STATE OF MINNESOTA
BEFORE THE
PUBLIC UTILITIES COMMISSION

Nancy Lange	Chair
Dan Lipschultz	Commissioner
Matthew Schuerger	Commissioner
Katie Sieben	Commissioner
John Tuma	Commissioner

In the Matter of the Commission Investigation into Grid Modernization	Docket No. E999/CI-15-556

COMMENTS OF THE INTERSTATE RENEWABLE ENERGY COUNCIL, INC. ON DISTRIBUTION SYSTEM PLANNING EFFORTS AND CONSIDERATIONS

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INTRODUCTION

On April 26, 2017, the Minnesota Public Utilities Commission (Commission) issued a Notice of Comment Period on Distribution System Planning Efforts and Considerations.[1] The notice established a bifurcated comment period—asking utilities, municipalities, and cooperatives to first comment on Sections A and B of the Commission's April 21, 2017 Questionnaire by June 21, 2017, and all interested parties and stakeholders to comment on Section C of the Questionnaire by July 21, 2017.[2] On July 25, 2017, the Commission issued a notice extending the latter deadline to August 21, 2017.[3] The Questionnaire's stated purpose is to "inform the Commission and stakeholders as to the current status of utility planning processes and results, to provide utilities and stakeholders an opportunity to identify potential improvements in planning processes, and to support a distribution system planning process and filing requirements."[4] Accordingly, the Interstate Renewable Energy Council, Inc. (IREC) submits these responses to Section C. We incorporate some comments on the utilities' June 21, 2017 filings into our responses.

IREC is a 501(c)(3) non-partisan, non-profit organization working nationally to increase consumer access to sustainable energy and energy efficiency through independent fact-based policy leadership, quality workforce development, and consumer empowerment. In service of our mission, IREC works to increase the adoption of regulatory reforms that expand access to and streamline grid integration of distributed energy resources (DERs) to optimize their

[1] Corrected Notice of Comment Period on Distribution System Planning Efforts and Considerations, Dkt. No. E999/CI-15-556, April 26, 2017.

[2] *Id.;* Notice of Comment Period on Distribution System Planning Efforts and Considerations, Dkt. No. E999/CI-15-556, April 21, 2017, pp. 2-3.

[3] Notice of Extended Comment Period, Dkt. No. E999/CI-15-556, July 25, 2017.

[4] Notice of Comment Period on Distribution System Planning Efforts and Considerations, Dkt. No. E999/CI-15-556, April 21, 2017, p. 2.

widespread benefits. The scope of our work includes: developing and advancing regulatory policy innovations; generating and promoting national model rules, standards, and best practices; fostering collaborative partnerships with diverse stakeholders to build to consensus and achieve workable solutions; updating interconnection processes to facilitate deployment of distributed energy resources and remove constraints to their integration on the grid; and incorporating DER growth into utility distribution system planning and operations.

IREC has been deeply engaged in grid modernization efforts in other states, including California and New York, both of which have also focused specifically on distribution planning, and brings that experience to this proceeding. As the Commission is aware, IREC has also already provided input in Minnesota's grid modernization efforts, submitting substantive comments on our grid modernization perspective and contributing to the Commission's related workshops.[5]

In addition, IREC is engaged in the related Xcel distribution study proceeding, Docket No. E-002/M-15-962, in which the Commission recently considered and solicited stakeholder comments on Xcel's hosting capacity report. Through our work to advance and support thoughtful and effective grid modernization throughout the United States, IREC has specifically emphasized hosting capacity as a key tool in harnessing the benefits of DERs while helping to solve the challenges of interconnecting DERs in increasing quantities. IREC's forthcoming paper

[5] *See, e.g.*, Response of the Interstate Renewable Energy Council, Inc. to the Commission's Request for Stakeholder Perspectives Regarding Grid Modernization, Dkt. No. E999/CI-15-556, September 15, 2015; Summary of Positions of the Interstate Renewable Energy Council, Inc. for Grid Modernization Workshop #3, Dkt. No. E999/CI-15-556, November 18, 2015.

on hosting capacity will outline the importance of hosting capacity within the larger grid modernization effort and provide recommendations on how to navigate this critical issue.[6]

IREC greatly appreciates the Commission's pioneering efforts on grid modernization, distribution planning, and hosting capacity, and the repeated opportunities for stakeholder participation. We further applaud the utilities in their efforts and engagement thus far in the proceeding, and their acknowledgement regarding the need to adjust their planning approaches for the future. As Xcel stated in its June 21, 2017 filing, "[t]he technology advancements and customer and utility adoption of DER that is underway will require utilities to think and act differently about the ways they plan and operate their systems."[7] Minnesota Power similarly noted that optimization of DER interconnection requires "a change in philosophy with regard to planning, in that distribution system planners must now work to find locations where distributed energy resources can not only be accommodated, but whe[re] they can enhance system reliability and possibly improve the economic operation of the system."[8]

These sentiments echo the Commission's recognition that "a more directed and coordinated approach to grid modernization is warranted."[9] As Commission staff explained in the March 2016 report filed in this proceeding, "[a]n integrated, modern grid provides for greater system efficiency and greater utilization of grid assets, enables the development of new products

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[6] IREC expects to release this paper Summer/Fall 2017, at which point it will be available on IREC's web site, www.irecusa.org.

[7] Xcel's Response to Notice and Questionnaire (Xcel's Response), Dkt. No. E999/CI-15-556, June 21, 2017, pp. 3-4.

[8] Minnesota Power's Response to Notice and Questionnaire (MN Power's Response), Dkt. No. E999/CI-15-556, June 29, 2017, pp. 3, 16; *see also* Dakota Electric's Response to Notice and Questionnaire (Dakota's Response), Dkt. No. E999/CI-15-556, June 21, 2017, p. 1 (emphasizing the need to plan for the long-term future).

[9] Staff Report on Grid Modernization (Staff Report), Minnesota Public Utilities Commission, March 2016, p. 6.

and services, provides customers with necessary information and tools to enable their energy choices, and supports a standards-based and interoperable utility network."[10] IREC provides the following comments and responses in an effort to aid Minnesota's progress toward these grid modernization and distribution planning goals.

I. RESPONSES TO COMMISSION SECTION C QUESTIONS

Success in the context of grid modernization is not necessarily easily defined, and states, including Minnesota, have the difficult task of striking the appropriate balance of achieving ambitious policy goals, reforming traditional regulatory paradigms, opening the door to new market opportunities, and enabling the transition to a more advanced, reliable, clean, and secure energy future. This remains a relatively new undertaking, with California, New York, Massachusetts, Maryland, and Hawaii as the primary states that are engaging in similar efforts, though other states are beginning their own proceedings, such as Illinois's NextGrid and Ohio's PowerForward. From our experience working in nearly all of these states, IREC notes that these laudable regulatory initiatives require the coordination of many moving pieces and overlapping processes, including but not limited to the requisite changes to planning, forecasting, interconnection, procurement, business models, rate design, customer engagement, and valuation mechanisms inherent to such a transformation. IREC appreciates the Commission's leadership in exploring integrated distribution planning and grid modernization, and applauds the Commission's commitment to navigating these important topics early on. We also acknowledge that such an undertaking is not without its challenges and limitations, particularly relative to the Commission's other workload and obligations. Yet, IREC believes these discussions are critically important to Minnesota's broader policy objectives, and we appreciate the

[10] *Id.* at p. 13.

Commission's thorough and thoughtful consideration of the multitude of issues within this proceeding and other related proceedings.

As the Commission has aptly recognized, integrated distribution planning is a critical component of its larger grid modernization effort.[11] The aim of integrated distribution planning should be to integrate DERs in a way that maximizes their beneficial use through identification of high-value locations, including where DERs may serve as non-wires alternatives (NWAs), and to identify low-cost locations where DER can interconnect easily, as well as traditional upgrades that may be required to accommodate expected DER growth. Such proactive distribution system planning and optimization of DERs relies on three tools that are typically relatively new to most utilities: hosting capacity, DER forecasting, and locational valuation.

Given our perspective as a national organization, IREC draws on examples from the abovementioned states—particularly New York and California, given their focused efforts on distribution planning—in our comments in this proceeding. We recognize that New York and California are notably different state markets from Minnesota's, and thus we are supportive of a process that works for Minnesota's needs and current situation, relatively early in its gird modernization process and with relatively low penetrations of DER. Without some of the pressure felt in other states that already have significant DER penetration, such as Hawaii and California, Minnesota has the opportunity to consider which actions to take now to move towards integrated distribution planning and how to allow appropriate flexibility to evolve with DER markets. Indeed, this early thinking and planning will help Minnesota avoid the pitfalls experienced by other higher-penetration states, and will help lay the foundation for more sustainable and predictable markets in the future.

[11] *See* Staff Report, pp. 12-14.

IREC also recognizes that the various Minnesota utilities are different with respect to size, service area, customers, and level of DER penetration. For this reason, we recommend that the Commission focus on creating common statewide goals and guidance for all utilities, while allowing for some variation in timelines and other specifics, depending on each utility's particular context, as discussed further below. Having clear, well articulated Commission guidance for all utilities will help to promote transparency, foster consistency to the greatest extent possible, and ensure that the utilities are collectively moving towards a common vision for the future.

In providing this guidance to the utilities, IREC emphasizes that it is important for the Commission to recognize current utility incentives, even if the Commission is not yet ready to address cost recovery and business model issues.[12] As Commission staff noted, absent changes to the utility business model, the utilities' traditional economic motivations (i.e., investment in capital projects upon which utilities earn a rate of return) may be undermined by increased DER adoption.[13] Therefore, fundamentally, the utilities may not be motivated to maximize the beneficial use of DERs on their systems, since many if not all of these may be third-party-owned. IREC suggests that the Commission's end goal should be for utilities' incentives to align with ratepayer interests and state policy objectives, including the economic, environmental, and customer-choice goals that motivate many DER installations. Until that time, additional processes and transparency will be required to ensure utilities are supporting these goals appropriately with their investments and internal processes.

[12] *See* Staff Report, pp. 31-35 (postponing these issues to the last phase of the grid modernization process).

[13] *Id.* at p. 31 ("As customers adopt distributed resources, they become less reliant on the incumbent utility for the provision of the electricity and may consume less of it over time. Fewer sales means less revenue collected, which means the utility needs to make up that lost revenue from the remaining customers. The question becomes how to keep the utility solvent.")

As the utilities noted in their responses to Sections A and B, distribution planning is a complex process.[14] Thus, the Commission will need to work with utilities and stakeholders to ensure that the correct balance between transparency and administrative efficiency is achieved. In striving to strike this balance, the Commission's ultimate focus should be on the public interest, including maintaining and enhancing consumer choice.[15]

1. Evaluation of Utility Plans

a. Utility Distribution Plans in Other Proceedings

IREC believes that the Commission should have enhanced oversight over utility distribution planning at this point in Minnesota's grid modernization efforts, in particular with respect to the utilities' efforts to integrate DERs into their planning processes. While the utilities' initial June 21, 2017 filings offer a helpful starting point, continued visibility into the utilities' distribution planning is important to ensure they are moving at an appropriate pace towards the Commission's and state's relevant goals. IREC suggests that the approaches taken in California and New York offer helpful models from which the Commission may draw. In both cases, those states' commissions provided guidance to the utilities regarding expectations for utility filings, on which stakeholders had an opportunity to comment, and then the ultimate utility filings were also subject to stakeholder and Commission review. As discussed further below in Section II.1.c., stakeholder engagement has been a cornerstone of both processes.

