process (Minnesota Distributed Energy Resource Interconnection Process (MN DIP)). Per the Commission's March 28, 2019 decision in Docket No. E002/M-18-714, MN DIP interconnections, including CSG applications, will not use the IE dispute resolution process (*Order forthcoming*.)

The third issue in dispute is the project's interconnection timeline and the quality of the engineering reviews. The initial application, filed in May 2015, has gone through multiple engineering study revisions. Further, SunShare and Xcel Energy had significant back and forth discussions about the engineering studies. Xcel Energy, at SunShare's request, updated the deadline for the Interconnection Agreement which is based on the current engineering study (Revision 3) from August 2017 to ultimately March 2018 while the parties continued to discuss the engineering review and results. The Linden Project has been subject to two disputes referred to an IE. The first dispute was withdrawn with the January 2017 settlement agreement, and the current dispute was filed in March 2018. SunShare executed the Linden Project Interconnection Agreement and provided the 1/3 cost down payment in June 2018; however, Xcel Energy refused to countersign or proceed with detailed design until the size of the Linden Project was finalized citing tariff. SunShare continues to dispute the quality of the current engineering study revision, and requests a restudy as recommended by the IE. Xcel argues the IE both: 1) fails to recognize the January 2017 Settlement Agreement as binding; and 2) proposes a study methodology not supported by technical justification or tariff. **(Interconnection Review and Timeline[4])**

Fourth issue is the validity of Xcel Energy's Simplified IEEE 1453 Method and what voltage issues limit the Linden Project. Xcel Energy's Simplified IEEE 1453 Method addresses design planning criteria for voltage fluctuation (e.g. flicker and rapid voltage change) and was filed with the Commission on April 26, 2017. Xcel argues steady state voltage is the limiting factor on the Linden Project's capacity, not IEEE 1453 related voltage fluctuation. SunShare disputes the validity of Xcel Energy's Simplified IEEE 1453 Method; especially as it applies to larger than 1 MW projects. **(IEEE 1453 and Voltage Fluctuations[5])**

Fifth, SunShare raises the claim that Xcel Energy should utilize the voltage regulation capabilities provided by advanced inverters that will be installed with the Linden Project. SunShare claims advanced inverters can alleviate the voltage concerns with less distribution upgrades (costs) and more solar capacity. Xcel argues advanced inverters have not been certified to meet the current technical standards in Minnesota (IEEE 1547.) **(Advanced Inverters[6])**

Sixth and final dispute is the cost of distribution upgrades. SunShare disputed the cost of materials and whether they are above industry standards. Xcel maintains the Company is required to use standard equipment used for other customers and the IE recommendation is not within IE authority. Lower costs could mean more reconductoring which could mean more MW capacity approved for interconnection. **(Distribution Upgrade Costs[7])**

---

[4] Issue Number 3 and 5 on SunShare's Intake Form Number 1 (March 16, 2018), IE Report, pp. 16-19

[5] Issue Number 2 on SunShare's Intake Form Number 1 and Issue Number 2 on SunShare's Intake Form Number 2 (August 14, 3018), *Id.*, pp. 9, 14-15

[6] Issue Number 1 on SunShare's Intake Form Number 2, *Id.* pp. 8-9. Xcel objected, and Department instructed IE not to consider this request.

[7] Issue Number 1 and 4 on SunShare's Intake Form Number 1, *Id.*, p. 13, 17-18

Motion to Strike

Xcel Energy cited the January 3, 2017 Settlement Agreement[8] as grounds to strike certain issues, disputes and claims SunShare included in their January 17, 2019 Response to Xcel Energy's Appeal of the IE Report, and included proposed redlines of SunShare's Response in Attachment A.[9] (**Decision Option 1).** In Response to the Motion to Strike, on April 5, 2019, SunShare filed an amended version of the January 17, 2019 Response agreed to by the Parties.[10] (**Decision Option 2).** The Commission may wish to verify the April 5, 2019 amended SunShare Response to Appeal resolves the Motion to Strike at the Agenda Meeting. These briefing papers reflect the April 5, 2019 SunShare filing.

Independent Engineer's Report

The Independent Engineer final report[11] summarizes each issue in dispute, the IE process and "charter", and provides determinations (i.e. recommendations) for resolution. Xcel appeals many of the IE's recommendation and the IE report in total in this docket. The IE Report takes each issue from the March 16, 2018 Intake Form submitted by SunShare[12], summarizes Xcel and SunShare's arguments[13], and provides determinations. Staff summarizes the IE's determinations:[14]

	IE Determination/Recommendation	Related Dispute in this Docket
A	Xcel shall share all inputs used in the Revision 3 model[15] with SunShare in writing, including rationale, and answer SunShare's follow up questions	*Interconnection Review and Timeline*
B	Provide SunShare with the actual, specific reasons why the 1/0 cable segment was originally buried in writing immediately	*Distribution Upgrade Costs*
C[16]	Xcel shall conduct another study of the Linden Project (referred to as "Revision 4") which shall have, but not be limited to: a. "SunShare's selected engineer(s) shall be permitted to be present during the development of the Revision 4 Linden model and shall be present at SunShare's discretion during the entire modeling process and shall be allowed to actively participate in the input evaluation, run of the software model,	*IE Authority and Charter, Settlement Agreement, Interconnection Review and Timeline, IEEE*

[8] SunShare refers to the same document as the January 2, 2017 Settlement Agreement. Staff uses January 3, 2017 given the date associated with Xcel's signatory.
[9] Xcel Motion to Strike, p. 1 and Attachment A.
[10] SunShare Response to Motion to Strike
[11] Xcel Appeal, Att. A IE Report, p. 1-50.
[12] *Id.*, pp. 12-20
[13] *Id., pp. 21-40*
[14] *Id.* pp. 23-47
[15] IE also determines it is reasonable for Xcel to share all inputs to each of the five previous studies performed by Xcel as requested by SunShare. Further, the IE report says SunShare's full access to all related information can be used for its own historical or research uses (IE Report, p. 35).
[16] SunShare summarizes the IE's Revision 4 restudy parameters at pp. 15-16

	IE Determination/Recommendation	Related Dispute in this Docket
	and output evaluation of the Revision 4 model and Study Report document." b. "If any variation of the Revision 4 Study addresses the use of 750 AL UG [underground] cable (at the joint determination of Parties), the 255A rating used in Revision 3 for the 750 AL buried cable shall be corrected to 630A in Revision 4." c. If the Revision 4 revised software model reveals reduced cable, or other equipment, ratings, etc. on Xcel's distribution system is acceptable that equipment shall be allowed by Xcel. d. If the Revision 4 revised software model reveals higher levels of solar output are acceptable, the highest level up to 5 MW shall be allowed. e. "Xcel shall work with SunShare to determine all of the inputs of the Revision 4 model." f. "The 1.5% with 75% drop criteria is not to be used in any variation of the Revision 4 Linden Study, since the IEEE 1453-2018 has excluded it. Voltage regulators shall be modeled with a 2% full on/full off value, or higher if there is no demonstrable result outside of the IEEE 1453 maximum Pst [short term perceptibility] Flicker values." g. "Xcel shall run variations of the Revision 4 model taking into consideration the results of the first, pre-construction Flicker Study …, with the following inputs, up to the point that … monitoring is appropriate" and provide the full results in writing: i. For each 3 MW, 4 MW, and 5 MW PV generation plant output: Study each 2% on/off; 3% on/off; and 4% on/off with a variation using 336 overhead lines instead of 750 AL underground segment.[17] ii. Xcel shall conduct a flicker field study within 1 month of the IE's determination to "… scientifically validate the actual level of flicker found there at the time of the [flicker field] Study." "Xcel shall note the equipment used, the locations, the results of the monitoring at those locations, and the conclusions of the monitoring…" "Xcel shall also allow SunShare's engineer(s) to be present, side by- side with Xcel, during this test and be fully involved in the setup and monitoring process as well as observing the results after the IEEE 1453 recommended testing period… The test shall be used in order to establish the actual base line level of Flicker prior to construction/connection of the	*1453 and Voltage Fluctuation*

[17] *Id*. Pp. 46-47. Staff understands this to be 18 sets of study parameters which according to Xcel becomes "close to 150 power flow models." (Xcel Appeal, p. 21). The IE report further states: "This list of Study content requirements are the minimum variations and may be added to by SunShare should it feel that circumstances justify additional cases, within reason. This Study shall be completed within three (3) weeks of the completion of the Flicker Study noted below. As noted previously by the IE, all costs associated with this additional modelling shall be born by Xcel, per MPUC Order on November 1, 2016."

	IE Determination/Recommendation	Related Dispute in this Docket
	Linden interconnection." Further, "… a second Flicker test will be performed at the same site(s) after commissioning is completed and the Linden PV farm is energized…[with] full participation by SunShare engineer(s) and full cooperation by Xcel... Depending on the results of the second flicker Study, the levels of flicker emissions from the Linden site can be accurately assessed and corrective adjustments can be implemented by Xcel and SunShare."	
D	Reset the Linden Project's 24-Month Mechanical Completion clock upon completion of this dispute or upon completion of appeals to the Commission by either party.	*Interconnection Review and Timeline*
E	Revised costs[18] shall continue through to the completion of the project staying below the $1M cap. SunShare shall further be granted relieve through Xcel not adding its typical profit, overhead or bond costs, or any other markups to this project's cable, poles, and associated line and hardware; as well as, labor required to perform this interconnection… Upon SunShare's request, Xcel shall demonstrate its actual wholesale costs..	*IE Authority or Charter, Interconnection Review and Timeline, Distribution Upgrade Costs*
F	It is reasonable for Xcel use 336 AL OH cable for the entire project, but Xcel will take their mark-up including profit and bond cost off of the price of the materials for this interconnection to make up for the problems and delays that have occurred with the modeling.	*IE Authority or Charter, Interconnection Review and Timeline, Distribution Upgrade Costs*
G	Update Xcel Energy's Section 10 Interconnection tariff[19] per the IE's suggestions to clarify voltage limits for ANSI C84.1 [Electric Power Systems and Equipment – Voltage Ratings] and IEEE 1453 [IEEE Recommended Practice for the Analysis of Fluctuating Installations on Power Systems] [(i.e. flicker or rapid voltage change.)]	*IEEE 1453 and Voltage Fluctuation*

What follows is a summary of the IE Report, including the IE's summary of Parties' positions at the time of the IE review, using these briefing paper's outline of the ongoing disputed issues before the Commission:

[18] These costs are indicative costs at this point in review; however, the IE appears to be recommending they be treated as actual costs with additional relief described.

[19] *Id.* pp. 41-42. Staff note: This tariff was revised recently in E002/M-18-714 to align with the updated statewide interconnection standards (Minnesota Distributed Energy Resource Interconnection Process and Interconnection Agreement (MN DIP/DIA)); however, the statewide technical requirements update has not been finalized yet.

1. IE Authority or Charter

The IE Report describes the IE's understanding of the authority or charter granted:[20]

- Make determinations based on technical expertise, personal experience, tariff, latest ANSI/IEEE standards, submittals, discover, industry standards and best practices; as well as, hold the safety and reliability of Xcel's system to be of utmost importance;
- Address appropriate and related best business and technical practices and trends in the PV interconnection industry that would benefit Parties and the wider Community Solar Garden and Solar Rewards Community Programs [*this is the contested "charter" in this docket*];
- Determine what information is considered Confidential, Trade Secret or other classifications of sensitive materials; and
- Does not have jurisdiction to overturn Statutes or Commission Orders, nor to make financial judgments against Parties.

Staff notes the Independent Engineer Dispute Resolution process is defined in tariff at Xcel Energy's Section 9; Sheet Nos. 68.11 – 68.13; including the considerations the IE should include in review of a dispute.[21] (See **Attachment C** to staff briefing papers.) In addition, the Service Agreement further outlines the IE's authority as discussed later in the **Parties' Comments** section of these briefing papers.

2. Settlement Agreement

On June 13, 2018, when the Dispute Resolution Service Agreement was signed for the current dispute, both Xcel Energy and SunShare requested the IE review the January 3, 2017 Settlement Agreement to determine if the current dispute should proceed. Xcel argued the Settlement Agreement invalidated the current dispute; whereas, SunShare argued the Settlement did not limit future disputes for the Linden Project.[22]

On August 7, 2018, the Independent Engineer issued a decision[23] that the January 3, 2017 Settlement Agreement does not preclude the current Linden Project Dispute. In reaching this determination, the IE cites five conclusions:

1) Post-Settlement Agreement computer models have significant errors that created differences between disputes;
2) Model errors have led to differences in indicative cost estimates that differ with each model's output;
3) Differences in distribution routes and associated equipment between the disputes;
4) Settlement agreement does not contain language that excludes this [current] Dispute; and
5) SunShare's complaints in the current dispute are different in content from the original dispute.

[20] *Id.*, p. 2
[21] Section 9, Sheet No. 68.11; 9(a)
[22] IE Report, p. 6
[23] *Id.*, p. 7

Staff notes the Dispute Resolution Agreement signed by both Parties states[24]:

> The IE does not offer legal advice and has no duty to assert or protect the legal rights of any Party… The Parties acknowledge that a prior settlement agreement was shared with Commerce by Xcel Energy prior to this dispute initiating, and that Commerce directed the dispute to proceed to the IE. The IE may, at his sole discretion, determine whether, or to what extent, the prior settlement resolves the issues set forth in the Intake Forms. The Parties agree that the prior settlement between them and counter-signed by Xcel Energy on January 3, 2017 shall not be modified by the IE.

3. Interconnection Review and Timeline

SunShare claimed Xcel has been delayed in sharing information since July 14, 2017; including, sharing studies performed, answering questions about study inputs, restudying the project with correct conductor parameters. Further, the Linden Project was similarly delayed prior to July 14, 2017 for different reasons. As a result, SunShare requests: 1) reset the 24-month Mechanical Completion clock; 2) require Xcel to begin detailed design immediately for 3 MW while preserving potential expansion up to 5 MW upon further study citing precedent of earlier SunShare projects doing this which helped queue and program to proceed; 3) require Xcel to charge summer construction costs regardless of construction season due to Xcel being the cause of delays; and 4) waive the $1 million material upgrade cap and allow the full 5 MW to be installed to compensate SunShare for years of delay resulting from Xcel delays and inaccurate studies.

Xcel argued the relief sought by SunShare is not allowed under either the Section 9 CSG program tariff or the Section 10 interconnection tariff. An interconnection agreement must be signed by both parties and 1/3 of the interconnection costs paid before detailed design and construction. The $1 million material upgrade cap for eligible co-located projects has been applied consistently throughout the program.[25]

The IE determines it is reasonable to reset the 24-month Mechanical Completion clock stating "[t]he Tariff does not specifically say that the clock is a fixed concept, and in fact has been used flexibly by Xcel, as is appropriate in any construction project."[26] According to the IE, the Department's rejection of SunShare's request to begin the detailed design or construction precluded the IE making a recommendation. The IE notes the Department's intervention also prevents SunShare from proceeding with payment or construction until the dispute is resolved. The IE Report recognizes the IE does not have authority to wave the $1 million material upgrade cap, but determines it is reasonable that the revised indicative costs continue through the completion of the project and grants further relief by not allowing Xcel "… to add its typical profit, overhead or bond costs, or any other markups to this project's cable, poles, and associated line and hardware, as well as labor required to perform this interconnection… and demonstrate its actual wholesale costs [at SunShare's request.]"[27] (**IE Recommendation E**).

[24] Dispute Resolution Service Agreement, 1(b), p. 2.
[25] *Id*. p. 29
[26] *Id.*, p. 30. Staff note: Mechanical Completion clock is described at Section 9; Sheet No. 67-67.1
[27] *Id.* p. 31

SunShare also argued in a separate claim (Issue Number 5, Form 1) in the dispute that Xcel performed 4 inaccurate studies in mid-2017 and was delayed or non-responsive in sharing all study results and inputs, and requested the IE review all studies for accuracy and validity. SunShare highlighted an error in April 14, 2017 Revision 2 study which references different lengths of 336 AL upgrades (~13,000 ft on p. 16 and 18,000 ft on pp. 4-5) as an example of the inaccuracies.

According to the IE, Xcel did not respond to SunShare's Issue Number 5, Form 1 claim. On the Issue 5, Form 1 claim, the IE determines it is reasonable for Xcel to share all of the inputs to each of the five Linden Project studies, completed between February 17, 2016 and June 27, 2017[28], and allow SunShare to "… have full access to all related information for its own historical and research uses."[29] Further, the IE determines a new Revision 4 study is warranted because none of the five studies completed to-date were entirely accurate and had to be changed due to inaccuracies in data, changing external conditions and Xcel's errors. (**IE Recommendation C**.)

4. IEEE 1453 and Voltage Fluctuations

SunShare argued both the 1.5% and 75% on/off voltage parameters and the 2% full on/full off were more restrictive than necessary. SunShare requested the IE rule that allowable flicker be increased from 2% to 4% citing Xcel's Section 10 interconnection tariff[30], and that an IEEE 1453 flicker field study be performed at the Linden Project similar to what the Commission ordered for the Glazier project. SunShare stated the Glazier compliance report demonstrated Xcel's engineering review criteria were too conservative because it found both short-term and long-term flicker severity calculated from the measured [field study] data was approximately half of the planning levels used in engineering review.[31]

Xcel Energy argued that the IEEE 1453 methodology (Simplified IEEE 1453 Method) was vetted with the Community Solar Garden stakeholder group; filed, without objection, with the Commission; and applied consistently to all CSG applications since April 2017. Xcel argued if the IE determined the IEEE 1453 method should not be used, then the Settlement Agreement stipulated the alternative -- the 2% full on/full off individual and aggregate per IEEE 141. Xcel concluded that the scope of IEEE 1547-2018 (published April 2018) is limited to the DER interface with associated electric power systems, and this scope excludes the voltage regulation equipment compatibility consideration which is the basis for the 1.5% and 75% on/off criteria. Xcel claimed SunShare was misinterpreting IEEE 1453 and the Glazier compliance report which is site specific and should not be used to draw general conclusions about the appropriate voltage fluctuation for all CSG sites.[32]

The IE cites as part of the IE's charter "… to address appropriate and related best business and technical practices and trends in the PV interconnection industry that would be noteworthy and of benefit to Parties as well as the wider CSG/SRC." The IE reasoned that because the Commission did not take action on Xcel Energy's April 26, 2017 Simplified IEEE 1453 Method compliance filing there is a vacuum and it is reasonable to require a different set of criteria in both an engineering review and, if built, field study of the Linden project. Further, the IE sets the criteria at 4% flicker,

[28] See Table 1, IE Report, p. 38
[29] *Id.*, p. 35
[30] Sec. 10, Sheet No. 146, 4(iii)
[31] IE Report, pp. 20, 25 (Issue 2, Form 2; Issue 2, Form 1)
[32] *Id*. p. 40

and notes that IEEE 1547-2018 does not include the 1.5% and 75% on/off criteria. Further, the IE determines if the revised criteria results mean reduced distribution upgrades or higher CSG capacity is acceptable they shall be allowed.[33]

Lastly, the IE takes issue with the Section 10 Interconnection tariff's description of flicker finding it to be outdated, "poorly written and misleading." For instance, the IE notes "flicker" and "voltage variation" is used interchangeably in the tariff, but are not always the same thing. For instance, the 4% maximum voltage fluctuation limit is based ANSI/IEEE C84.1 standard; whereas, "flicker" is a subset of voltage fluctuation types; including Rapid Voltage Change (RVC) which is another form that can include "flicker."[34] The IE notes the Section 10 tariff refers to IEEE 1547 for further information on flicker which in turn refers to IEEE 1453. The IE agrees with Xcel that this makes IEEE 141's flicker standard (i.e. the GE flicker curve) "moot", but disagrees that Xcel's Simplified IEEE 1453 Method is appropriate. The IE also notes that the Commission ordered Xcel to perform a wider examination of flicker at both the Glazier site and the wider Xcel system in 2016. Thus, the IE determines it is not appropriate to hold SunShare to the voltage fluctuation review included in the Settlement Agreement nor Xcel's Simplified IEEE 1453 Method, and establishes the up to 4% flicker limit and field study parameters to fill what the IE finds to be a gap in flicker standards.[35] **(IE Recommendation C(f-g)).**

5. Advanced Inverters

On September 4, 2018, the Department directed the IE not to address SunShare's claim that Xcel should be required to consider advanced inverter functionality for the Linden project.