In New York, the utilities' "Distribution System Implementation Plans" (DSIP) are intended to "serve as a source of public information regarding DSP [Distribution Service Platform] plans and objectives, including specific system needs allowing market participants to

[14] MN Power's Response, pp. 3, 16; Xcel's Response, p. 3; Dakota's Response, pp. 9-10;

[15] *See* Response of the Interstate Renewable Energy Council, Inc. to the Commission's Request for Stakeholder Perspectives Regarding Grid Modernization, Dkt. No. E99/CI-15-556, pp. 1-2.

identify opportunities [as well as to] serve as the template for utilities to develop and articulate an integrated approach to planning, investment, and operations . . . ."[16] The Commission's guidance on their content specifies that they address: distribution system planning, including forecasting, identification of beneficial locations for DER, hosting capacity, and certain other issues; distribution grid operations; advanced metering; and customer data.[17] Utilities were required to file individual "initial DSIPs," somewhat similar to the descriptions of current process and status the Commission has already required of the Minnesota utilities, as well as a joint "supplemental DSIP" with more forward-looking information and aimed at improving consistency among utilities where appropriate.[18] The Commission reviewed the utilities' first round of filings, and provided further guidance and direction to the utilities, requiring several additional deliverables.[19] The Commission specified a 5-year planning horizon with future plans to be filed on a biennial basis beginning in June 2018.[20]

In California, the utilities' "Distribution Resource Plans" (DRP) are more narrowly focused and intended to recognize "the need for investment to integrate cost-effective DERs and for actively identifying barriers to the deployment of DERs such as safety standards related to

[16] Order Adopting Distribution System Implementation Plan Guidance, New York Public Service Commission, Case No. 14-M-0101, April 20, 2016, p. 8 (quoting Order Adopting Regulatory Policy Framework and Implementation Plan, Case No. 14-M-0-0101, February 26, 2015, p. 32).

[17] *Id.*, Att. 1.

[18] *Id.*

[19] Order on Distributed System Implementation Plan Filings, New York Public Service Commission, Case No. 14-M-0101, March 9, 2017.

[20] Order Adopting Distributed System Implementation Plan Guidance, New York Public Service Commission, Case No. 14-M-0101, July 20, 2016, p. 18.

technology or operation of the distribution circuit."[21] As in New York, the California Commission also provided specific guidance on the content of the DRPs, requiring that they include detail on: integration capacity analysis (i.e., hosting capacity), optimal location benefit analysis for DERs, DER growth scenarios, demonstration and deployment projects, data access, and certain other issues. Since their submittal, the Commission has issued several rulings addressing their contents and related issues, providing additional guidance to utilities and stakeholders. Like the DSIPs, the DRPs are also expected to be filed on a biennial basis.[22]

IREC suggests that the Commission should follow a similar process in Minnesota. IREC emphasizes the importance of providing upfront guidance to the Minnesota utilities regarding the content, format, and timing for their distribution planning filings. Such guidance should also provide high-level direction regarding the ultimate goals for the utilities' distribution planning processes, such as improved integration and optimal utilization of DERs. After soliciting stakeholder input on the plans, as discussed further in Section II.1.c below, IREC suggests that the Commission issue another order with further guidance for the next round of plans, and any interim steps that may be necessary. Ultimately, IREC believes Minnesota's goal should be one seamless process in which DER integration and grid modernization investments are just part of broader distribution planning. In the nearer term, however, this extra guidance, transparency, and review are appropriate in light of the utilities' current business model and cost-recovery framework, which do not necessarily fully align their incentives with the public interest and various state policies, as discussed above.

[21] Assigned Commissioner's Ruling on Guidance for Public Utilities Code Section 769—Distribution Resource Planning, California Public Utilities Commission, R.14-08-013, February 6, 2015, p. 2.

[22] *Id.*, p. 11

While the Commission may choose to approve or request modifications to the plans, IREC does not believe that such approval should constitute a prudency finding. Instead such a finding would continue to be made as part of a utility's general rate case or other separate proceeding. IREC notes that both New York and California have taken a similar approach.[23] However, IREC suggests that approval of a utilities' distribution plan should factor into the Commission's analysis of prudency when investments are proposed. If a proposed investment comports with a utility's approved distribution plan or the Commission's guidance, it should support an ultimate prudency finding (and vice versa).

b. Integration with Other Planning Activities

IREC generally supports integration of distribution system plan development, review, and approval with other planning activities, especially where doing so optimally aligns timelines for the Commission, utilities, and stakeholders, and eases the administrative process. To the extent possible, any integration between distribution system planning and other planning activities should be based on common assumptions so that the related efforts can bolster each other and overlap as appropriate.

Although interconnection has historically been a reactive process in response to applications, rather than a forward-looking "planning activity," interconnection stands out as a particularly important opportunity for alignment with distribution system planning. Accurate interconnection information plays an important role in DER forecasting, and hosting capacity

[23] Order Adopting Distributed System Implementation Plan Guidance, New York Public Service Commission, Case No. 14-M-0101, July 20, 2016, pp. 3-4; Assigned Commissioner's Ruling on Guidance for Public Utilities Code Section 769—Distribution Resource Planning, California Public Utilities Commission, R.14-08-013, February 6, 2015, Att. p. 11.

Notably, within its DRP proceeding, California is currently working on grid modernization investment and distribution investment deferral frameworks to help the Commission assess the prudency of proposed investments made in the name of grid modernization in other proceedings.

and locational valuation analyses, in that these tools may incorporate data regarding interconnected DERs and DER interconnection applications. Collectively, these three tools are vital to integrated distribution planning. Utilities can use them to understand the current areas within their systems that can accommodate DERs at low or no cost, as well as areas where additional upgrades or other system modifications may be needed to do so, and plan accordingly. In addition, they can help utilities identify optimal or high-benefit areas for DERs, such as areas where DERs may serve as NWAs. In turn, such proactive planning can help to streamline the interconnection process. By proactively planning for DER interconnections and by directing DERs to areas of the grid that can best accommodate them, utilities can begin to avoid some of the issues with interconnection "hot spots" and clogged queues, which have been due in part to the high volume of interconnection requests combined with a lack of up-front transparency and streamlined protocols within the interconnection process.

IREC encourages the Commission to remain cognizant of these relationships between interconnection and distribution system planning, in particular with respect to the development and refinement of the three tools that may serve to improve both processes—DER forecasting, hosting capacity, and locational valuation.

c. Stakeholder participation

IREC believes that stakeholder participation should be a key part of the distribution planning process. DER providers, consumer advocates, environmental groups, and other stakeholders can provide valuable non-utility perspectives that can help to produce robust policy outcomes, and balanced recommendations for operational, technological, and other grid modernization-related changes. As mentioned above, stakeholder input has been an important component in other states.

In New York, the Commission provided an opportunity for written comments on its DSIP guidance, and then stakeholders had several opportunities for written comments on the utilities' DSIPs themselves. The utilities were also directed to jointly organize stakeholder engagement groups on key topics, including hosting capacity, forecasting, NWAs, and other topics. These groups began meeting prior to the DSIPs' filing to inform their development, and have continued afterwards.[24]

Massachusetts followed a similar process with respect to its utilities' "Grid Modernization Plans" (GMP). It convened a working group to inform draft guidance with respect to the plans,[25] and then solicited written stakeholder input on that guidance. Once the utilities submitted their plans, stakeholders had an opportunity to comment on them in formal proceedings, which are ongoing.

The California Commission also provided an opportunity for stakeholders to file written comments on its DRP guidance, and then stakeholders filed written comments on the utilities' individual DRPs. In addition, California has undertaken robust stakeholder working group processes to address the three foundational DRP tools: integration capacity analysis (i.e., hosting capacity); locational net benefit analysis; and, more recently, DER growth scenarios (i.e., forecasting).[26] California has also established a Distribution Planning Advisory Group to help review and inform the utilities' NWA solicitation process.[27]

Based on our experience in these states, IREC has found that written comments and in-person opportunities (workshops and/or working groups) can complement each other, and

[24] Joint Utilities of New York Engagement Groups, http://jointutilitiesofny.org/joint-utilities-of-new-york-engagement-groups.

[25] MA Grid Modernization Working Group, http://magrid.raabassociates.org/.

[26] California IDER and DRP Working Groups, http://drpwg.org/.

[27] *See* D.16-12-036, California Public Utilities Commission, December 15, 2016.

together provide a productive framework for stakeholder participation with respect to distribution planning. As far as written comments, IREC suggests that the Commission ensure that stakeholders have an opportunity to review and provide written comments on any Commission guidance as well as the utilities' distribution planning filings. To the extent warranted, the Commission can respond to stakeholder comments on the utilities' filings in an order approving or requiring modifications to the plans, or otherwise providing further guidance and/or requiring additional actions prior to the next planning cycle.

IREC believes that working groups and workshops can offer good forums to delve into more complex issues to come up with productive, consensus-based solutions. Such opportunities can be especially important as utilities develop their plans, so that stakeholders can better understand and offer useful input into those plans. In both workshops and working groups, IREC recommends ensuring meaningful incorporation of stakeholder input, including appropriate record keeping and/or reporting that reflect both consensus and non-consensus points. Any notes, reports, and other workshop or working group products should be available to the Commission and to the public. Understanding where stakeholders agree and disagree, as well as why and how, can help to inform the process and discussions going forward.

Finally, IREC suggests that more informal engagement between stakeholders and utilities throughout the process can also be helpful. While the Commission may not have direct oversight over such informal engagement, it can encourage utilities and stakeholders to undertake it, and can require utilities to document it in their filings.

d. Criteria or Metrics

Commission guidance in the form of specific criteria and/or metrics will be vital in fostering some degree of consistency across utility plans, despite the utilities operating in different circumstances. Establishing uniform criteria also provides the Commission with a tool

to evaluate the utilities progress towards identified distribution planning and grid modernization goals. In the future, they could also form the basis for performance-based incentives or rates, which could allow utilities to earn a return based at least partially on their achievement of Commission-identified goals. This is one strategy the Commission could consider to help to correct the currently misaligned utility incentives described above.

IREC suggests at least the following three categories of criteria or metrics could be used in evaluating proposed distribution plans:

1. Achievement of traditional distribution planning goals, e.g., reliability, customer satisfaction, and cost-effectiveness. Metrics could include traditional metrics (SAIDI, SAIFI, etc.) and compliance with relevant benefit-cost assessments.

2. Achievement of existing and future state renewable energy goals, e.g., renewables portfolio standard, and any technology (solar) or other DER carve-outs. Metrics could include number of DER interconnections and timeframes associated with DER interconnections, number of DER applications installations that do not complete the interconnection process, and number of cost-effective NWAs employed in place of traditional upgrades.

3. Achievement of equity goals, including access to DERs across all customers, including low-income customers. Metrics could include diversity in DER and/or NWA ownership by location, which could be cross-referenced with income, pollution, public health, or other factors.

While the categories and criteria may be consistent across the utilities, the Commission could determine appropriate specific targets for each utility given its particular context.

IREC notes that currently, Minnesota utilities do not appear to be transparently or consistently considering the state's goals regarding DERs or renewable energy generally.[28] Xcel mentions "[e]valuation of compliance with environmental regulations," but takes a narrow

[28] *See* Xcel's Response, pp. 6, 36, Attachment A, p. 23; MN Power's Response, p. 4; Otter Tail Response to Notice and Questionnaire (Otter Tail's Response), Dkt. No. E999/CI-15-556, June 21, 2017, p. 4.

interpretation of the regulations, stating that they are "not usually applicable."[29] Similarly, Otter Tail references "external policy and regulations" that are taken into consideration during planning, but does not expound on what those policies and regulations are.[30] IREC suggests that ensuring that the utilities' distribution planning process appropriately and proactively take into account the state's environmental, renewable energy, and DER policies would be an important goal for this proceeding.

e. Frequency of Utility Plan Review

IREC recommends that the Commission require the utilities to update their plans every two years, as in New York and California.[31] These updates should discuss both shorter-term and longer-term planning activities[32] with a focus on DER integration and optimization, and over time should integrate new market, technology, data, and other developments. This biennial update would not replace the annual distribution planning that utilities currently do.[33] Rather, it would likely resemble and perhaps could supplant or complement the utilities' current longer-range planning activities.[34]

[29] Xcel's Response, p. 36, Att. A, pp. 13-14.