6. Distribution Upgrade Costs

SunShare argued Xcel is requiring a more expensive 750 AL underground (UG) line without providing justification for the line being underground or for the size of the line; further, Xcel improperly used an ampacity rating of 255A rather than the correct 630A in its study software. SunShare also requested the IE review other inputs for errors, and noted the Revision 3 study appeared to be limited to 3 MW based on previous studies despite SunShare's Linden application was for up to 5 MW. SunShare also challenges Xcel's use of 336 AL overhead (OH) lines as more robust than industry standards, and requests the IE review industry standards of 336 AL versus other alternative, less expensive equipment (ex. 4/0 Penguin or 4/0 Oxclip). [36]

Xcel indicated that it typically uses overhead (OH) lines in the load flow studies that indicate voltage restraints and indicative cost estimates. Xcel noted the alternative overhead lines requested by SunShare are not typically stocked, and the use of 336 AL OH reduces purchasing, stocking and handling costs; as well as, standardizes and reduces the number of types of fittings and line hardware in inventory. Xcel claimed the 750 AL-type UG conductor was required to replace the existing line (1/0 AL UG) to lower the impedance to resolve the steady state overvoltage and voltage fluctuation violations identified in the engineering review. Xcel responded that the underground (UG) line section corresponds to existing property lines which is

[33] *Id.*, pp. 26-28
[34] See **Attachment D** for technical analysis on flicker versus rapid voltage change by the Commission's former Solar Energy Innovator Fellow.

[35] *Id.*, pp. 40-43
[36] *Id.*, pp. 21-22, 32

typically customer-driven, and either paid by the customer or negotiated as part of an easement. Since Xcel was aware of the underground cable it was included in the indicative estimate; however, later the Company redid the estimate using overhead lines which lowered the costs under the $1 million material upgrade cap. Xcel warns final, actual costs could vary widely from the OH-based indicative estimate. Xcel admits the ampacity error (255 A vs. 630A), but reaffirms the ampacity does not impact the voltage results or conductor impedance required.[37]

The IE determines it is reasonable to require Xcel to provide all inputs used in the Revision 3 model with explanations in writing, and allow SunShare to review them and ask questions (**IE Determination A** from chart above.) The IE notes a lack of transparency and problems identified that were not corrected in the current study. The IE feels the ampacity error "… is indicative of the many errors and ongoing inaccuracies in Xcel's studies throughout the project", but does not challenge Xcel's claim that it does not impact the voltage results. The IE further determines Xcel should provide SunShare the actual, specific reasons why the 1/0 cable is underground (**IE Recommendation B**).[38] The IE determines Xcel's Tariffs allow for equipment alternatives that are technically equivalent and appropriate for renewable projects and allow Xcel to use standard equipment citing to Section 9, Sheet No. 68.11, 9(a). The IE determines Xcel can use the more expensive 336 AL OH cable, but cannot include profit and bond cost off the price of the materials as relief for delays.[39]

Parties' Comments

Xcel Energy Appeal

On January 3, 2019, Xcel Energy filed an appeal of the IE Report requesting[40]:

> … the Commission reject the IE Report in total and find that it was proper for Xcel Energy to offer 3 MW of capacity at the Linden site consistent with the results from the June 2017 study [Revision 3]. (**Decision Option 3)**

Xcel argues four grounds support this request[41]:

1) The IE Report does not include any technical assessment or analysis of general industry standards or best practices, nor of the Linden project's specific engineering study assumptions, models or results;
2) The IE overstepped their authority by granting special treatment for the Linden project and directing Xcel to make exceptions to tariffed Solar*Rewards Community program rules and standard interconnection requirements;

[37] *IBID*
[38] *Id.*, p. 23-25
[39] *Id.* p. 34
[40] Xcel Appeal, p. 3
[41] Id. pp. 1-2

3) The IE inappropriately granted monetary compensation in violation of the Services Agreement and ordered relief not requested by SunShare.
4) Issues raised by SunShare have already been resolved by a binding Settlement Agreement executed in January 2017.

Staff includes an Index of Xcel's Appeal filing, both public and non-public, in **Attachment B** to these briefing papers. Staff summarizes Xcel's appeal related to the six identified issues still in dispute:

1. IE Authority or Charter

Xcel Energy takes issue with the IE's summary of a "charter" noting the language cited to support the IEEE 1453 determination does not appear in the Services Agreement, any Commission Order in the CSG docket, nor Xcel's tariffs. Xcel cites Section 9, Sheets 68.11-68.13 and the Service Agreement as the basis for the IE's authority, and notes neither allows the IE to make exceptions or initiate program-wide changes to established CSG program rules, processes or Xcel's tariffs. Xcel further argues the IE focused on broad policy issues rather than technical analysis of the Linden project studies. Xcel believes these issues alone are sufficient to reject the IE report in total.[42]

2. Settlement Agreement

Xcel has maintained throughout this dispute that the Settlement Agreement is binding on the Linden Project; including initially refusing to sign the Service Agreement, in Responses to the IE[43], Appeal to the Commission, and in the Motion to Strike. Xcel argues the IE erred by not holding SunShare to the terms of the Settlement Agreement related to how voltage fluctuation could be studied.

3. Interconnection Review and Timeline

Xcel Energy maintains the Revision 3 study results are correct in all material aspects. Xcel argues the difference between the Revision 3 and Revision 2 study is the mitigation selected for reducing voltage impacts to acceptable limits. Revision 2 did not consider the $1 million cap and focused on overhead reconductoring to mitigate high voltage; whereas, Revision 3 identified the least cost option as reconductoring overhead and underground cable. Xcel argues the IE does not offer a technical basis for his conclusions; rather, the IE points to an irrelevant typo that does not impact the results. The IE offers no explanation of how the typo may have impacted the voltage constraints that result in reduced MW capacity for the Linden project. Xcel takes issue with the IE using internal emails as part of the rationale for a Revision 4 study claiming the emails focused on the presentation of study results in the written study report not the validity of the study results. Xcel disagrees with the IE's general assessment of "inaccuracies and errors" between the studies, noting the different results were a matter of: 1) transition to a 2% individual voltage fluctuation threshold; 2) adoption of the IEEE 1453 method; 3) application of the $1 million material upgrade limit; and 4) refinements to the study model (i.e. field conductor verification.) Xcel notes

[42] *Id.*, pp. 7-9
[43] *Id.*, Attachment E, p. 1-2; Attachment I, p. 2

SunShare has paid for one study, and all other studies have been conducted at the Company's cost.[44]

Xcel Energy states the IE's claim that additional capacity (MW) may be gained by changing the voltage fluctuation criteria is not supported by the studies because the limitation to the Linden Project's capacity is steady state voltage not voltage fluctuation. Further, the extensive reconductoring is due to high voltage rather than voltage fluctuation. Xcel acknowledges if the Linden Project was not held to the $1 million material upgrade cap a higher capacity (MW) would be allowed until voltage fluctuation or thermal limits were met.[45]

Xcel argues the remedies the IE proposes as relief to SunShare for project delays are unwarranted and not allowed under either the Section 9 or Section 10 tariffs. **(IE Recommendations D-F).** Xcel claims the IE misunderstood the $1 million material upgrade limit when recommending it apply to actual interconnection costs, and that neither the Company Tariffs nor the Services Agreement allow the IE to award costs, monetary relief or sanctions. **(IE Recommendations E-F)**. Xcel notes the Commission overruled a similar recommendation by this IE in another dispute in its November 1, 2016 Order.[46]

4. IEEE 1453 and Voltage Fluctuations

Xcel argues the Simplified IEEE 1453 Method used in the Linden Project Revision 3 study has been applied consistently in the CSG program since April 1, 2017, and was transparently developed and vetted; including extensive review of industry standards, peer utility review and CSG stakeholder group input. Xcel correctly explains there is no legal or other requirement for the Commission to take action on the Company's April 26, 2017 compliance filing describing the Simplified IEEE 1453 Method. Xcel also raises concerns about the consequences of adopting the IE Report alternative IEEE 1453 analysis: 1) IE did not provide technical justification for why the IE's recommendation is more appropriate; and 2) creates uncertainty for CSG projects (over 200 projects totaling 250 MW) evaluated under the Simplified IEEE 1453 Method. Xcel interprets a SunShare February 2017 email as acknowledging the Linden project would be studied under the updated IEEE 1453 methodology when finalized in the CSG stakeholder group.[47]

Xcel clarifies the Simplified IEEE 1453 Method does not apply flicker limits; rather, the method is focused on voltage fluctuation limits with Rapid Voltage Change and equipment compatibility. Xcel notes both IEEE 1547-2003 and 1547-2018 are interconnection standards; neither address impact on grid equipment remote from the point of common coupling (where the DER interconnects with the utility grid). The Simplified IEEE 1453 Method the Company developed includes application of a 1.5% with 75% on/off (equivalent of 2% full on/full off) at utility voltage regulation equipment remote from the CSG, and applies 3% full on/full off at the point of common coupling. Xcel notes the 4% limit in the Section 10 tariff the IE calls "poorly written and

[44] *Id.*, pp. 11-15
[45] *Id.*, p. 16
[46] *Id.*, p. 25-29
[47] *Id.*, pp. 9-10

misleading" is from the 2004 statewide interconnection technical requirements approved by the Commission.[48]

Xcel argues the IE's alternative IEEE 1453 voltage fluctuation study (**IE Recommendation C(f-g)**) should not be seriously considered. Xcel believes the study is flawed in the following ways:

- In no way resembles the full IEEE 1453 methodology which requires baseline analysis and time-series power flow study with high resolution load and solar data in order to determine flicker (Pst and Plt);
- IE did not provide any technical basis for the various levels of voltage fluctuation and the industry standard;
- IE did not provide examples from other jurisdictions or industry practice for joint responsibility between the utility and SunShare to run the models;
- Using a field study on an already constructed CSG to determine the appropriate voltage fluctuation limits could result curtailment.

Xcel takes issue with the IE rationale that a "gap in the flicker standards" warrants the IE's proposed voltage fluctuation studies in Revision 4. Xcel argues the issue is how to fully implement the IEEE 1453 methodology during a desk evaluation with the complexity related to time series modeling and required data to run the analysis; whereas, power quality tools are available to evaluate installed projects and take baseline measurement. Xcel claims Revision 4 as proposed by the IE would require at least 144 separate power flow runs with no clear criteria on what constitutes a passing case.[49]

5. Advanced Inverters

Xcel Energy supports the Department's determination that this issue is outside the scope of the IE dispute resolution given the Commission's update of statewide interconnection technical requirements in E999/CI-16-521.[50]

6. Distribution Upgrade Costs

Xcel responds to SunShare and the IE's claims about distribution upgrades and related costs. Xcel disagrees with the IE **(IE Recommendation B)** and claims the Company's privacy rules do not allow sharing further information regarding the existing customer's choice to go with underground lines with SunShare. Xcel maintains the Revision 3 study provides the least cost indicative estimate, but that detailed design cost may differ due to site-specific conditions. With regard to the 336 AL versus lower cost equipment options, Xcel argues the IE misinterprets the Section 9, Sheet 68.11, 9(a) tariff by not recognizing the Company should not vary standards for distribution upgrades for CSG projects compared to its own retail customers. Further, Xcel argues if the IE had reviewed industry standards for overhead conductors, it would be found that 336 AL is a standard conductor commonly used by utilities and specified in the Company's Overhead Distribution Construction Manual. Xcel uses standard equipment to achieve operational safety and efficiency.

[48] *Id.,* pp. 14-19
[49] *Id.*, p. 20-21
[50] Xcel Appeal, p. 6

Lastly, Xcel notes this recommendation **(IE Recommendation F)** contradicts the Commission's November 1, 2016 Order based on an August 5, 2016 IE Report in another dispute by a different IE which concluded Xcel's unit cost for 336 AL mainline construction was within a reasonable range based on national data and industry practice.[51]

Procedural Concerns

Xcel outlines a number of procedural concerns with the IE dispute resolution process related to the Linden Project[52]; however, since the Commission elected to phase out the IE process in its March 28, 2019 decision in E002/M-18-714 (*Order forthcoming*) and Xcel is not requesting action in this docket, staff does not summarize.

SunShare Response

SunShare claims Xcel's continued delays since the January 2017 Settlement Agreement have resulted in an estimated $520,000 in damages, not including lost profits and staff time, nor the nearly $2 million in deposits and down payments to Xcel and private capital SunShare has spent on construction to meet local deadlines, and requests[53]:

> … [T]he Commission… promptly affirm the IE Report, and order Xcel to:
>
> 1. Immediately conduct the flicker study and restudy ordered by the IE, including SunShare's participation to identify errors, to be completed by no later than mid-February;
> 2. Complete any interconnection upgrades and schedule witness testing by no later than May 31, 2019, expedited at Xcel's company expense;
> 3. Immediately execute the interconnection agreement and complete detailed design review for the 3 MW capacity Xcel has approved
> 4. In its restudy, analyze whether advanced smart inverter functionalities such as voltage control functions can reduce interconnection costs, and allow for their use if so
> 5. Comply with all other relief ordered by the IE, including in particular the determination that interconnection costs be capped at $1 million and that Xcel be prohibited from charging any profit, labor, overhead, bond costs, or any other markups to the equipment and labor used to complete the interconnection. **(Decision Option 4)**

Further, SunShare claims Xcel's delays harm Xcel's residential customers who comprise 100% of the Linden project's subscribers (nearly a thousand residential subscribers[54]), and is indicative of broader persisting interconnection delays and procedural issues that unnecessarily increase costs

[51] *Id.*, pp. 23-25
[52] *Id.*, pp. 29-32
[53] SunShare Response, pp. 1-3
[54] *Id*, p. 13

and impede the ability of CSG developers. SunShare cautions the sheer costs of raising an IE dispute and supporting it at the Commission or fully participating in related dockets are barriers to smaller CSG developers, and the Commission should consider the issues in this dispute when considering other dockets (e.g. interconnection standards and adjustments to CSG rates.)[55]

1. IE Authority or Charter

SunShare argues the IE acted within the appropriate scope of authority, and that authority is broader than Xcel's efforts to limit it to technical review of specific engineering issues. SunShare refers to tariff language[56] and the Commission's associated November 1, 2016 Order[57] as acknowledging a broader authority; including commenting on and recommending program-wide changes or policy reforms. SunShare notes improvements identified by IE disputes have impacted not only Xcel's CSG program but improved interconnection standards in other states.[58] SunShare notes the IE "Charter" challenged by Xcel in this dispute was used in past disputes without a challenge from Xcel, and is reinforced by the Service Agreement language that directs the IE to "rely on industry codes, standards and references, as well as Commission order, rules and tarris, *and other relevant sources that he may determine to be appropriate* [SunShare emphasis.]"[59]

SunShare notes the IE recognized it was outside the IE's scope of authority to order SunShare's requested relief that the $1 million material upgrade threshold be waived for the Linden Project allowing the full 5 MWs to be constructed. However, SunShare supports the IE's determinations on project costs as within the IE's authority **(IE Recommendations E-F).**

SunShare defends the IE's technical review challenged by Xcel, and supports the IE Report and Recommendations. As evidence of the IE's technical engineering review , SunShare points to several of the IE's observations[60]:

1) Xcel did not correct known issues between study Revisions;
2) The ampacity error, regardless of material impact, is indicative of many errors and ongoing inaccuracies;
3) After review of each study, found none of the studies were entirely accurate and had to be changed due to inaccuracies, changing external conditions and Xcel's errors;
4) Xcel admits using wrong input values in each of the Studies… and the trend continued through the IE process;
5) Found Xcel's Simplified IEEE 1453 Method "utterly different" than the full IEEE 1453 method and unwarranted because no action on the Simplified Method was taken by the Commission;
6) Determined SunShare's alternative overhead cables were sufficient for interconnection and cheaper than Xcel Energy's standard cables; and

[55] *Id.,* pp. 1-3
[56] Section 9; Sheet o. 68.11(9a). See Attachment C to these briefing papers.
[57] MN PUC, Order Resolving Independent-Engineer Appeals and Establishing Procedures for Future Disputes (November 1, 2016), Docket No. E002/M-13-867
[58] SunShare Response, pp. 23-26
[59] *Id*., p. 26
[60] *Id*., pp. 15-17

7) Found Xcel did not sufficiently explain why underground cable was necessary and included in the indicative cost estimate.

2. Settlement Agreement

SunShare notes Xcel Energy's delay tactics continued when the Company refused to sign the Service Agreement while arguing the January 3, 2017 Settlement Agreement precluded the current dispute. SunShare claims Xcel has since dropped this claim, but offers the following:

> In case Xcel reasserts this argument, SunShare notes that the argument lacks merit for the reasons stated in the IE Report. Section 1(b) of the IE Contract [Service Agreement] authorizes the IE to, "at his sole discretion, determine whether, or to what extent, the [January 3, 2017 Settlement Agreement] resolves the issues set forth in the Intake Forms.

SunShare maintains the Settlement Agreement does not bind the Linden Project's voltage fluctuation review, and the Commission should affirm the IE's proposed restudy.

3. Interconnection Review and Timeline

SunShare disagrees with the technical merits of Xcel's claim that additional study is unnecessary because steady state voltage - not flicker - was the limiting factor, and argues Xcel's argument attempts to diminish valid concerns with the studies since the January 2017 Settlement Agreement. SunShare argues the IE is justified in requiring Xcel to complete Revision 4 with SunShare's participation (**IE Recommendation C**) because of inaccuracies in data, changing external conditions, and Xcel's errors and lack of transparency. SunShare believes other errors may be identified in the process of the restudy (Revision 4); including those that contribute to the steady state voltage limit.[61] SunShare argues a non public example of a change between studies that could impact the steady state voltage limit; however, Xcel explains the difference as field conductor verification - replacing an assumption with site-specific information in the studies.[62] Further, SunShare argues it is impossible to know if more than 3 MW could be installed for less than $1 million because Xcel neither studied distribution upgrades above the $1 million material upgrade nor studied capacity above 3 MW.[63]

SunShare describes reluctance by Xcel to share some study results until ordered to do so by the IE as proof of delays, and provides confidential email exchanges between Xcel employees to describe internal Company discussion of the quality and timing of the studies and study results.[64] SunShare also notes, similar to past disputed projects, payment of 1/3 interconnection costs and a signed interconnection agreement for 3 MW was offered by SunShare in an effort to avoid delay and accelerate review while the pending dispute was being resolved; however, Xcel refused to countersign but held the payment (see SunShare non public response, page 12, for the amounts held.) SunShare notes the Department of Commerce rejected their request for IE review of

[61] *Id.*, pp. 20-21
[62] *Id.*, pp. 29-30 and Xcel Appeal, p. 15 and Att. E, pp. 112, 247, 327
[63] *Id.*, pp. 8, 23
[64] *Id.*, pp. 9-11

whether or not Xcel was allowed to do this and said such issue could be addressed by the Commission.