[30] Otter Tail's Response, p. 4.

[31] Assigned Commissioner's Ruling on Guidance for Public Utilities Code Section 769—Distribution Resource Planning, California Public Utilities Commission, R.14-08-013, February 6, 2015, p. 11; Order Adopting Distributed System Implementation Plan Guidance, New York Public Service Commission, Case No. 14-M-0101, July 20, 2016, p. 18.

[32] *See* Xcel's Response, Att. A, pp. 10-11; Dakota's Response, p. 5.

[33] *See* Xcel's Response, Att. A, p. 10; MN Power's Response, p. 4; Dakota's Response, p. 4.

[34] *See, e.g.,* Dakota's Response, p. 18.

2. Feasibility of Planning Enhancements

a. Uniform Utility Planning Processes

IREC recognizes that Minnesota utilities are different sizes, cover different geographic areas (urban vs. rural), deal with different customer economics, and have different states of technological adoption, including DER penetration.[35] This means that the timelines, as well as the types of near- and longer-term investments and activities, may be different for each utility. Nonetheless, some level of uniformity based on Commission guidance is necessary to ensure that all utilities are moving towards common goals. In addition, utility filings that are in similar formats, covering similar topics, would facilitate Commission and stakeholder review. At the least, improving transparency in all utility service territories would allow the Commission, utilities, and stakeholders to understand clearly the Minnesota's starting point and the plan for moving forward toward comprehensive grid modernization.

b. Triggering Enhanced Planning

In reviewing the utility responses to Sections A and B, IREC notes that all of the IOUs—even Xcel, which is the largest of Minnesota's utilities and has the most DERs on its system—seem to share the belief that their respective current planning processes are sufficient.[36] While this may be accurate under the status quo, at least for some of the smaller utilities, Minnesota state policies promoting renewable energy and DERs create a need for enhanced planning efforts in the near future. Though the Commission has time to consider the best avenues and timing to phase in the necessary changes, it is advantageous to prepare for those changes ahead of time

[35] *See, e.g.,* MN Power, p. 3; Dakota Power, pp. 2-3.

[36] *See* Xcel's Response, p. 4; *see also* MN Power's Response, p. 12; Dakota's Response, p. 12.

rather than responding to increasing DER penetrations after they have already begun to accelerate.

Utilities must invest in their systems under any circumstance, but making those investments with integrating future DERs in mind will help ensure that utilities are investing in a way that best aligns with state policies. The utilities recognize this, noting that as they "replace . . . key components, [they] do so with an eye to the future to ensure that the investments [they] make . . . lay the groundwork for the grid of tomorrow."[37] As explained above, Commission oversight and transparency regarding utility investments will be needed to make sure that this is the case, and that those investments are appropriately cost-effective for ratepayers.

IREC believes that certain basic planning requirements would be relevant for all utilities, such as evaluation of NWAs for large capital projects and other fundamental transparency measures, such as regular planning filings. Even where load growth does not trigger long-term planning for some of the smaller utilities, DER growth and policies should still prompt utilities to undergo this basic endeavor.[38] IREC further suggests that a certain level of DER penetration—perhaps measured as the number of DG or other DER interconnection requests per year (i.e., increased rate of DER growth)—could serve as a trigger for more resource-intensive planning requirements, such as developing a hosting capacity analysis, developing more robust DER forecasting, or using multiple scenarios in planning. Pilot programs may also be an appropriate tool, especially in areas that are less familiar for a utility or where fully fledged program or effort

[37] Xcel's Response, p. 35, Att. A, p. 20 ("When assets are considered for replacement, we consider whether the functionality of a particular asset can be enhanced to promote grid modernization."); *see also* MN Power's Response, p. 13 ("The largest single driver for capital projects is age-related asset renewal."); Otter Tail's Response, p. 15 ("Any project that increases the strength or operating performance of the distribution system will be able to better integrate DERs.").

[38] *See, e.g.,* Dakota's Response, p. 6; Otter Tail's Response, p. 6.

is not yet appropriate.[39] However, IREC cautions that any pilot program should incorporate a plan for scaling and expanding appropriately, depending on its results.

3. Forecasting

a. Integrating DER Forecasts

DER forecasting is an integral part of successful integrated distribution planning and must be incorporated accordingly. In combination with hosting capacity and locational valuation, forecasting helps utilities to identify areas of low-cost and/or high-value for DERs and then proactively plan for their integration. After reviewing the utilities' responses to Sections A and B, IREC is concerned that the utilities are not currently considering DER in their forecasts—even Xcel, despite having predicted significant DER growth through 2020.[40] Traditional forecasting, focused only on peak load without accounting for DER growth, will not suffice to achieve advancements in integrated distribution planning and a modern grid.[41] More sophisticated DER forecasting at the circuit level will be required, in order to help utilities to understand the localized impacts and potential of DERs, and plan accordingly, including taking advantage of DERs to defer traditional upgrades. Even if not immediately feasible,[42] IREC recommends that the Commission identify an ultimate goal of 8760-hour, circuit-level forecasts that will provide additional locational and temporal precision for planning purposes.

Load forecasts should also ultimately integrate system level (top-down) and localized (bottom-up) forecasting, allowing each set of projections to inform the other to aid in accuracy.

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[39] *See, e.g.,* MN Power's Response, p.7.

[40] Xcel's Response, Att. B, p. 2.

[41] *Id.* at p. 7.

[42] *See, e.g.,* Xcel's Response, Att. A, p. 15; Otter Tail's Response, p. 5; MN Power's Response, p. 7; Dakota's Response, pp. 9-10.

Currently, a number of utilities employ only a top-down forecasting approach.[43] While use of system-level forecasts is helpful in allowing for incorporation of system-level policy drivers and ensuring consistency across applications (e.g., transmission planning, etc.),[44] it is important to combine these "big picture" forecasts with a more granular, bottom-up forecast data to achieve the best, most accurate predictions, especially at more localized levels, and drive investment decisions accordingly.

IREC recognizes that it can be challenging to disaggregate system-level forecasts to the distribution level, especially when the utilities do not yet have access to reliable local data. In addition, the more granular (e.g., circuit-level) load forecasts become, the greater the chance that errors or inaccuracies may be magnified due to limited information and/or erroneous assumptions about levels of DER uptake or adoption. One way to combat these uncertainty problems is to strengthen and improve existing real data through improved tracking and verification. The utilities do consider some additional data sources in their forecasting efforts, such as local government development plans, but IREC believes this should be expanded.[45] Improved DER forecasting efforts may require utilities to look at new data sources that they have not traditionally considered, which may include other state agencies, local governments, state or regional DER industry trade associations, community organizations, consumer advocates, DER providers, and other relevant entities. One example of a new data source for DERs could include a voluntary registry for existing electric vehicle owners, rooftop solar customers, and/or energy storage customers. To the extent that Minnesota law allows for it, utilities could also use available electric vehicle registration data from the Department of Motor Vehicles. The utilities

[43] MN Power's Response, p. 6; Otter Tail's Response, p. 5

[44] *See, e.g.,* Xcel's Response, Att. A, pp. 11-12; Dakota's Response, p. 7.

[45] Xcel's Response, p. 7; Dakota's Response, p. 8.

could also issue periodic surveys of existing customers to learn who is strongly considering investments in DERs within 3 to 5 years. Certainly more sophisticated methods exist and should be explored, and improving DER forecasting may also require additional investments over time, potentially in SCADA and other monitoring technology.[46] At the least, the utilities should make full use data they already have, such as substation data, DER applications, and interconnection data.[47] The more accurate and robust the input data, the more accurate and robust the forecast will be, which will then allow for better overall system planning. The utilities could then follow up with assessments and true-ups of forecast accuracy to understand how to improve their efforts in the future. It does not appear that the utilities are currently undertaking this type of internal review.[48]

b. Probabilistic Analyses

Probabilistic planning can help utilities in thinking through DER growth scenarios, understanding the likelihood of forecasted DER growth system-wide and at the circuit-level, and making planning decisions. For example, if there is a high certainty of DER growth in an area (e.g., a residential solar-ready development in which all homes are expected to have panels, and may also be are more likely to have energy efficiency, electric vehicles, and energy storage), this may lead to different system planning decisions than in area where there is lower certainty of DER growth. IREC also agrees that such analyses can also help utilities to understand the reliability of DERs as NWAs, such as through the consideration of the likelihood of coincident failure or unavailability of multiple DER assets.

[46] MN Power's Response, p. 4 (30% SCADA coverage); Otter Tail's Response, p. 3.

[47] *See* MN Power's Response, p. 6 (MN Power only uses its interconnection data in its interconnection review process).

[48] *See, e.g.,* Dakota's Response, p. 11.

4. Scenarios

a. Stakeholder Input

IREC urges the Commission to provide guidance to the utilities regarding the selection of planning scenarios, in particular with respect to the levels of DER growth that may be assumed. For example, the California DRP guidance requires all utilities to consider three DER growth scenarios as part of their planning—a "trajectory" scenario, and "high DER growth" and "very high DER growth" scenarios.[49] Currently, the Minnesota utilities largely only look at one peak load scenario without considering DER growth, which may lead to inaccurate forecasting, which will only be exacerbated in the future as DER penetrations increase.[50] Even in instances where utility service areas have low DER penetration, future DER—which is likely to grow across the state—should be considered in the planning process.

In addition to historical changes and policy directives, stakeholder input could be useful in giving the Commission and utilities a better sense of growth in each type of DER, and should inform decisions about DER growth scenarios to be considered within planning. Regardless, IREC emphasizes that it is vital that the utilities be transparent about their scenario assumptions and forecasting methodology so the Commission and stakeholders can fully understand their planning filings and provide meaningful input.

b. Criteria for Planning Scenarios

As indicated in the section above, IREC suggests that the Commission should provide guidance to the utilities regarding DER growth scenarios to be incorporated into their planning

[49] Assigned Commissioner's Ruling on Guidance for Public Utilities Code Section 769—Distribution Resource Planning, California Public Utilities Commission, R.14-08-013, February 6, 2015, Att. p. 5.

[50] *See* Xcel's Response, Att. A, pp. 17, 22; MN Power's Response, p. 9; Otter Tail's Response, pp. 5-6.

processes, informed in part by stakeholder input. IREC further suggests that the Commission allow enough flexibility within those guidelines to permit utilities to forecast appropriately for their respective service territories and capabilities. For example, it may be prudent for utilities to start with a system-wide scenarios of DER growth, and then make goals to disaggregate on a specific schedule, depending on the utility, as more accurate circuit and feeder information is gathered and verified, and/or as DER penetrations in a service territory increase. IREC recognizes that in encouraging best practices and ensuring transparency, the Commission may also have to ensure that it does not stall improvements to the utilities' distribution planning processes by imposing as-yet unnecessary requirements across the board. As discussed in Section II.2.a, IREC suggests that utilities may require different timelines for process improvements, depending on their particular contexts.

c. Utility Coordination

Please refer to IREC's comments in the section immediately above regarding the balance between consistency and flexibility for utility forecasting scenarios.

d. Planning Cycle Consistency

While the Commission's overarching guidance regarding planning scenarios and DER growth scenarios may not need to be changed between planning cycles, IREC believes that new data should be incorporated into those scenarios as it becomes available. As the utilities refine and improve their DER forecasting capabilities, these changes should also be incorporated. Incorporating additional data and more robust methodologies should contribute to more accurate forecasts over time, leading to more useful scenarios.

e. Timeframes and Reevaluation

IREC suggests that California's use of a 10-year DER growth scenario horizon provides a useful model for Minnesota.[51] IREC recognizes that the further out the utilities are asked to forecast, the less certain they can be, but believes it is important to have an overarching long-range vision to inform nearer-term planning decisions.

5. Standards

IREC has no comments at this time.