SunShare explains the timeline for the Linden Project is exacerbated by a change in local zoning law which has required them to investing nearly $1 million of private capital in beginning construction on the 3 MW preliminarily approved with a building permit that is set to expire June 1, 2019. SunShare will need additional zoning approval for the additional 2 MW, if approved, after restudy, and argues Xcel's delays may require a variance given the change to local zoning policy.[65] For these reasons, SunShare is requesting the Commission set expedited timelines on the Linden Project's restudy, interconnection agreement, detailed design and upgrades.[66]

4. IEEE 1453 and Voltage Fluctuations

SunShare argues Xcel Energy's Simplified IEEE 1453 Method does not comply with the Commission's November 1, 2016 Order, and industry participants continued to not support it; especially for larger than 1 MW projects. SunShare argues Xcel should do a full IEEE 1453 study for projects that required additional review after applying the Simplified IEEE 1453 Method. SunShare notes National Grid utilizes a time series IEEE 1453 approach with greater site specificity, and Xcel could work with developers to access similar data to complete a full IEEE 1453 study. SunShare points out that Xcel's April 26, 2017 compliance filing notes the Company is capable of performing more robust analysis on a case-by-case basis.[67] SunShare notes Xcel misstates SunShare's position in the February 2017 email, and that SunShare expected then and continues to expect Xcel to apply the IEEE 1453 method in full.[68] SunShare argues Xcel's concern for the uncertainty that would be created in the CSG program for other projects if the Linden Project is allowed to proceed with a full IEEE 1453 study is unwarranted because the IE did not order action related to other projects and Xcel has recognized an end goal of transition to a full IEEE 1453 methodology.[69]

5. Advanced Inverters

SunShare requested both in this dispute and in a November 2015 dispute that Xcel and the IE consider allowing the Linden Project to use voltage control functions on its advanced functionality inverters to mitigate potential flicker and steady-state overvoltage to lower interconnection costs. SunShare notes the Commission decision that advanced functionality inverters should not be permitted "… until such time as the inverter functions have been tested and certified under UL standards, or until further order of this Commission." However, SunShare argues industry acceptance of this technology has progressed substantially since this Commission Order.

[65] *Id.*, pp. 12-14
[66] *Id*., p. 19
[67] *Id.*, pp. 5-8
[68] *Id*, p. 27; See Att. E in Att. K of Xcel Appeal for email exchange.
[69] *Id*. p. 27-28

6. Distribution Upgrade Costs

SunShare highlights Section 9 tariff language[70] and the associated December 15, 2015 Commission Order[71] related to Material Upgrades and the detail Xcel Energy must provide arguing had Xcel complied with the intent of this language the current dispute may have been avoided.[72]

SunShare supports the IE's recommendations to limit the distribution upgrade costs to the $1 million material upgrade with the limits described (**IE Recommendations E-F**), and notes Xcel has verbally reported interconnection costs could run as high as $1.6 million with no supporting documentation. SunShare claims the IE addressed or evaluated industry best practices or standards when determining SunShare's proposed alternative overhead cables were cheaper than Xcel's standard equipment, but still sufficient for interconnection.[73] SunShare maintains Xcel is obligated to share greater detail on why the underground cable is warranted because SunShare has paid for detailed design review.[74]

Regarding the cost of the lines used for reconductoring, SunShare argues the IE recommendation to limit what Xcel can charge SunShare is consistent with this tariff language[75]:

> However, if the independent engineer determines that a particular piece of equipment or engineering alternative proposed by Xcel is more restrictive than industry standards but does not discourage cogeneration or small power production, the Company may implement that alternative, if the Company pays the incremental cost in excess of the amount necessary to implement the industry standard.

Further, SunShare claims Xcel's reference to a past IE report finding Xcel's unit costs were reasonable is not the same as establishing a cheaper alternative, and the incremental costs difference between the 336 AL overhead line and the alternatives identified in the IE Report should be paid by Xcel not SunShare.[76] SunShare requests the Commission independently affirm this relief.

Procedural Issues

SunShare argues the IE's Recommendations and Report are final and binding up until the point they are modified by the Commission, and Section 4(e) of the Service Agreement does not state the IE Report is without effect pending an appeal.[77]

---

[70] Section 9; Sheet No. 68.5(h). See Attachment C to these briefing papers.
[71] MN PUC, Order Approving Tariffs as Modified and Requiring Filing (December 15, 2015), Docket No. E002/M-13-867
[72] *Id.*, pp. 23-24
[73] *Id.*, pp. 14-17
[74] *Id.*, p. 31-32
[75] Section 9; Sheet No. 68.11(9a)
[76] *Id.*, p. 32
[77] *Id.*, p. 19 (footnote 55)

Staff Analysis

1. IE Authority or Charter

Staff agrees with Xcel Energy's review of tariff and the Service Agreement related to the IE's authority, and also was not able to find justification for the IE's description of the "Charter" including:

> Address appropriate and related best business and technical practices and trends in the PV interconnection industry that would benefit Parties and the wider Community Solar Garden and Solar Rewards Community Programs.

SunShare does correctly cite the Service Agreement's inclusion of "… and other relevant sources that he may determine to be appropriate."[78] SunShare is also accurate that the IE has used this expanded description of a "Charter" in past IE reports, and the Commission has not addressed it directly. The Xcel Community Solar Garden Stakeholder Group in reviewing the IE dispute resolution process noted the importance of the flicker solution, which includes the transition to IEEE 1453, identified in an IE dispute but adopted program-wide as critical for the CSG industry. Xcel cautions in this dispute that if accepted the IE's recommendations on application of IEEE 1453 review may create uncertainty within the CSG program for projects evaluated and approved with the Company's Simplified IEEE 1453 Method. The Commission may wish to address these issues as part of any determination made in its Order.

Beyond the incremental difference between alternatives to 336 AL lines, staff did not see citation from SunShare to support the claim that it is within the IE's authority to issue project cost relief by limiting what Xcel Energy can recover of and on the actual interconnection costs; including the disputed distribution upgrades. The Commission may wish to flesh this issue out more with parties if inclined to accept the IE's recommended cost relief (**IE Recommendations E-F.**)

2. Settlement Agreement

To staff's knowledge, the January 3, 2017 Settlement Agreement was not provided to the Commission prior to Xcel Energy's Errata filing in this docket. Staff is unclear why the Parties agreed in the Services Agreement to allow the IE, at his sole discretion, determine whether, or to what extent, the prior settlement resolves the issues set forth in the Intake Forms, but they did.[79] In essence, the Service Agreement directed the Independent Engineer to determine a legal question. Staff does not have access to the details in the April 13, 2016 initial Linden dispute resolved by the January 3, 2017 Settlement Agreement to confirm whether or not the IE's determination the Settlement Agreement does not apply in this current dispute is correct. Xcel continues to claim the Settlement Agreement is binding, at least, as it relates to how the Linden Project's voltage fluctuation will be studied. The Commission may wish to ask parties to provide more information in hearing.

---

[78] Service Agreement, 1(f), p.
[79] *Id.*, 1(b), p. 2

3. Interconnection Review and Timeline

The Linden Project has been in engineering review for three years and gone through multiple restudies to-date. SunShare cites to the IE report to support the claim that Xcel admitted it used the wrong input values in each of the Studies[80]; however, the IE Report does not cite that claim[81] and Xcel Energy refutes any material impact to inaccuracies in Appeal.[82] Staff cannot proffer on whether other inaccuracies related to steady state voltage would be identified by active engagement of SunShare's engineers in Xcel's Revision 4 restudy. Relying on the few details or examples provided in the record, staff offer the following analysis:

Error/Inaccuracy Noted	Limiting Factor	Material Impact on Limiting Factor	Material Impact on Distribution Upgrade Costs
750 AL UG ampacity rating stated as 255A instead of 630A	Steady State Voltage (High Voltage)	No.	No.
Length of OH line reconductoring reported differently in same study	Steady State Voltage (High Voltage)	No.	Unclear.
Change in Assumption to Site Specific Information via Field Conductor Verification	Steady State Voltage (High Voltage)	Possibly.	Possibly.

If the Commission agrees with the IE and SunShare that Xcel's engineering review continues to be flawed by inaccuracies or errors that could impact the results of the steady state voltage limits, a restudy (Revision 4) may be warranted. If the Commission is concerned with Xcel using site-specific information in later studies or indicative cost estimates for Linden, a restudy (Revision 4) may be warranted; however, staff notes the tariff allows for the Company's general knowledge of the feeder or substation[83] and the Company has been criticized before for variances between the indicative cost estimate and the detailed design cost estimate when not including site-specific information. If Revision 4 is warranted, then the Commission must also decide if it is appropriate, as proposed by the IE and SunShare, to require Xcel to modify its voltage fluctuation review from the Simplified IEEE 1453 Method to the full IEEE 1453 study described by the IE.

Given the timing constraints of SunShare for local zoning and Xcel Energy's argument that steady state voltage – not voltage fluctuation – is the limiting factor of the Linden Project's approved capacity (MW), staff offers a modified decision option that does not include a restudy. Staff

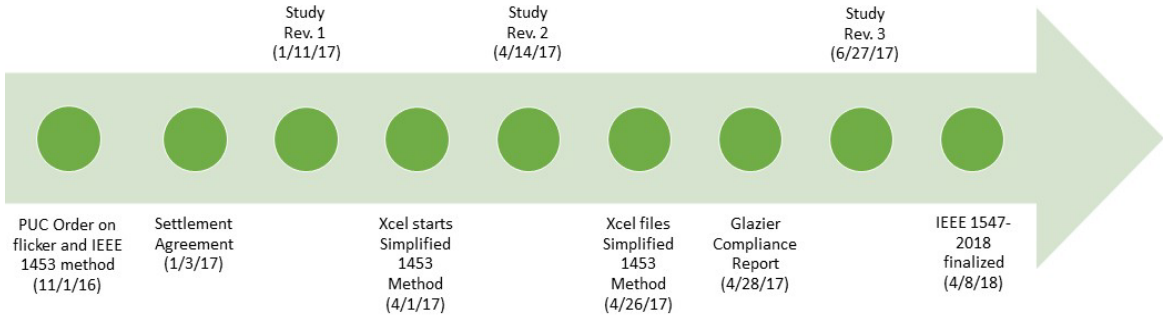
[80] SunShare Response, p. 20
[81] IE Report, p. 38
[82] Xcel Appeal, p. 3
[83] Section 9; Sheet No. 68.6 (5j)

recognizes this decision option does not address all the issues in this docket and may not be satisfactory to either party **(Decision Option 5.)**

4. IEEE 1453 and Voltage Fluctuations

The chart below demonstrates how conditions changed related to voltage fluctuation review over the time of the Linden Project restudies after the January 2017 Settlement:

Linden Project Study Timeline and Evolution of Flicker and RVC Study Methods



As Xcel adopted new voltage fluctuation review standards, the criteria used for interconnection review changed in a way that allowed for increased Linden Project capacity before hitting voltage fluctuation limits; however, as mentioned previously, steady state voltage remains the limiting factor to the approved capacity for the Linden Project in the most recent study (Revision 3.)

Flicker is the subjective impression of fluctuating luminance caused by voltage fluctuations and measured in short term and long term perceptibility (Pst and Plt); whereas, Rapid Voltage Change (RVC) and the voltage threshold in the ANSI C84.1 standard are measured in a percentage change in voltage over a timeframe. All three are caused by changes in voltage over time (i.e. voltage fluctuations.)[84]

Among other industry input, Xcel met 3 times with CSG stakeholders to develop the current Simplified IEEE 1453 Method. SunShare did not participate in any of the meetings according to the meeting minutes. SunShare is correct that developers did raise concerns with the application of the Simplified Method to larger than 1 MW projects; however, the workgroup did not take up the issue in a final meeting as alluded to in earlier meeting minutes. Xcel maintains full IEEE 1453 study is cost-prohibitive and because an element of the review involves a post-construction field study can result in risk management issues around curtailing production versus necessary material upgrades. SunShare and Xcel disagree on how much weight should be given to the

[84] See **Attachment D** for the Commission's Solar Energy Innovator Fellow Pam Johnson's summary of the difference between flicker and rapid voltage change.

Glazier Compliance Report findings that actual voltage fluctuation measured was half of what was expected in engineering review.

IEEE 1453 is a recommended practice which IEEE 1547-2018 includes along with the International Electrotechnical Commission Technical Report 61000-3-7 in describing how to assess and measure flicker.[85] These changes are broadly seen as an improvement over IEEE 141 (sometimes, referred to as the GE Flicker Curve) which was not designed for application to distributed energy resources; however, how to apply the new standards in engineering review of a DER interconnection application is not yet a clear industry-wide standard. For instance, Xcel's Simplified IEEE 1453 Method uses what is described in IEEE 1547-2018 Clause 7.2, but also incorporates an additional voltage fluctuation measurement at the utility's line voltage regulators (on the utility grid beyond the point of common coupling) which the IE notes is not addressed in the IEEE 1547-2018 standard[86]; nor, to staff's knowledge, the associated standards mentioned. The Commission and Parties recognize over time improvements to how voltage fluctuation is studied are likely, and the question before the Commission in this docket is what should be required in this instance.

5. Advanced Inverters

SunShare has raised the issue of advanced inverter utilization in IE disputes with the Commission before, and the Commission has not required utilization to-date but is tracking progress toward certification and broader adoption of advanced inverters (i.e. installation and use.)[87]

The newly revised IEEE 1547-2018 was finalized in April 2018 and requires certain performance capabilities for distributed energy resources; including advanced inverter functionality. Phase II in Docket No. E999/CI-16-521 is focused on developing Minnesota's statewide interconnection and interoperability technical requirements informed by this updated standard.

UL 1741 certified equipment complying with the updated IEEE 1547-2018 is not expected until 2020-2021. Several states, including ISO-NE, are moving forward with advanced inverter functional requirements in the interim using a supplemental amendment (UL 1741 SA) based on California's Rule 21 or Hawaii's Rule 14H as the source requirement document (instead of IEEE 1547-2018.) EPRI provided a draft chart outlining how certification with the various rules and standards aligned with the new IEEE 1547-2018 to the Technical Subgroup (TSG) working on updating Minnesota's statewide technical interconnection and interoperability requirements (TIIR).[88] The TSG is currently proposing to wait for the update to the testing procedures (IEEE 1547.1) for UL 1741; rather than adopting an interim solution. The draft TIIR has not been reviewed or approved by the Commission (anticipated not later than 4 Q 2019), but discusses when advanced inverter functions would be required, enabled, disabled or allowed by mutual agreement.[89] Sunshare has not been involved in the TSG to-date.

[85] IEEE 1547—2018, Clause 7.2.3, p. 62
[86] IE Report, p. 26
[87] MN PUC, August 6, 2015 Order (E002/M-13-867). SunShare makes a similar claim for the complaint on Xcel Energy's treatment of the Schiller Project in E002/M-19-203.
[88] Technical Subgroup Meeting #7 (September 14, 2018), Docket No. E999/CI-16-521, Slide 42
[89]Technical Subgroup In-Person Meeting (September 21, 2018), Docket No. E999/CI-16-521, Slides 25-27

6. Distribution Upgrade Costs

Staff did not see in the record the incremental cost difference between the lower cost SunShare alternatives to the 336 AL overhead lines. Unlike some states that choose to spread interconnection costs across all customers, Minnesota requires Interconnection Customers to pay the actual interconnection costs, including for required distribution upgrades. Xcel drew attention to tariff language that stated[90]:

> The standards employed by the Company (and as used by the independent engineer) should not vary, where applicable, from the standards which the Company uses when constructing, maintaining, or repairing its distribution network for purposes of providing service to its own retail customers

Standardized equipment results in cost savings in procurement, installation and ongoing maintenance. Staff could not find reference to either alternative SunShare proposed in the Overhead Electric Distribution Design and Substation Construction Manual; however, part of the manual was not included in the record.[91] It is unwise to introduce unique distribution equipment per customer, but it is up to the Commission to determine whether the incremental cost or some cost relief is appropriate.

[90] Section 9, Sheet No. 68.11 (9a)
[91] Xcel Appeal, Att. J

Decision Options

1. Grant Xcel Energy's March 26, 2019 Motion to Strike and accept the redline strikethroughs in Attachment A.

OR

2. Accept the amended version of SunShare's January 17, 2019 Response to Appeal provided in SunShare's April 5, 2019 Response as resolving the Motion to Strike. (*SunShare)*

---

3. Reject the Independent Engineer Report recommendations and find that it was appropriate for Xcel Energy to offer 3 MW of capacity at the Linden site consistent with the results of the June 27, 2017 engineering review study. (*Xcel Energy)*

OR

4. Affirm the December 24, 2018 Independent Engineer Report and require Xcel Energy to comply with the Independent Engineer's recommendations to: *(SunShare)*
   a) Immediately conduct the flicker study and restudy ordered by the IE, including SunShare's participation to identify errors, to be completed by no later than __[*intentionally left blank*]__;
   b) Complete any interconnection upgrades and schedule witness testing by no later than May 31, 2019, expedited at Xcel's company expense;
   c) Immediately execute the interconnection agreement and complete detailed design review for the 3 MW capacity Xcel has approved
   d) In its restudy, analyze whether advanced smart inverter functionalities such as voltage control functions can reduce interconnection costs and allow for their use
   e) Comply with all other relief ordered by the IE, including in particular the determination that interconnection costs be capped at $1 million and that Xcel be prohibited from charging any profit, labor, overhead, bond costs, or any other markups to the equipment and labor used to complete the interconnection.

OR

5. Find that it was appropriate for Xcel Energy to offer 3 MW of capacity at the Linden site consistent with the results of the June 27, 2017 engineering review study (*Staff modification of Xcel D.O. 3)*. Direct Xcel to:
   a) Immediately execute the interconnection agreement and complete detailed design review for the 3 MW capacity (*Staff modified SunShare D.O. 4c)*;
   b) Complete any interconnection upgrades and schedule witness testing by no later than May 31, 2019 (*Staff modified SunShare D.O. 4b);* and,
   c) Work with Community Solar Garden Stakeholder Workgroup to propose an advanced functionality inverter pilot project, upon mutual agreement of the utility and the DER developer, for voltage regulation using inverters certified to IEEE 1547-2018 that would reduce anticipated distribution upgrade costs. (*Staff modified SunShare D.O. 4d)*

Timeline of Linden Project[92]

Date	Event
May 5, 2015	SunShare submits application for Linden Project (SunShare Reply, p. 4)
May 20, 2015	Application fee/deposit received
June 3, 2015	Xcel initial application review
June 5, 2015	SunShare submitted Solar*Rewards Community applications for five 1 MW solar gardens for the Linden Project (Xcel Appeal)
July 10, 2015	Xcel comments on additional info needed
July 27, 2015	SunShare submitted updated 1-line and site plan
August 27, 2015	SunShare Linden Project applications deemed complete
September 18, 2015	Engineering SOW provided to SunShare
[redacted]	[redacted]

[92] This timeline is recreated from SunShare and Xcel's filings in this docket. Staff blacked out the timeline from the first IE dispute through the January 3, 2017 Settlement per SunShare's April 5, 2019 Response to Motion to Strike.

[redacted]	[redacted]
January 3, 2017	SunShare and Xcel executed a Settlement Agreement (affecting several other SunShare projects too)
January 11, 2017	Xcel 3rd study of Linden Project (internal analysis)
April 1, 2017	Xcel begins to use simplified IEEE 1453 approach for all projects
April 12, 2017	Xcel and Department filed Standardized Form for IE Reports (filed again on May 12, 2017) (Xcel Appeal, p. 31)
April 14, 2017	Xcel 4th study of Linden Project (IEEE 1453 Simplified; included error of not applying $1m cap)
April 26, 2017	Xcel compliance filing summarizing the simplified IEEE 1453 methodology
June 27, 2017	Xcel 5th study of Linden Project (labeled Revision 3)
July 14, 2017	Xcel offers revised cost estimate to SunShare (SunShare Response, p. 8)
July 25, 2017	Xcel provides redacted study results to SunShare
August 6, 2017	Initial Mechanical Completion/ Placed in Service deadline
August 7, 2017	Additional follow up by Xcel
August 14, 2017	Deadline for SunShare to execute and pay the IA
October 31, 2017	Xcel emailed SunShare requesting update on IA and noting deadline passed; SunShare began responding to the IA with questions
November 1, 2017	Xcel provided updated deadline for IA execution and payment of 1/3 costs by 11/8/17.
November 1, 2017 - December 2017	SunShare emails; Xcel responds (Nov 1-3; Dec 8)
Dec X, 2017	Xcel engineer email referenced by SunShare
December 31, 2017	Mechanical Completion/ Placed in Service deadline from Settlement
January 1, 2018 - February 2018	SunShare emails; Xcel responds and requests signed IA by Mar 16 or cancelled. (Jan 8; Feb. 13; Feb 20 SunShare; Mar. 2 Xcel response.)
March 14, 2018	SunShare sends 4th set of questions and requests IA extension
March 14, 2018	Xcel responds no extension of IA beyond Mar. 16.
March 15, 2018	Xcel responds to questions
March 15, 2018	SunShare initiates IE dispute with email to Dept
March 16, 2018	New, extended deadline for SunShare to sign and pay IA
March 16, 2018	SunShare filed IE dispute intake form (current dispute). (Form 1)
April 4, 2018	SunShare offers to pay for detailed design; Xcel declines (IE Report, Xcel, Att. A, p. 17)
April 17, 2018	SunShare submits a revised intake form (Form 1)
April 18, 2018	Department refers IE dispute to IE (IE report, p. 1; Xcel Appeal, Att. A, p. 1)
April 26, 2018	Service Agreement initiated bw IE, SunShare, Xcel (IE report, Xcel Att. A, p. 6))
June 13, 2018	Xcel and SunShare and IE execute Services Agreement and NDA (Xcel Appeal, p. 29) (SunShare claims Xcel delayed on Services Agreement for 3 months and argued dispute was precluded by Jan 2017 Settlement Agreement (SunShare Reply, p. 11) (NDA was on Jun 18, 2018 (IE report, Xcel Att. A, p. 6))