6. Access to Grid and Planning Data by Customers and Third Parties

a. Level of Third-Party Access

One of the fundamental aspects of guaranteeing successful grid modernization and maximization of DER potential is to ensure effective data sharing between the utilities and customers, DER providers, and other stakeholders. Every effort should be made to provide customers and others with transparency and the data they need to make informed energy decisions, within the bounds of appropriate privacy and cybersecurity protections. As discussed above in Section II.1, Commission evaluation of utility plans with opportunity for stakeholder review constitutes an important component of such transparency.

At the same time, providing consumers and third-party provider with data is not necessarily a good in itself unless that information can be used to achieve specified goals, including improved reliability, increased customer choice, and renewable energy and environmental goals identified by the State and the Commission. Moreover, data must be shared in such a way that it can be used effectively by the intended recipients. IREC suggests that the Commission consider use cases studies to guarantee that information is shared in a purposeful

[51] Assigned Commissioner's Ruling on Guidance for Public Utilities Code Section 769—Distribution Resource Planning, California Public Utilities Commission, R.14-08-013, February 6, 2015, Att. p. 5.

way. For instance, sharing hosting capacity data has a number of crucial benefits for the grid modernization effort. Hosting capacity maps can help utilities and third parties identify areas where DERs may more easily interconnect to the system, and where they may be able to provide grid services and potentially serve NWAs. However, as discussed further below in Section II.7, it is important that these maps contain the appropriate level of detailed information, and are accurate and updated with sufficient frequency, to be used in this manner.

Providing access to hosting capacity data combined with relevant forecasting data and locational valuation could also help utilities to identify upcoming grid needs, and potentially procure NWAs to fill them through solicitations or other mechanisms. In some cases, NWAs may have advantages over traditional large infrastructure projects in that they can be procured in phases over time, which may be useful in dealing with uncertainty in forecasted growth. Minnesota Power appears to already be considering such scalability in its pilot projects, which is something DER may be able to offer more widely.[52] As Dakota acknowledged, "non-wire solutions could be incrementally implemented."[53]

Though the utilities have not considered NWAs to be viable in most instances in the past,[54] IREC urges the Commission and the utilities to continue to consider them and incorporate them into planning, and to take a broader view of what NWAs could be. While demand response[55] and energy storage[56] are promising NWA opportunities, these do not define the full scope of possibilities. For example, NWAs could also include use of aggregated behind-the-

[52] MN Power's Response, p. 7.

[53] Dakota's Response, pp. 12-13.

[54] Xcel's Response, p. 30, Att. A, pp. 25-26; MN Power's Response, p. 9; Otter Tail's Response, p. 14.

[55] Otter Tail's Response, pp. 7-8.

[56] Xcel's Response, Att. A, pp. 25-26.

meter distributed generation, leveraging the forthcoming value of smart inverter functionalities. IREC suggests that additional stakeholder input, especially from DER providers, may be helpful in further defining and exploring NWA opportunities. In addition, in evaluating NWA possibilities, the Commission should consider the appropriate benefit-cost framework to capture the full suite of benefits of these alternative.[57]

b. Categories unsuitable

IREC understands and fully supports the need for appropriate cybersecurity and confidentiality protections, especially when existing laws or regulations apply to the data at issue. In cases where confidentiality or privacy is at issue, but where data would be useful in meeting the Commission's goals, IREC encourages the consideration of appropriate protections, such as non-disclosure agreements. IREC offers additional suggestions regarding mitigating security concerns associated with hosting capacity maps and data in Section II.7.c below.

c. Categories of Data

i. Participate in developing system plans

ii. Critically review proposed plans

IREC believes that the type of data and transparency required for the above two categories would be similar. In their distribution planning filings, and any prior materials or discussions, IREC suggests that the utilities should be clear and transparent in their underlying methodologies and assumptions, including in particular with respect to hosting capacity, DER forecasting, and locational valuation. Stakeholders should be able to review a utility's plan and comprehend the utility's evaluation of its system and how it arrived at the decisions it did.

[57] Xcel's Response, Att. A, p. 21; Otter Tail's Response, p. 14.

iii. Prepare commercial projects in response to plans

As discussed above in Section II.6.a, IREC suggests that data regarding utility grid needs is essential for DER providers seeking to develop projects. This would include hosting capacity, forecasting data, and locational value data. We provide additional detail on useful data in Section II.7.a below.

d. Standard, downloadable format

IREC emphasizes that having grid and planning data available in a standard, downloadable is important for promoting transparency and empowering consumers. This is especially true for hosting capacity data, as discussed above and below.

7. Hosting Capacity

As mentioned at the outset of these comments, IREC has also been active in the Commission Docket Number E002/M-15-962 and has provided detailed comments on Xcel's recent hosting capacity report.[58] Rather than reiterating them in detail here, IREC provides them as attachments to these comments, as much them is applicable to hosting capacity more broadly. In our prior comments, IREC noted that "[w]hen developed and utilized to its full potential, a robust hosting capacity analysis will become a tool for [utilities], the Commission, and other stakeholders to use to facilitate integration of DERs through efficient, streamlined interconnection, and integrated distribution planning."[59] Hosting capacity analysis has a number of crucial benefits for the grid modernization effort—especially for distribution system planning.

[58] *See* Comments of Interstate Renewable Energy Council, Inc. Regarding Xcel Energy's Hosting Capacity Analysis and Supplemental Comments (IREC Hosting Capacity Opening Comments), Dkt. No. E002/M-15-962, April 20, 2016; Reply Comments of Interstate Renewable Energy Council, Inc. Regarding Xcel Energy's Hosting Capacity Analysis and Supplemental Comments, Dkt. No. E002/M-15-962, May 5, 2017.

[59] IREC Hosting Capacity Opening Comments, p. 5.

Hosting capacity can be combined with DER forecasting and locational valuation to identify areas of the grid where DERs can interconnection at low-cost, as well as areas that require upgrades to integrate DERs. Utilities can then construct those upgrades or direct DERs to those locations to serve as NWAs as makes sense.[60] Moreover, robust, accurate hosting capacity data will improve DER forecasting itself by giving utilities a better understanding of the existing state of their systems and their capacity to integrate DERs. Hosting capacity can also have benefits for the interconnection process by: 1) providing the necessary transparency to facilitate interconnection at optimal locations, and 2) streamlining the interconnection process at circuits where there is available hosting capacity.

Xcel is the only one of Minnesota's utilities that has undertaken a hosting capacity analysis, but notably states its hosting capacity analysis is "not part of the planning process."[61] While we acknowledge the considerable work and time that Xcel spent to undertake its analysis, IREC is quite concerned that the current analysis does not directly connect to the utility's planning process, particularly in light of hosting capacity's potential benefits in the distribution planning context and Xcel's substantial investment in its analysis. If hosting capacity is not currently a part of Xcel's planning process, its application or relevance in the context of this proceeding is seemingly quite limited. Yet, there are clear areas of overlap between Xcel's efforts and this proceeding, and IREC strongly encourages the Commission to take necessary steps to ensure the two efforts do not continue to be divergent and unrelated. Indeed, there could be considerable consequences from a ratepayer prudency standpoint, as well as a time and resource standpoint for the Commission and parties involved in both proceedings. As discussed in our Docket Number E002/M-15-962, IREC would also be curious to learn from Xcel what

[60] *See id.*, p. 10.

[61] Xcel's Response, p. 18.

changes or modifications would be necessary to ensure their hosting capacity analysis can be used for both planning as well as interconnection purposes.

With respect to Minnesota's other utilities, IREC recognizes that a full hosting capacity analysis may not yet make sense for all.[62] Yet, IREC also believes that the Commission should provide guidance for all utilities regarding this critical component of integrated distribution planning to help set the stage for future analyses or other similar undertakings that these utilities can undertake to provide valuable information to optimize DER growth down the road. As DER penetrations increase and hosting capacity methodologies mature, the Commission can continue to assess the role of hosting capacity as it emerges in other utility service territories. For example, initial hosting capacity efforts should focus on the utilities' ability to track and share data and provide information such as distribution indicator maps (see Section II.7.c below).

a. Information to Be Made Available

IREC suggests that the following information should ultimately be available via hosting capacity maps and/or a standard, downloadable format:

- Voltage of line
- DER capacity: currently installed, queued, and available
- Minimum and peak loads
- Hosting capacity for each DER type
- Any identified criteria violations
- Planned upgrades
- Load curve information

[62] *See, e.g.,* MN Power's Response, p. 4; Otter Tail's Response, p. 3.

In addition, IREC suggests that the utilities should clearly describe how criteria limitations were identified (e.g., voltage, thermal, etc.).

While IREC recognizes that it may not be possible to provide all of this information at the outset, we emphasize that the utilities could begin with a rougher map or set of data, and then refine and add to it as additional data becomes available.

b. Description, Method, and Technological resources

IREC's comments in Docket Number E002/M-15-962 address this question in detail, noting that a utility's hosting capacity methodology must be carefully chosen to satisfy the Commission's potential use cases in the long term.[63] Identifying the Commission's goals and intended uses cases up front will help the utilities to efficiently deploy their resources to develop hosting capacity analyses that are as useful as possible. In undertaking their chosen hosting capacity methodology, utilities must also be mindful of accuracy. As IREC discussed in detail in our Docket Number E002/M-15-962 comments, we currently have some concerns regarding Xcel's current methodology and the accuracy of its results.[64] In addition, IREC continues to emphasize the importance of considering the hosting capacity for other DERs besides only distributed generation, including energy storage, electric vehicles, energy efficiency, and demand response. The hosting capacity analysis and results may vary by DER type. Moreover, certain DERs may be able to mitigate criteria violations and expand hosting capacity in different ways. To fully realize the benefits of a hosting capacity analysis, it will be critical to consider its application to all types of DERs, or at least refine a methodology over time with the eventual goal of doing so.

[63] IREC Hosting Capacity Opening Comments, pp. 5-8.

[64] *Id.*, pp. 16-19; *see also* Xcel's Response, p. 17, Att. A, pp. 8-9.

c. Format for Sharing Results

As emphasized throughout these comments, hosting capacity maps and data are vital to distribution system planning and interconnection.[65] In recognition of this, the Commission indicated at its August 1, 2017 Order Setting Additional Requirements for Xcel's 2017 Hosting Capacity Report that it would require Xcel to provide a color-coded, map-based representation of the available hosting capacity down to the feeder level.[66] IREC suggests that over time the map should be improved to incorporate the data listed in Section II.7.a. As the Commission determines that hosting capacity analyses are appropriate at Minnesota's other utilities, IREC suggests that they should likewise provide publicly accessible maps. In the meantime, to the extent possible, the other utilities could provide rougher "distribution indicator" maps (e.g., including just voltage, DER capacity, and minimum and peak load information). IREC further recommends having the utilities create downloadable accessible spreadsheets with the data listed above for the purpose of DER project planning. Ultimately, the utilities should be moving toward a goal of near real-time updates, though IREC recognizes that it may be some time before that can be achieved. IREC notes that, to the extent there are security concerns associated with making such maps or data publicly available, these can be mitigated by setting up registrations with password protected logins to access them. In addition, connecting with other utilities that have made their hosting capacity and system maps publically available online could be a useful exercise for both the utilities and the Commission, and could help identify any additional strategies to ensure security and confidentiality measures are sufficiently addressed.

[65] *See also* IREC Hosting Capacity Opening Comments, pp. 12-13.

[66] Order Setting Additional Requirements for Xcel's 2017 Hosting Capacity Report, Dkt. No. E-002/M-15-962, Aug. 1, 2017, p. 6 (Order ¶ 3: "Xcel shall provide a color-coded, map-based representation of the available Hosting Capacity down to the feeder level. This information should be provided to the extent it is consistent with what Xcel believes are legitimate security concerns. If security concerns arise, Xcel shall explain in detail the basis for those concerns.").

8. Strawman Distribution Planning Outlines and/or Processes

IREC has no comments at this time, but looks forward to reviewing any responses provided to this question by other parties.

9. Additional Topics

IREC has not identified additional, relevant topics at this time.

II. CONCLUSION

IREC appreciates the opportunity to submit these comments, and looks forward to reviewing other parties' comments and continuing our participation in this proceeding.