June 13, 2018	SunShare signed July 14, 2017 IA, and paid 1/3 interconnection costs (Xcel refused to countersign the agreement and complete final design review, arguing it would be inconsistent with its business practices because there was an ongoing IE review. (SunShare Reply, p. 11) (IE Report, Xcel Att. A. p. 8)
June 28, 2018	Xcel response to SunShare IE dispute intake form (Intake Issues #2& 7; SunShare Request #1)
July 19, 2018	Xcel responds to IE IR No. 1-4
July 24, 2018	Department determines SunShare's request the IE order Xcel Energy to begin immediate construction of 3 MW was outside IE's jurisdiction. (Intake Issue and SunShare Request #3) (IE Report, Xcel Att. A. p. 8)
August 7, 2018	IE determines Settlement Agreement does not preclude current dispute
August 14, 2018	SunShare filed IE dispute intake form (addendum to current dispute) (Form 2)
August 15, 2018	Xcel emails IE and Dept objecting to advanced inverters; ok with model assumptions (#2 issue)
August 16, 2018	Dept requests IE stop work while parties discuss settlement (IE Report, Xcel Att. A. p. 9)
August 21, 2018	Xcel responds to IE IRs. No. 5, 6, 8
September 4, 2018	Dept requests IE to resume (IE Report, Xcel Att. A. p. 9)
September 4, 2018	Department determines SunShare's request the IE order Xcel Energy to incorporate smart inverter capability was outside the IE's jurisdiction (Intake Issue #6; SunShare Request #4) (IE Report, Xcel Att. A. p. 9)
September 6, 2018	IE on medical leave (IE Report, Xcel Att. A. p. 9)
September 14, 2018	Xcel responds to IE IR No. 7
September 17, 2018	Xcel response to IE with limited series of emails (IE Report, Xcel Att. A. p. 10)
September 21, 2018	IE informs parties would consider 2nd issue on Aug 14 Addendum Intake Form (IE Report, Xcel Att. A. p. 9)
September 21, 2018	Xcel Response (Intake Issues #2& 7; SunShare Request #1)
October 3, 2018	IE returns from medical leave. IE issues IRs
October 15, 2018	Xcel responds to IE IR No. 9-10
November 5, 2018	IE, Xcel agree to release Attorneys Eyes Only emails from Xcel (IE report, Xcel Att. A, p. 5)
November 14, 2018	Emails due. Xcel says no. (IE report, Xcel Att. A, p. 5)) Xcel Energy responds to IE Information Request No. 11, marking information as “Attorney Eyes Only.”
November 15, 2018	IE raises issue with Dept. (IE report, Xcel Att. A, p. 5))
November 19, 2018	Dept. recommends IE complete report, and if report references any emails marked "attorney eyes only" Xcel shall provide all parties with a standard confidential version of those emails.
December 18, 2018	IE report issued
December 24, 2018	IE report revision issued

Index of Xcel's Appeal Attachments (Public and Non Public)

Att.	Title	Pages	Xcel Filing
A	IE Report	1-50	Att. Part 1, pdf pgs. 1-50 (Public) Binder, pdf pgs. 1-50 (Non Public)
B	Issue Matrix for the SunShare Linden IE Report	1-6	Att. Part 1, pdf pgs. 51-56 (Public) Binder, pdf pgs. 51-56 (Non Public)
C	Xcel Energy Community Solar Garden Dispute Resolution Services Agreement	1-20	Att. Part 1, pdf pgs. 57-76 (Public) Binder, pdf pgs. 57-76 (Non Public)
D	Non-Disclosure Agreement	1-6	Att. Part 1, pdf pgs. 77-82 (Public) Binder, pdf pgs. 77-82 (Non Public)
E	Xcel Energy Initial Response to IE (June 28, 2018)[93]	1-413	Att. Part 1, pdf pgs. 83 – 120; Att. Part 2, pdf pgs. 1-22 (Public) E, parts 1 -2 (Non Public)
F	Department of Commerce July Email	1	Att. Part 2, pdf pg. 23 (Public) Binder, pdf pg. 83 (Non Public)
G	August 14, 2018 Intake Form for IE Review	1-3	Att. Part 2, pdf pg. 24-26 (Public) Binder, pdf pgs. 84-86 (Non Public)
H	Department of Commerce September Email	1	Att. Part 2, pdf pg. 27 (Public) Binder, pdf pgs. 87 (Non Public)
I	Xcel Energy Response to Intake Form (September Response)	1-4	Att. Part 2, pdf pg. 28-31 (Public) Binder, pdf pgs. 88-91 (Non Public)
J	Xcel Energy Response, IE IR #2 (IR No. 2 (excluding Att. B)) Response, IE IR #2, Att. A (Overhead Electric Distribution Design and Construction Standards)	1-1289 1-343 (of 1289)[94]	J, parts 1-3 (Non Public) J, part 1, pdf pgs. 1-161 J, part 2, pdf pgs. 1-102 J, part 3, pdf pgs. 1-80
K	Xcel Energy Response to IE IR #4 (Information Request 4)	1-93	Att. Part 2, pdf pgs. 32-125 (Public) Binder, pdf pgs. 92-184 (Non Public)
L	Xcel Energy Response, IE IR #9 (Information Request 9)	1-2	Att. Part 2, pdf pgs. 126-127 (Public) Binder, pdf pgs. 185-186 (Non Public)
M	Xcel Energy Response, IE IR #11 (Information Request 11)	1-23	Binder, pdf pgs. 187-209 (Non Public)
N	Linden Project Timeline Since 3/15/2018 (Project Timeline)	1-2	Att. Part 2, pdf pgs. 130-131 (Public) Binder, pdf pgs. 210-211 (Non Public)
O	Confidentiality Concerns	1-6	Att. Part 2, pdf pgs. 132-137 (Public) Binder, pdf pgs. 212-217 (Non Public)

[93] On January 4, 2019, Xcel filed an Errata (Non Public) containing the January 3, 2017 Settlement Agreement which was labeled as Attachment E, pp. 32-37.

[94] Attachment J to Xcel Energy's Appeal includes pgs. 1-343 of Attachment A of the Company's Response to the IE IR #2. The remainder of the Overhead Electric Distribution Design and Construction Standards was not filed as part of the Appeal. Neither was Attachment B including the Company's Underground Distribution and Substation Construction Manual, nor "several other standards that may be of interest to the IE in this case labeled as Attachments C-F."

Xcel Ratebook's Section 9; Sheets 68.5; 68.11-68.1

Northern States Power Company, a Minnesota corporation
Minneapolis, Minnesota 55401
MINNESOTA ELECTRIC RATE BOOK - MPUC NO. 2

SOLAR*REWARDS COMMUNITY PROGRAM Section No. 9
(Continued) 1st Revised Sheet No. 68.5

5. Interconnection Agreement Time Line Review (Continued)

h. Beginning with the Initial Revised Tariff Filing Date, once a Community Solar Garden is Expedited Ready it will undergo Engineering Scoping Studies which will include among other matters the following: (Continued) T

bb. In addition, a Material Upgrade includes the following upgrades or additions resulting from the engineering indicative cost estimate which, in the aggregate (and not including computation of any applicable contribution in aid of construction (CIAC)) exceed $1 million for a Community Solar Garden Site:

- Three-phase line extension on existing feeders
- Reconductor/build Line

For a material upgrade exceeding the $1 million limitation applicable to (1) three-phase line extension on existing feeders and (2) reconductor/build line, the Company will provide the applicant with an itemized list of the cost inputs, including unit costs and any underlying data and documentation related to those unit costs, that comprise the Company's determination.

ii. If a Material Upgrade is needed, the Company will inform the applicant that the Community Solar Garden Site size cannot be accommodated. If the Company believes that it could accommodate a lower capacity at that location compliant with the Material Upgrade threshold, it will so inform the applicant. In such a situation, the applicant would be allowed to resize the applications, and the Community Solar Garden Site would proceed at the lower capacity without a change to its Study Queue position. If the Company makes an offer to the applicant to resize application(s) under these circumstances, the applicant will have 30 business days to do so. If the the applicant timely resizes application(s), the Company will proceed with completing the Engineering Scoping Study, and the timeline for completion of the Engineering Scoping Study will be extended by 30 business days.

iii. If no Material Upgrade is needed, the Company will develop and provide to the applicant an engineering indicative cost estimate as to the construction needed by the Company to accommodate the Community Solar Garden Site, along with providing to the applicant the total number of MWs ahead of it in the Study Queue at the time of providing the indicative cost estimate. No detailed estimates per Step 5 of the Section 10 tariff will be performed. The engineering indicative cost estimate will be provided to the applicant within the Interconnection Agreement Time Line. Applications becoming Expedited Ready at a later date will have the Interconnection Agreement Time Line begin when Expedited Ready. The Interconnection Agreement Time Line is subject to the provisions in par. 6 below.

i. Beginning with the Initial Revised Tariff Effective Date, once a Community Solar Garden is Expedited Ready, the Company will have the time in the Interconnection Agreement Time Line as defined above to provide an Interconnection Agreement for signature subject to the provisions in par.6 below. The Interconnection Agreement will then need to be signed by applicant and countersigned by the Company. T

(Continued on Sheet No. 9-68.6)

Northern States Power Company, a Minnesota corporation
Minneapolis, Minnesota 55401
MINNESOTA ELECTRIC RATE BOOK - MPUC NO. 2

SOLAR*REWARDS COMMUNITY PROGRAM Section No. 9
(Continued) 1st Revised Sheet No. 68.11

9. Requests for Independent Engineer to Resolve Material Disputes Affecting Interconnection Application (Continued)

a. Any applicant may submit interconnection disputes materially affecting the application to an independent engineer selected or approved by the Department to ensure neutrality. The independent engineer shall be available on a standing basis to resolve disputes on the study process, including material disputes related to the Company's determination of application completeness, timeliness of application and study processing, and the cost and necessity of required study costs and distribution system upgrades. The applicant requesting such an independent engineer review shall share 50% of the costs of the independent engineer. The safety and reliability of the Company's system should be given paramount consideration in any analysis. The review of the independent engineer must consider industry standards for interconnection, including the current version of the National Electric Safety Code, National Electric Code as adopted in Minnesota, FERC rules, NERC rules, Minnesota rules and Minnesota Interconnection Standards and must consider, on a case-by-case basis, the Company's standards for building, safety, power quality, reliability and long-term stable operations for building facilities even where such standards are more restrictive than the minimum requirements set forth in the codes, standards and rules. Continuity and consistency of using Company standards is paramount for employee safety. The standards employed by the Company (and as used by the independent engineer) should not vary, where applicable, from the standards which the Company uses when constructing, maintaining, or repairing its distribution network for purposes of providing service to its own retail customers. However, if the independent engineer determines that a particular piece of equipment or engineering alternative proposed by Xcel is more restrictive than industry standards but does not discourage cogeneration or small power production, the Company may implement that alternative, if the Company pays the incremental cost in excess of the amount necessary to implement the industry standard. The additional incremental costs paid by Xcel cannot be included in the $1 million material upgrade limit. Xcel would continue to have the burden of proof to show that it is reasonable for its ratepayers to pay for the costs of the more restrictive standards. This engineering review specifically excludes appeals relating to Co-Location Determination addressed in par. 4 above, and excludes disputes not related to the interconnection application such as disputes after interconnection has been achieved.

b. The applicant shall initiate such a request by submitting via email any such dispute to the Department. The Company must be copied on this email for this request to be effective. The submission of a such a dispute to the independent engineer may take place before the applicant is Expedited Ready, after being Expedited Ready but before a signed Interconnection Agreement, or after the Interconnection Agreement is signed but only related to issues occurring prior to initial energization of the Generation System. L

c. Such a dispute which is submitted before the applicant is Expedited Ready or after the Interconnection Agreement is signed shall not affect Study Queue position.

d. A dispute which is submitted after an Interconnection Agreement is signed is limited to disputes on the actual costs incurred by the Company to interconnect the Community Solar Garden. A condition precedent to filing such a dispute is that the applicant must have first paid the amount in controversy. Such a dispute must be brought within 60 days of the date the bill is mailed or electronically sent by the Company under Section 10, Sheet 117, par. V.2.b.iii. L

(Continued on Sheet No. 9-68.12)

Northern States Power Company, a Minnesota corporation
Minneapolis, Minnesota 55401
MINNESOTA ELECTRIC RATE BOOK - MPUC NO. 2

SOLAR*REWARDS COMMUNITY PROGRAM Section No. 9
(Continued) 1st Revised Sheet No. 68.12

9. Requests for Independent Engineer to Resolve Material Disputes Affecting Interconnection Application (Continued)

e. A dispute which is submitted after an application is Expedited Ready but before the Interconnection Agreement is signed may impact processing in the Study Queue for the applicant and for those behind the applicant in queue. If the issues presented to the independent engineer are in the Company's judgment so significant that they may impact the results of the engineering indicative cost study or impact as a practical matter how the Company studies the application or those in queue behind the applicant, then the Company may send notice to the applicant and to those behind the applicant in queue that it will not sign an Interconnection Agreement until the dispute raised to the independent engineer is resolved. Similarly, if the consequence of the independent engineer's determination (or any determination as affirmed or reversed by the Commission if any such appeal is taken) is that the scope of assumptions in the Engineering Scoping Cost study must be redone, then such studies will be redone and the Interconnection Agreement Time Line will be reset accordingly for all applications impacted by this determination. L

f. Once a dispute is submitted and an independent engineer selected (i.e., the contract between the applicant, Company and independent engineer has been signed), the Company shall file a notice in Docket No. E-002/M-13-867 that includes (1) the filing and date, (2) the developer, (3) the engineer assigned, and (4) a brief summary of the disputed issues. N N N N T

g. Once a dispute is submitted, the independent engineer will determine what additional information is needed from the applicant and/or the Company and when that information is needed. Both the applicant and the Company shall be included on all emails and communications to and from the independent engineer. The independent engineer should address only those issues necessary to resolve the dispute between the parties. The independent engineer may request additional information from parties necessary to resolve the dispute before the independent engineer. The independent engineer will make a determination of the issues in a written report which provides a description of the pertinent facts, the conclusions and basis for the conclusions. N N N

h. There is an expectation that the independent engineer will issue its written determination on such a dispute within 30 calendar days of the dispute being submitted to it. As part of this program, the Company shall work with the Department and developers to develop a standardized format for independent engineer reports, including the independent engineer's credentials and licensure, and once that is developed the most current version of the standardized format should be used as the format for independent engineer reports. The independent engineer will provide a copy of the independent engineer report with its written determination via email to both the applicant and the Company. Once an independent engineer report is issued, the Company shall file it with the Commission within ten business days. T N N N N NT T N N

(Continued on Sheet No. 9-68.13)

Northern States Power Company, a Minnesota corporation
Minneapolis, Minnesota 55401
MINNESOTA ELECTRIC RATE BOOK - MPUC NO. 2

SOLAR*REWARDS COMMUNITY PROGRAM Section No. 9
(Continued) 1st Revised Sheet No. 68.13

9. Requests for Independent Engineer to Resolve Material Disputes Affecting Interconnection Application (Continued)

i. The applicant or the Company may appeal to the Commission the determination of the independent engineer by making a filing in Docket No. 13-867 (or such other docket as designated by the Commission) within 10 business days of the delivery of the independent engineer's written determination. A report delivered after 4:30 pm (central standard or central daylight savings time, as applicable) shall be considered to be delivered on the next business day. If an appeal is filed, notice shall be given to those on the E-002/M-13-867 service list, and the Commission will open a new docket. When a party appeals an independent engineer's report, each party must identify the documents submitted to the independent engineer in the record necessary for the Commission's record. Such an appeal should include all information relied upon by that party. Responses to any such appeal are due 10 business days from the date of the filing of the appeal. No reply to the response will be allowed.

T
C
N
N
N
N

10. Capacity Screen

a. Any Community Solar Garden applicant may enter into a reasonable and customary non-disclosure agreement with the Company to receive distribution infrastructure and load analysis on a per feeder basis, and study results for previously studied projects. A response to such an information request must be fulfilled within 15 business days of the request. Information requests may include feeder specific voltage, concurrent minimum and peak loading analysis, existing distributed generation under operation, amount of distributed generation in the interconnection queue or Study Queue, terminated maximum distance substation, and any other pertinent information for the purposes of interconnection.

b. The response to the distribution infrastructure and load analysis on a per feeder basis will consist of the following:

i) Substation name
ii) Distance from Substation
iii) Substation transformer nameplate capacity
iv) Substation transformer minimum daytime load
v) Substation transformer maximum load
vi) Feeder name
vii) Feeder Voltage
viii) Feeder minimum daytime load
ix) Feeder maximum load
x) Presence of a voltage regulator
xi) Presence of a reclosure
xii) Distributed resources in operation per feeder and substation
xiii) Distributed energy resources in the interconnection queue or Study Queue per feeder and substation
xiv) Conductor size and material

(Continued on Sheet No. 9-68.14)

Flicker vs. Rapid Voltage Change; the same, or different?[95]

Pam Johnson, Solar Energy Innovator Fellow
February 22, 2019

From reading the IE report, the Xcel appeal, and several of the Xcel documents, unless the reader is an expert on these items, confusion is expected. The IE uses the terms flicker and voltage fluctuation interchangeably, but it is clear they are not 1:1.

Flicker: this is measured by taking voltage measurements at 1-second intervals and processing that data in a statistical analysis which provides a result for every 10 minutes. The limiting value in the standard for flicker on a distribution system is intended to reduce changes in the light output of electric lamps to a level beneath being severe enough that when it is observed by the human eye that it is perceived that the lights are changing their output very rapidly, i.e. flickering. The standard was written for the behaviors of incandescent lighting without electronic ballasts, so may not apply to as many applications today as when it was written. The limits and techniques for measuring flicker are found in the IEEE 1453-2015 standard. Predominantly, changes would need to occur many times per second in order to have a human perceive "flicker." Assessments are made for short term flicker, P_{st}, (10 minute evaluation) and long term flicker, P_{lt} (a 2 hour integrated rolling sum of P_{st} values). [1]

Step Voltage change: this can be differentiated from flicker when it occurs on a time scale of one large step that occurs without repeating for several seconds, minutes, or ever. Turning on a motor can cause a step voltage change.

The blurry line: if there are enough step voltage changes occurring from different sources close together, as noted in the Xcel whitepaper [1], they can create a perception analogous to a long term flicker event.

Rapid Voltage Change (RVC): a step voltage change, referenced often in the Xcel whitepaper [1], including reference to a trip limit recommendation, but also noted as not well defined in the industry.

Voltage Fluctuation: a term used throughout this docket by multiple parties to refer to either flicker, rapid voltage change, or both. The reader must pay attention to determine what is being referenced, although at times it is not possible to tease this out, especially in the IE report.

Xcel notes that although electricity generation is mentioned in the 1453-2015 standard in the definitions and one other portion of the standard, the overarching discussion (and limits) are for flicker caused by loads.

Reference

[1] Xcel white paper *Applying IEEE 1453-2015 for Determining the Voltage Deviation Limits for Medium Voltage Distribution Connected Photovoltaics for Step-Changes in Voltage and Ongoing Voltage Deviations due to the Passage of Clouds, March 30, 2017*.

[95] This is an excerpt from a longer technical review which included non public information.