DATED: August 21, 2017

Respectfully submitted,

SHUTE, MIHALY & WEINBERGER LLP

By: /s/ Erica S. McConnell

ERICA S. McCONNELL
396 Hayes Street
San Francisco, California 94102
Telephone: (415) 552-7272
Facsimile: (415) 552-5816
mcconnell@smwlaw.com

Attorneys for Interstate Renewable Energy Council, Inc.

Attachment 1

Comments of the Interstate Renewable Energy Council, Inc. Regarding Xcel Energy's Hosting Capacity Analysis and Supplemental Comments
(Docket No. E002/M-15-962)

STATE OF MINNESOTA
BEFORE THE
PUBLIC UTILITIES COMMISSION

Nancy Lange	Chair
Dan Lipschultz	Commissioner
Matthew Schuerger	Commissioner
Katie Sieben	Commissioner
John Tuma	Commissioner

In the Matter of Xcel's Biennial Distribution Study Report	Docket No. E002/M-15-962

COMMENTS OF INTERSTATE RENEWABLE ENERGY COUNCIL, INC. REGARDING XCEL ENERGY'S HOSTING CAPACITY ANALYSIS AND SUPPLEMENTAL COMMENTS

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I. INTRODUCTION

Pursuant to the statutory directive in Minn. Stat. § 216B.2425, subd. 8, Minnesota utilities operating under a multiyear rate plan must file certain information regarding the interconnection of small-scale distributed generation projects within the biennial transmission planning process. On October 30, 2015, Northern States Power Company, doing business as Xcel Energy (Xcel), filed its *2015 Biennial Report—Distribution Grid Modernization* with the Minnesota Public Utilities Commission (Commission).[1] A number of parties provided comments on Xcel's filing, including the Interstate Renewable Energy Council, Inc. (IREC). In its February 22, 2016 reply comments, IREC suggested that the Commission require Xcel to provide a hosting capacity analysis and more detailed forecasts for distributed generation (DG) and other distributed energy resources (DER) growth as part of its comprehensive distribution study.[2] On

[1] *See* Xcel's 2015 Biennial Report—Distribution Grid Modernization, Dkt. No. E002/M-15-962, Oct. 30, 2015.
[2] Reply Comments of the Interstate Renewable Energy Council, Inc. for 2015 Biennial Report—Distribution Grid Modernization, Dkt. No. E002/M-15-962, Feb. 22, 2016, pp. 3-5.

June 28, 2016, after reviewing these and other public comments, the Commission issued an order requiring a new distribution system study and mandating a hosting capacity analysis.[3]

In compliance with the June 2016 order, Xcel filed its *Distribution System Study—Hosting Capacity Analysis* on December 1, 2016.[4] On February 13, 2017, the Minnesota Department of Commerce issued comments on Xcel's study, identifying its concerns related to reliability and additional questions that Xcel had not addressed.[5] The Commission then issued a February 21, 2017 information request for additional explanation from Xcel and to invite public comment on the *Distribution Study Report—Hosting Capacity Analysis*.[6] On March 20, 2017, Xcel submitted its supplemental comments in response to the Commission's information request.[7] IREC now submits our comments on Xcel's report and supplemental comments.

IREC is a 501(c)(3) non-partisan, non-profit organization working nationally to increase consumer access to sustainable energy and energy efficiency through independent fact-based policy leadership, quality workforce development, and consumer empowerment. In service of our mission, IREC works to increase the adoption of regulatory reforms that expand access to and streamline grid integration of distributed energy resources to optimize their widespread benefits. The scope of our work includes: developing and advancing regulatory policy innovations; generating and promoting national model rules, standards, and best practices;

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[3] Order Certifying Advanced Distribution-Management System (ADMS) Project Under Minn. Stat. § 216B.2425 and Requiring Distribution Study, Dkt. No. E002/M-15-962, June 28, 2016, p. 13.
[4] Xcel Distribution System Study ("Xcel Study"), Dkt. No. E002/M-15-962, Dec. 1, 2016.
[5] Comments of the Minnesota Department of Commerce, Division of Energy Resources ("Dept. of Comm. Comments"), Dkt. No. E002/M-15-962, Feb. 13, 2017.
[6] *See* Information Request PUC #1, Dkt. No. E002/M-15-962, Feb. 21, 2017; *see also* Notice of Comment Period on Distribution System Study, Dkt. No. E002/M-15-962, Feb. 21, 2017.
[7] Xcel Supplemental Comments ("Xcel Supp. Comments"), Dkt. No. E002/M-15-962, Mar. 20, 2017.

fostering collaborative partnerships with diverse stakeholders to build to consensus and achieve workable solutions; updating interconnection processes to facilitate deployment of distributed energy resources and remove constraints to their integration on the grid; and incorporating distributed energy resource growth into utility distribution system planning and operations.

IREC has been deeply engaged in grid modernization efforts in other states, including California and New York, and brings that experience to this proceeding. Through our work to advance and support thoughtful and effective grid modernization throughout the United States, IREC has specifically emphasized hosting capacity as a key tool in harnessing DER benefits while helping to solve the challenges of interconnecting DERs in increasing quantities. IREC's forthcoming paper on hosting capacity further outlines the importance of hosting capacity within the larger grid modernization effort and provides recommendations on how to navigate this critical issue.[8] For these reasons, IREC is also engaged in the related Minnesota grid modernization proceeding, Docket No. 15-556, where hosting capacity is also at issue, in particular with respect to its role in integrated distribution planning.[9]

II. OVERVIEW OF RESPONSES TO COMMISSION QUESTIONS AND SUGGESTIONS REGARDING NEXT STEPS

IREC appreciates the Commission's and Xcel's recognition of the importance of hosting capacity and its essential role in facilitating the integration of DER. As this is Xcel's first full hosting capacity analysis, IREC applauds the utility's efforts. IREC also concurs with Xcel's

[8] IREC expects to release this paper Summer 2017, at which point it will be available on IREC's web site, www.irecusa.org.

[9] IREC pioneered the concept of integrated distribution planning, and continues to work within regulatory proceedings and other forums to refine it. *See* IREC (T. Lindl & K. Fox) & Sandia Nat'l Lab. (A. Ellis and R. Broderick), *Integrated Distribution Planning Concept Paper: A Proactive Approach for Accommodating High Penetrations of Distributed Generation Resources* (May 2013), *available at* www.irecusa.org/publications/integrated-distribution-planning-concept-paper.

recognition that "more work still needs to take place in regards to the present limitations."[10] Given the foundational position of this hosting capacity analysis in Minnesota's distribution planning and grid modernization efforts, it is critical that the underlying methodology be capable, at least in the longer term, of satisfying the needs of the potential use cases, as these are identified by the Commission. IREC recognizes that Xcel's hosting capacity analysis was done per a statutory requirement and is not yet officially integrated into Minnesota's broader grid modernization proceeding. Nonetheless, we believe that these interrelated efforts should be considered together to ensure that Commission and stakeholder energy, as well as the resources and time incurred by Xcel to conduct such an analysis, are well spent, particularly relative to the Commission's goals within the grid modernization proceeding.

Although Minnesota's DER markets are in relatively early stages of development, the Commission has an opportunity now to ensure Xcel is preparing appropriately for higher penetrations of DERs in the future. When developed and utilized to its full potential, a robust hosting capacity analysis will become a tool for Xcel, the Commission, and other stakeholders to use to facilitate integration of DERs through efficient, streamlined interconnection, and integrated distribution planning. Hosting capacity analysis is meaningful only when it actually enables achievement of these intended use cases and goals, or at least puts the utility on a path toward them. For this reason, IREC suggests that the Commission articulate these hosting capacity use cases and goals as soon as possible in this proceeding to act as a guide for the utility's efforts. In drafting these comments, IREC has focused on the questions the Commission laid out in its Notice of Comment Period on Distribution System Study:

[10] Xcel Study, p. 2.

1. Are there questions about the foundational elements or assumptions used in Xcel's hosting capacity report?

2. Are there any areas of improvement or modification that would make future hosting capacity reports from Xcel more useful?

3. Are there other questions or comments about Xcel's hosting capacity report**?**

In our comments below, IREC describes our concerns regarding certain foundational elements of the methodology Xcel employed to generate its hosting capacity report—the Distribution Resource Integration and Value Estimation (DRIVE) tool developed by the Electric Power Research Institute (EPRI). IREC has considered the methodology's results and ability to realize the various goals associated with hosting capacity, which we describe below in Section III.A. IREC is concerned that the DRIVE tool may not be capable of achieving these goals, at least in its current form, even with the near-term modifications Xcel identifies in its report. In particular, as discussed in Sections III.B, III.C, and III.D, IREC has concerns related to the transparency of the methodology, the repeatability of the analysis, and the accuracy of results, all of which are essential to a robust, useful hosting capacity analysis. In Section III.E, IREC offers some specific technical critiques, questions, and suggestions for improvements to the methodology, with an eye toward ensuring the hosting capacity analysis can realize the various goals the Commission may identify, at least in the longer term.

In light of the concerns articulated in these comments, IREC recommends that the Commission facilitate near-term consideration in this proceeding and/or Docket No. 15-556 regarding goals for a hosting capacity analysis, to what extent Xcel's current tool (DRIVE) can achieve those goals, what changes are necessary to enable it to do so, and whether and when DRIVE can accommodate those changes. IREC encourages the Commission to undertake this process in advance of Xcel's next hosting capacity filing, expected on November 1, 2017, to ensure that Xcel is moving forward on a productive path. We recognize that some improvements

to Xcel's hosting capacity analysis may require a longer timeframe, but such a process would allow the Commission, Xcel, and stakeholders to identify concrete plans and timelines for making the necessary improvements, and ensure the hosting capacity reports generated in the interim are as useful as possible. In addition, as discussed further in Section III.A.2.a, IREC suggests that an appropriate near-term goal would be for Xcel to develop and publicly provide a feeder-level map in advance of, or at least in conjunction with, its November 1, 2017 filing, as a tool for use in the interconnection process.

III. RESPONSES TO COMMISSION QUESTIONS

A. The Intended Practical Use Cases Should Guide Commission And Stakeholder Consideration Of Xcel's Hosting Capacity Analysis.

IREC recognizes that the statutory directive triggering Xcel's hosting capacity analysis is focused on directing and planning for small-scale DG,[11] but strongly encourages both Xcel and the Commission to take a broader view of hosting capacity to ensure that it can ultimately achieve all of the potential intended use cases and short- and long-term goals. This type of foresight will help ensure that Xcel is spending its resources wisely in preparation for distribution planning and interconnection use cases that will only grow in importance over time. IREC appreciates that Xcel has devoted significant time and resources to developing its initial hosting capacity analysis, and notes that the utility has already identified certain areas in which it will be working this year to refine its methodology and analysis. IREC is concerned, however, that this investment may be wasted if the methodology that Xcel relies on and the analysis it produces cannot and will not be able to achieve the all of the Commission's objectives, once

[11] Minn. Stat. § 216B.2425, subd. 8 ("Each entity . . . that is operating under a multiyear rate plan . . . shall conduct a distribution study to identify interconnection points on its distribution system for small-scale distributed generation resources and shall identify necessary distribution upgrades to support the continued development of distributed generation resources . . .).

fully identified. Therefore, IREC urges the Commission to consider and explicitly articulate its goals for Xcel's hosting capacity analysis. The Commission should then assess whether the methodology can meet those goals currently, what improvements and refinements may be necessary, and whether the methodology is capable of eventually incorporating those changes. Based on Xcel's description of the methodology, IREC is unsure of DRIVE's capacity to satisfy this test, at least in its current form.

Xcel claims that its hosting capacity analysis furthers achievement of the three purposes identified in ICF's *Integrated Distribution Planning* report prepared for the Minnesota Public Utilities Commission: (1) indication of distribution feeder capacity for DER, (2) streamlining interconnection studies, and (3) annual long-term distribution planning.[12] Xcel's report does not discuss how the analysis does so in much detail, however, especially with respect to the second and third goals identified. As discussed in the sections below, IREC has significant concerns about whether the chosen methodology can achieve the intended use cases. We also note that Xcel acknowledges in its supplemental comments that "the small distributed methodology [used in its hosting capacity analysis] may not fit as well" and "other methodologies may provide a better analysis considering the present nature of DER in our state."[13] In addition, Xcel stated that its hosting capacity analysis "is only meant as an initial look," and should not be used for the intended applications without further study.[14] IREC understands that Xcel is still in the early stages of its hosting capacity efforts, but has concerns about the utility expending resources on analysis that is not yet useful and does not include clear, concrete improvements and timelines to become so.

[12] Xcel Study, p. 3.
[13] Xcel Supp. Comments, p. 3.
[14] Xcel Study, pp. 13, 15.

For these reasons, IREC recommends that the Commission, Xcel, and other key stakeholders identify their intended practical uses cases for hosting capacity, either in this proceeding and/or in the related Docket No. 15-556, and evaluate the ability of Xcel's hosting capacity analysis and its underlying methodology to realize these use cases. IREC provides our initial thoughts on the two categories of practical uses cases below—distribution planning and interconnection—which comport with the initial discussion of these issues in Docket No. 15-556.[15]

1. Distribution Planning Use Case

Distribution planning captures some of the key applications for hosting capacity analysis. Indeed, the underlying statute that prompted Xcel's hosting capacity analysis specifically asks the utility to "identify necessary distribution upgrades to support the continued development of distribution generation resources."[16] In response to this directive, Xcel points to its interconnection process,[17] which remains an important, *reactive* process as DG comes online. As Xcel clarifies in response to the Department of Commerce's comments, interconnection procedures serve to ensure that DG does not cause reliability issues or other negative grid impacts by applying appropriate mitigations.[18] The list of potential mitigations Xcel provides in

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[15] *See, e.g.*, ICF *Integrated Distribution Planning* (prepared for the Minnesota Public Utilities Commission), Dkt. No. E999/CI-15-556, Aug. 2016, p. v ("Hosting capacity analysis is used to establish a baseline of the maximum amount of DER, including portfolios of DER, an existing distribution grid (feeder through substation) can accommodate safely and reliably without requiring infrastructure upgrades. . . . These methods can be applied to interconnection studies and long-term distribution planning.").

[16] Minn. Stat. § 216B.2425, subd. 8.

[17] Xcel Study, pp. 12-13.

[18] Xcel Supp. Comments, pp. 2, 12-13 ("The interconnection process . . . is central to assuring DER is connected in a manner that assures safety, reliability, and power quality. The interconnection process allows for a detailed review of system impacts, mitigations, and costs in order to meet the statewide guidelines found in Xcel Energy's Section 10 tariff.")

its report reflects only a few of the possibilities.[19] In terms of hosting capacity, generally speaking, the interconnection process requires that each DG project is within a circuit's hosting capacity; if the project causes a technical violation or violations of some kind, the process requires construction of upgrades or other mitigations, paid for by the interconnection applicant, to address those issues and expand hosting capacity to accommodate that project. In other words, and in response to the Department's concerns, the interconnection process guarantees against the existence of "excess DG" on the system because it screens for and, if needed, mitigates any negative reliability or other impacts.[20] Because the interconnection procedures require applicants to pay for any required upgrades, they protect ratepayers from these mitigation costs.

The traditional interconnection process is distinct from the *proactive* distribution planning that the statute appears to contemplate, which would require Xcel to pair hosting capacity with DER forecasting to identify areas of the grid that require upgrades to integrate DER, and (1) construct those upgrades or (2) direct DERs to those locations to serve as non-wires alternatives. These two potential scenarios involve the expansion of hosting capacity through distribution planning, whether through traditional upgrades or DERs serving as non-wires alternatives, with the ultimate goal of better integration of DERs.

In addition to a hosting capacity analysis that can effectively inform such planning, improvements to DER forecasting are also required to fully realize these distributed planning use case applications. Xcel touches on the forecasting issue briefly in its hosting capacity report, noting that "[i]n general, it is difficult to fully predict where future DER will be located, even

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[19] Xcel Study, p. 13.

[20] *See* Dep't of Comm. Comments, pp. 4-5, 7 (" . . . the Department recommends that, if future, more refined hosting study results indicate that there may be reliability issues due to excess installed DG, Xcel should address such issues in the hosting study report . . ."); *cf.* Xcel Supp. Comments, pp. 2, 12-13.

with an interconnection queue, but beyond that it is also difficult to incorporate distribution system modifications in the analysis as a result of pending interconnections."[21] IREC recognizes this difficulty, but cautions Xcel and the Commission against using this as an excuse not to engage in an effort to improve DER forecasting. All forecasting methods, both historic and new, grapple with some uncertainty in various ways (e.g., probabilities, error bands, etc.) and IREC is confident that utilities can do so with DER forecasting as well. We encourage Xcel and the Commission to learn from ongoing DER forecasting efforts in California and New York, as well as available DER forecasting literature,[22] and to consider DER forecasting improvements in this proceeding and/or Docket No. 15-556.

2. Interconnection Use Case

The other key use case for hosting capacity is interconnection, which also has two primary applications. First, a hosting capacity analysis can provide the utility, the Commission, DER providers, and others with greater transparency and information up front in the form of maps or other tools to facilitate interconnection at optimal locations. These locations may include not only high-value locations, such as those discussed above in relation to non-wires alternatives, but also relatively low-cost locations, where there is sufficient hosting capacity for DERs to interconnect with no or only very minimal upgrades. While maps are a key tool for directing DER interconnections, as discussed further below, the Commission and Xcel could also use price signals to direct DERs to optimal locations on the grid, including through tariffs, solicitations,

[21] Xcel Study, p. 11.
[22] *See, e.g.*, Mills, A., Barbose, G., Seel, J., et al. "Planning for a Distributed Disruption: Innovative Practices for Incorporating Solar into Utility Planning," Lawrence Berkley National Laboratory, August 2016.

and other programs.[23] Such deployment of hosting capacity information, especially in directing DER to low-cost locations more likely to require little or no study, can help reduce strain on the interconnection process generally, and allow it to proceed more efficiently and cost-effectively.

Second, a reliable, accurate hosting capacity analysis can help streamline the interconnection process by allowing expedited interconnection on circuits with available hosting capacity, similar to the current expedited review process. When a developer seeks to interconnect at a given node, the utility could check to see if its proposed DER falls within the hosting capacity value for that location. If it does, the developer could be given the greenlight to interconnect with no additional study. Ultimately, with frequent (near real-time) updating of hosting capacity analysis, utilities can implement a "click and claim" interconnection process whereby developers propose a project on a specific node and reserve capacity in the interconnection queue if the project fits within existing hosting capacity constraints. Utilities could also use hosting capacity analysis results to provide interconnection applicants with potential project alternatives that would help them stay within hosting capacity limits, such as use of on-site storage to shave peak load or interconnection agreements that allow curtailment during limited peak hours of the year. While some of these applications may be longer-term goals, it is vital to ensure that Xcel's hosting capacity analysis is moving the utility toward these types of interconnection use cases.

[23] The Minnesota Department of Commerce envisions this type of data sharing and enhanced locational selectivity in its comments. *See* Dep't of Comm. Comments, p. 7 ("With the hosting study now in hand, it may be possible to determine the extent to which DG proponents value available hosting capacity and gradually shift proposed DG to the better feeders and the extent to which DG proponents value other siting criteria and demonstrate a willingness to pay to upgrade hosting capacity.").

a. Hosting Capacity Map

Within the interconnection context, as discussed above, a regularly updated map displaying feeder-level hosting capacity data can serve as a key tool for regulators and the public. Accordingly, Xcel's explanation of why it cannot provide visual results in a map is concerning.[24] After describing the mapping limitations of the DRIVE tool, Xcel asserts that "only the IOUs in California have publicly attempted to map hosting capacity results at this time," but that is somewhat misleading.[25] While the California utilities may be most advanced in their efforts, utilities in New York and a handful of other states have provided hosting capacity maps, or at least precursor "heat maps" or maps with rougher "distribution indicators."[26] Moreover, the California utilities provided prior, rougher versions of their now more comprehensive hosting capacity maps starting nearly five years ago. Even more worrisome, Xcel's report did not include next steps and timelines to remedy this deficiency.

In light of the importance of hosting capacity mapping and overall grid transparency, IREC suggests that the Commission require Xcel to provide a map in advance of, or at least in

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[24] Xcel Study, p. 12.
[25] *Id.*
[26] *See, e.g.*, Consolidated Edison Distributed Generation Hosting Capacity Map (New York), http://legacyold.coned.com/dg/dsp/hostingCapacity.asp (indicating locations where Con Edison anticipates it can accept solar DG output with little to no additional cost to the project); National Grid DG Interconnection Siting Map (New York), http://ngrid.maps.arcgis.com/apps/webappviewer/index.html?id=4d87884ed0c541fca944c36be9e199b6 (indicating general areas/circuits where cost to interconnect DG greater than 1 MW in capacity will be higher due to low minimum daytime load, already-connected or queued DG, small conductors, operating voltage, and indicating to update with more refined hosting capacity map as analysis is developed); Commonwealth Edison Distributed Generation Interconnection Map (Illinois), https://www.comed.com/MyAccount/MyService/Pages/DistributionLess10k.aspx (providing indicative information for interconnecting DG facilities on the utility's electric distribution system); Pepco Holdings (PHI) Restricted Circuit Map (Mid-Atlantic service territory), http://www.arcgis.com/home/webmap/viewer.html?webmap=812d894ca4624065b9266123945a5a47&extent=-78.735,37.9118,-72.0773,41.3006 (showing general areas where circuits are "restricted," due to the need for significant upgrades).

conjunction with, its November 1, 2017 filing. If the Commission determines that it is premature to incorporate hosting capacity data into the map until issues with the methodology have been resolved, then IREC suggests that Xcel provide a map with rougher "distribution indicators," i.e., grid characteristics such as substation or line capacity, existing generation capacity on a line, available capacity for new generation, or other relevant data points. This map could serve as a starting point for a more refined hosting capacity map later. IREC suggests that Xcel should be required to update the map at least monthly to ensure it remains useful for DER providers and other stakeholders.

B. Additional Information Regarding The Hosting Capacity Methodology Is Needed To Meet The Fundamental Requirement For Transparency And Allow For Effective Evaluation Of The Resulting Analysis.

In introducing its hosting capacity analysis, Xcel identifies six "fundamental requirements" that should guide a hosting capacity analysis.[27] These requirements include transparency and repeatability.[28] Xcel states that its hosting capacity has met the transparency standards because "EPRI is clear in their methods for the analysis and has published papers describing the technical details," and because Xcel's study explains the utility's key assumptions and decisions.[29]

IREC disagrees, and does not believe that the DRIVE tool currently meets the transparency and repeatability requirements. The EPRI methodology centers on a "streamlined" approach which has been described at a high level, but none of the "published papers" Xcel mentions explain this approach at the granular level or make publicly available detail about the underlying assumptions and parameters behind EPRI's methodology. Similarly, within Xcel's

[27] Xcel Study, pp. 6-8.
[28] *Id.*, p. 7.
[29] *Id.*

report and supplemental comments, the main technical information given regarding the DRIVE tool is the utility's table of criteria thresholds and a relatively high-level list of assumptions.[30] This overall lack of transparency makes it difficult for other stakeholders to review and understand the methodology or to potentially repeat the DRIVE tool's results. Perhaps even more importantly, failure to provide transparency regarding hosting capacity methodology prevents the Commission, utilities, and other stakeholders from critically analyzing whether the chosen methodology will be successful in achieving the Commission's intended hosting capacity use cases.

Xcel's responses to the Commission's Information Request are a helpful first step in remedying this transparency issue, but IREC continues to have numerous questions regarding the methodology and its assumptions and limitations, some of which we detail in Section III.E below. Going forward, IREC suggests that the Commission require Xcel to provide additional clarity on these questions and any others that arise as stakeholders consider to what extent the methodology may or may not be able to achieve the intended goals for hosting capacity. Ultimately, the methodology should be sufficiently transparent to allow third parties to independently test and validate it to ensure its accuracy and reliability.

C. The Hosting Capacity Methodology Should Allow For The Analysis To Be Updated On At Least A Quarterly Basis.

While the ability for stakeholders to repeat the hosting capacity analysis is one way to understand the fundamental requirement of repeatability, it also speaks to Xcel's ability to repeat its analysis internally. Xcel appears to intend to update its analysis annually, which would severely impact its usefulness, especially for the interconnection use cases discussed above. For the ultimate goal of a "click-and-claim" interconnection process, for example, near real-time

[30] *Id.*, pp. 8-10.

updating of hosting capacity results across the entire grid will be necessary. For planning purposes, less frequent updating may be required. The Commission and Xcel could also consider regular updating (weekly or monthly) of results for the entire grid, coupled with targeted updating of particular grid segments for interconnection purposes. For instance, the hosting capacity of the entire grid could be mapped annually, and these results could be updated incrementally each time the hosting capacity of a feeder is assessed as part of the interconnection process. In any case, it is essential that the methodology permit sufficient repeatability to allow for the necessary frequency of updates for each particular use case. At this point, it is not clear whether or not the DRIVE tool has this capacity currently and, if not, when it will.

D. Additional Information Is Needed To Establish The Accuracy Of Xcel's Hosting Capacity Methodology And To Identify Improvements Needed For Application To The Intended Use Cases.

Although Xcel does not list "accuracy" among its six fundamental requirements for a successful hosting capacity analysis, accuracy is essential to achieving the broader goals for hosting capacity with respect to both planning and interconnection. Xcel's report is largely silent on the subject of accuracy, and does not give detailed information regarding the accuracy of the DRIVE tool for Minnesota's purposes, how the DRIVE tool analysis compares to a traditional power flow model, or whether tests have been run to assess these issues. Xcel describes the DRIVE tool as "proven," in that it has "validation from across the world," but does not give examples of other systems where DRIVE has been successfully utilized and in what way.[31] Specifically, it is not clear from the report whether this means DRIVE has been proven accurate in analyzing hosting capacity on Xcel's Minnesota system.

[31] *Id.*, p. 7.

These accuracy questions should be evaluated at the earliest possible stage to allow for the Commission to understand whether they are inherent in the methodology or whether they may ultimately be corrected through future methodological refinements such that the results can be applied in the identified use cases. A recent California report on hosting capacity found that the "streamlined" approach to hosting capacity initially used by some of that state's utilities was not sufficiently accurate—not only for interconnection purposes, but also potentially for planning.[32] In other words, the streamlined approach, which serves as the basis for the DRIVE tool,[33] could not support achievement of the intended use cases in California, which are similar to the uses cases under discussion in Minnesota.[34] The California report identified the alternative, "iterative approach" as more accurate and useful for interconnection, but also acknowledged that method as more computationally intensive and time-consuming.[35] Given these recent findings, it is especially important for Xcel and the Commission to analyze how the DRIVE tool compares with respect to accuracy. Although Xcel notes that DRIVE is "based on EPRI's streamlined hosting capacity method," it does not explain what this means or whether DRIVE incorporates

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[32] Final Integration Capacity Analysis (ICA) Working Group Report, California Distribution Resources Plan (R.14-08-013), pp. 11-14 ("If the maps and data are derived from the streamlined method, which Demo A demonstrated is inaccurate in too many cases, then interconnection applicants would not be able to rely on this information and would be left in their current business-as-usual situation, where obtaining accurate interconnection information requires a manual review by the utility.").

[33] Xcel Study, pp. 3-4.

[34] *See, e.g.*, ICF *Integrated Distribution Planning* (prepared for the Minnesota Public Utilities Commission), Dkt. No. E999/CI-15-556 (Aug. 2016), p. 9 (suggesting the first step for a hosting capacity analysis should be to "[i]dentify the uses and objectives for hosting capacity analyses (e.g., indicative information for heat maps, fast-track interconnection approvals, annual distribution system studies)").

[35] Final Integration Capacity Analysis (ICA) Working Group Report, California Distribution Resources Plan (R.14-08-013), pp. 11-14 (The iterative method "performs iterative power flow simulations while varying the DER level at each node on the distribution system to determine the maximum amount of DER that can be installed without triggering thermal or voltage criteria violations" and " . . . requires additional IT and engineering resources to complete.").

key changes to overcome the accuracy issues associated with the streamlined approach, as identified in California's report.[36] Further information about the DRIVE tool, its use in other states, and Xcel's accuracy findings should be shared with the Commission and the public.

In addition to these overarching concerns about the streamlined DRIVE methodology, the limited information Xcel did provide on its assumptions and approach raises accuracy concerns, as discussed further below. For instance, Xcel notes in its study that "EPRI's software is not able to factor in the impacts from existing distributed generation in their DRIVE tool," so the results of Xcel's hosting capacity analysis do not factor in existing or anticipated DER.[37] Similarly, Xcel acknowledges that "DRIVE cannot [incorporate] demand values for daytime minimum loading," even though the utility has the ability to collect that data.[38] These omissions and some of the other issues raised below in Section III.E undermine the accuracy of the hosting capacity analysis and, in turn, its utility for system planning and interconnection purposes. Xcel's report does not provide a specific timeline as to when all of these limitations will be remedied, raising further concerns for the efficacy of the DRIVE tool going forward.[39]

IREC understands that Xcel, through the use of the EPRI DRIVE tool, is trying to balance speed with accuracy in utilizing an existing methodology and that hosting capacity analysis necessarily relies to some extent on assumptions instead of actual system data. However, any benefits associated with speed are ultimately meaningless if the resulting analysis is not accurate enough to be used in the intended practical applications. As Xcel itself acknowledges, "[i]n some situations the hosting capacity information may be incorrect and

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[36] Xcel Study, pp. 3-4.
[37] *Id.*, pp. 10-11.
[38] Xcel Supp. Comments, p. 7.
[39] *See, e.g., id.*, p. 12 (discussing improvements to DRIVE tool without providing a timeline for these changes).

further analysis will be needed."[40] It is not clear how frequently these inaccuracies occur and to what extent they impact the ability to use this DRIVE-based hosting capacity analysis in any practical applications, now or in the future. For this reason, IREC strongly encourages Xcel and the Commission to consider what accuracy improvements would need to be made to the hosting capacity analysis to make it usable for the Commission's short- and long-term goals, once identified, and whether and when the DRIVE tool could accommodate these changes.

E. Xcel Should Provide Additional Information To Explain And Justify Its Methodological Choices, Especially With Regard To Their Impact On Accuracy Of Results.

IREC has referenced some of its methodological concerns above, in particular with regard to their impact on accuracy, and reiterates and expands upon a number of these more technical concerns below. IREC notes that this is not an exhaustive list of all questions about the methodology, in part because we do not have a transparent view into all of its attributes, as discussed above. IREC would welcome the opportunity to explore these and other issues in the future to ensure that Xcel's chosen hosting capacity methodology can or will be able to achieve the Commission's goals as they are identified.

1. Use of the "Small Distributed Method" and Allocation of Load on Feeder

Xcel describes the DRIVE tool's three methods for allocating DER across a feeder:

- *Large Centralized*: Considers Large DER at a single location and does not consider DER at any other location on the feeder.
- *Large Distributed:* Considers distribution of large DER at different feeder locations.
- *Small Distributed*: Considers distribution of small DER at different feeder locations.[41]

[40] Xcel Study, p. 15.
[41] *Id.*, p. 5.

Xcel expressed concern that "providing the results for each method or trying to blend all three methods' data sets into one would be confusing and could lead to misleading results," choosing instead to rely solely on the "Small Distributed method."[42] Xcel explained that this selection was made in attempt to best match the Commission's intent,[43] but in its supplemental comments, the utility offered a contradicting reflection:

> While we do have a significant amount of smaller, more distributed, rooftop PV on our system, much of the new PV installation capacity is occurring on a larger scale at a single site, such as the community solar gardens. To this point, the small distributed methodology may not fit as well. One of the other methodologies may provide a better analysis considering the present nature of DER in our state.[44]

Xcel also acknowledged that the small distribution method assumes DER location next to load, which is not the case for community solar gardens.[45] Moreover, this method limits hosting capacity to the peak load of a feeder, which may be overly conservative in many cases.[46]

IREC is concerned by Xcel's description of the DRIVE tool's inability to accommodate the full range of DER present on Minnesota's system, especially the growing number of community solar gardens. IREC would benefit from additional clarity regarding whether and how the DRIVE tool will be able to accommodate all types of DER in the future.

In addition to these limitations, assuming the DER is located next to load raises the related question of how load is allocated within the model. Xcel states that it allocated loads "on a section by section basis and . . . based on the combination of appropriate load curves by customer type and customer energy usage. When available, demand data from Primary Metered

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[42] *Id.*, pp. 5-6.
[43] *Id.*
[44] Xcel Supp. Comments, p. 3.
[45] *Id.*
[46] *Id.*

customers was also used."[47] Although Xcel provided some additional detail in response to the Commission's question on this topic, IREC understood Xcel's response to indicate that it is using average customer class load curves rather than more granular, accurate data.[48] IREC understands that Xcel employs Automatic Meter Reading (AMR) technology on its system. We would benefit from understanding what information that system can provide and at what intervals (e.g., monthly kWh only, monthly peak, etc.), and whether that data is or could be incorporated into the DRIVE tool to generate more accurate results.

2. Incorporation of Existing or Anticipated DER

Xcel explained that the DRIVE tool was "not able to factor in" impacts from existing or anticipated DER.[49] The company further claimed that this "feature of the tool is still in development and not available to any utility using the [DRIVE] software at this time,"[50] but California has been able to incorporate this information, even when utilizing the streamlined methodology. IREC would benefit from further explanation of this omission. For example, what is it about the DRIVE tool that prevents inclusion of existing DER? Does it have to do with an underlying data problem associated with existing DER? Or is it inherent in the tool itself?

This omission seems especially problematic from both an accuracy perspective as well as a practical use standpoint, and will only become more problematic as more DERs are installed on Xcel's system. Xcel states "the next release of the DRIVE tool in the first half of 2017 . . . would include this capability."[51] IREC emphasizes that its incorporation is critical to producing usable, accurate results.

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[47] Xcel Study, pp. 8-9.
[48] Xcel Supp. Comments, pp. 7-8.
[49] Xcel Study, pp. 10-11.
[50] *Id.*
[51] *Id.*, p. 11.

Related to the incorporation of existing DG and other DER, IREC notes the importance of considering how to incorporate smart inverter settings and their impacts now, such that they can be incorporated into Xcel's hosting capacity analysis appropriately in the future, after the relevant standards have been adopted.[52] Smart inverters will allow DG to provide additional grid services, including voltage regulation and other capabilities that could positively impact hosting capacity and otherwise benefit the utility's system.

3. Incorporation of Other DER in Addition to DG

As the Commission noted in its Information Request, Xcel's report did not explicitly define what types of DER are included in its hosting capacity analysis.[53] The utility appears to be focused exclusively on small DG.[54] Indeed, Xcel's supplemental comments reveal that the hosting capacity analysis did not include demand response (DR) or energy efficiency (EE) in its DER definition, though Xcel acknowledged the utility of including DR and EE for a locational value analysis.[55] IREC recognizes that Xcel is still in the early stages of its hosting capacity efforts, but notes that the lack of inclusion of other types of DER limit the accuracy of the methodology and its usefulness in the various intended applications. It would be helpful to have a better understanding of when a broader range of DER, in particular energy storage, can be incorporated.

4. Treatment of Pre-Existing Conditions

Xcel's description in its report and supplemental comments do not address how the DRIVE tool would treat pre-existing conditions, in particular voltage violations. Specifically, Xcel does not articulate if and how it would address the ability of DER to help resolve such

[52] *See* Xcel Supp. Comments, pp. 3-4.
[53] Commission Information Request #1, Question 6(a).
[54] *See* Xcel Study, pp. 5-6.
[55] Xcel Supp. Comments, p. 11.

violations or exacerbate them, or whether it would simply display that circuit as having no remaining hosting capacity. IREC requests additional information on how pre-existing violations are screened and handled. If a circuit had pre-existing low voltage, would the hosting capacity analysis immediately halt, effectively resulting in a zero value? Or, for example, would it account for the ability of solar PV to increase voltage and mitigate the issue? Could these results be displayed such that they communicate mitigation opportunities to DER providers? If there is a pre-existing high voltage issue, does Xcel have a plan to factor in projected DER growth before implementing a mitigation?

5. Loading Levels

Xcel states that it populated its feeder models with "peak load information that was scaled down to 20% by the DRIVE tool to represent Daytime Minimum Loading."[56] The peak load data was from SCADA, which is present on 90% of Xcel's feeders; if SCADA was not available, Xcel obtained data from its from its manual monthly peak substation read process.[57] Xcel notes that "for feeders with SCADA, even though we have the ability to collect data and pull out the actual daytime minimum load information, the DRIVE tool does not have the capability to accept this type of input. At this time, DRIVE cannot take demand values for daytime minimum loading and incorporate them into the hosting capacity analysis."[58]

IREC is very concerned by DRIVE's inability to incorporate actual daytime minimum load information. Such data would be significantly more accurate than the conservative rule of thumb Xcel employs to estimate it, scaling down peak load to 20%. Although Xcel points to a National Renewable Energy Laboratory (NREL) report to justify its use of that assumption, the

[56] Xcel Study, p. 8.
[57] *Id.*; Xcel Supp. Comments, p. 6.
[58] Xcel Supp. Comments, p. 6.

same report also states: "For typical distribution circuits in the United States, minimum load is approximately 30% of peak load. The actual ratio varies widely depending on many factors such as the type of load served."[59] It goes on to note that the typical interconnection technical screen of 15% of peak load (half of 30%) is a "conservative penetration level for general screening purposes."[60] Therefore, Xcel appears to have selected an especially conservative assumptions for its estimate.

IREC requests additional information regarding what exactly prevents the DRIVE tool from using a minimum load value recorded from SCADA as opposed to the conservative estimates produced by Xcel. Until this limitation of the tool is remedied, its resulting analysis seems very likely to be inaccurate and of limited usefulness.

6. Data Validation

IREC appreciated Xcel's explanation in its supplemental comments regarding its data validation approach.[61] However, IREC is unsure of whether these validation steps were done in a way such that they will preserved in future modeling efforts. Was the GIS data updated, and will appropriate changes be made in future versions of the model? IREC suggests it is important that any modifications for data accuracy are captured in future iterations of the analysis.

7. Conductor Spacing

Xcel states that it assumes the same conductor spacing for each voltage class, relying on the 13.8 kV standard, which predominates in their system.[62] IREC notes that this assumption would affect the accuracy of the resulting analysis, but the magnitude of the effect would depend

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[59] M. Coddington et al., *Updating Interconnection Screens for PV System Integration*, at 2 (Feb. 2012), *available at* www.nrel.gov/docs/fy12osti/54063.pdf.
[60] *Id.*
[61] Xcel Supp. Comments, pp. 4-6; *see also* Xcel Study, p. 8.
[62] Xcel Study, p. 8.

on how prevalent the 13.8 kV lines are as compared to other classes. IREC would benefit from a better understanding of the prevalence of 13.8 kV lines, and what other distribution voltage classes are present in Xcel's service territory.

8. Capacitors

Xcel assumed capacitor banks were switched on at peak unless known to be offline, and assumed they were switched off for off-peak analysis.[63] To better evaluate to what extent this is a reasonable assumption and its impact on accuracy, IREC would like to understand whether peak hours are assumed or whether the actual feeder peak load hour is used, and how long before the peak hour and for how long after are the capacitor banks switched on.

9. Secondary conductors

Xcel does not account for secondary conductors in its analysis.[64] While IREC understands this current limitation, we emphasize that the ultimate goal should be to incorporate secondary conductors into the analysis, especially if the hosting capacity analysis is to be used for interconnection purposes. In the meantime, IREC would benefit from better understanding any assumptions used for secondary conductors (e.g., size, material, length, etc.).

10. Load tap changers and voltage regulating devices

Based on our review of the report and supplemental comments, IREC is unsure of whether the analysis allows for load tap changers (LTCs) and other voltage regulating devices to float as they would in the field. IREC notes that allowing these devices to do so is important and affects the accuracy of the ultimate analysis. IREC requests additional information on this point.

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[63] *Id.*; Xcel Supp. Comments, pp. 10-11.
[64] Xcel Study, p. 8.

IV. CONCLUSION

IREC appreciates the opportunity to comment on Xcel's hosting capacity analysis and supplemental comments, and looks forward to continued participation in this proceeding. We again applaud the Commission and Xcel for their leadership and responsiveness in this undertaking. Lastly, IREC plans to remain active in Docket No. 15-556 regarding grid modernization and hope that those efforts will continue to be coordinated with the ones here.

DATED: April 20, 2017

SHUTE, MIHALY & WEINBERGER LLP

By: /s/ Erica S. McConnell

ERICA S. McCONNELL
TORI BALLIF GIBBONS
396 Hayes Street
San Francisco, California 94102
Telephone: (415) 552-7272
Facsimile: (415) 552-5816
mcconnell@smwlaw.com
gibbons@smwlaw.com

Attorneys for Interstate Renewable Energy Council, Inc.

CERTIFICATE OF SERVICE

Docket No. E002/M-15-962

I, the undersigned, state that I am a citizen of the United States and am employed in the City and County of San Francisco; that I am over the age of eighteen (18) years and not a party to the within cause; and that my business address is 396 Hayes Street, San Francisco, CA 94102.

On April 20, 2017, I served a true and correct copy of

COMMENTS OF INTERSTATE RENEWABLE ENERGY COUNCIL, INC. REGARDING XCEL ENERGY'S HOSTING CAPACITY ANALYSIS AND SUPPLEMENTAL COMMENTS

on the parties in this action as follows:

SEE ATTACHED SERVICE LIST

BY ELECTRONIC FILING: I caused a copy of the document(s) to be sent to the e-mail addresses of the persons designated as accepting electronic service on the Official Service List by using the eService feature of the eFiling application of the Minnesota Public Utilities Commission.

BY MAIL: I enclosed the document(s) in a sealed envelope addressed to the persons designated as requiring paper service on the Official Service List. I am readily familiar with Shute, Mihaly & Weinberger LLP's practice for collecting and processing correspondence for mailing. On the same day that the correspondence is placed for collection and mailing, it is deposited in the ordinary course of business with the United States Postal Service, in a sealed envelope with postage fully prepaid.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Executed in San Francisco, California on April 20, 2017.

/s/ Amy Zehring
Amy Zehring

877975.9

Attachment 2

Reply Comments of the Interstate Renewable Energy Council, Inc. Regarding Xcel Energy's Hosting Capacity Analysis and Supplemental Comments (Docket No. E002/M-15-962)

STATE OF MINNESOTA
BEFORE THE
PUBLIC UTILITIES COMMISSION

Nancy Lange	Chair
Dan Lipschultz	Commissioner
Matthew Schuerger	Commissioner
Katie Sieben	Commissioner
John Tuma	Commissioner

In the Matter of Xcel's Biennial Distribution Study Report	Docket No. E002/M-15-962

REPLY COMMENTS OF THE INTERSTATE RENEWABLE ENERGY COUNCIL, INC. REGARDING XCEL ENERGY'S HOSTING CAPACITY ANALYSIS AND SUPPLEMENTAL COMMENTS

In response to the Commission's February 21, 2017 Notice of Comment Period on Distribution System Study, the Interstate Renewable Energy Council, Inc. (IREC) filed initial comments detailing our impressions, questions, and concerns related to Xcel Energy's December 1, 2016 hosting capacity report. In these reply comments, after reviewing comments filed by the Department of Commerce, the Institute for Local Self-Reliance (ILSR), and Fresh Energy, IREC offers suggestions regarding appropriate next steps.

Fresh Energy, ILSR, and IREC identified several common concerns. In particular, all three parties requested additional clarity regarding the intended goals and use cases for the hosting capacity analysis.[1] In different ways and with varying levels of detail, each party identified elements of the current analysis and underlying methodology that seemed insufficient as far as achievement of potential goals. All three parties focused especially on the need to incorporate impacts of existing and expected distributed generation (DG) and other distributed

[1] Fresh Energy Initial Comments at 1-2, 5; ILSR Initial Comments at 2-3; IREC Initial Comments at 7-14.

energy resources (DERs).[2] All three also pointed to proceedings regarding hosting capacity methodologies in California, which may help Minnesota better understand if and to what extent the methodology currently employed by Xcel will be able to meet its ultimate goals.[3] IREC emphasized that, without near-term consideration of the Commission's goals for hosting capacity and the current methodology's ability to meet those goals, Xcel, the Commission, and stakeholders are at risk of spending significant resources refining a methodology that cannot achieve the intended objectives.[4]

In light of these initial comments, IREC encourages the Commission to consider identification of its goals and use cases for hosting capacity as an essential next step in this proceeding. We suggest that such consideration should be informed by the ICF *Integrated Distribution Planning* report filed in Docket No. 15-556, as well as the comments the Commission receives in that docket in response to its April 21, 2017 Notice of Comment Period on Distribution System Planning Efforts and Considerations. As explained in more detail in our initial comments, IREC submits that goals for hosting capacity should include:

1. Integrated Distribution Planning[5]
    a. Proactive planning: Using hosting capacity analysis in tandem with DER forecasting, identify areas of the grid that will require upgrades in order to accommodate expected DER growth and proactively construct those upgrades in order to facilitate DER interconnection and integration.

[2] Fresh Energy Initial Comments at 3; ILSR Initial Comments at 2-3; IREC Initial Comments at 21-22.

[3] Fresh Energy Initial Comments at 2; ILSR Initial Comments at 2; IREC Initial Comments at 17-18.

[4] IREC Initial Comments at 7-8.

[5] IREC Initial Comments at 9-11.

Ultimately such proactive planning could address organic DER growth (e.g., customers deciding to install rooftop solar because their neighbor has done so), as well as growth that is managed through pricing structures and other programs that direct DER growth to optimal grid locations.

b. DERs as solutions: Instead of traditional upgrades, rely on DER solutions to defer or eliminate the need for those upgrades, and generally ensure that the benefits of DER are being used optimally. While traditional upgrades may still be necessary, DER may provide solutions that are less costly for ratepayers and offer additional benefits, as well, such as environmental and other societal benefits. There are a variety of mechanisms that could be used to procure DER solutions, depending on the need, including solicitations for non-wires alternatives and locational pricing.

2. Streamlined Interconnection[6]

a. Up-front transparency: Provide hosting capacity data in map and/or searchable spreadsheet formats to potential interconnection applicants to help them direct their projects to lower-cost (e.g., where upgrades would be unnecessary to accommodate the project) or higher-value (e.g., where the DER project could provide needed grid services) grid locations. As more detailed, granular information is provided in this way, applicants may also be able to design their projects to meet the grid needs in a particular location, not only with respect to their size/capacity, but also in

[6] IREC Initial Comments at 11-14.

how the project would operate (e.g., when a storage system might charge and discharge).

b. More efficient application processing: Allow projects that fall within the hosting capacity at their intended interconnection location to receive expedited interconnection processing, eventually moving towards a "click and claim" process that is highly automated for such projects. In its full form, this application for hosting capacity would require high confidence in the accuracy of the analysis as well as frequent (near real-time) updates to the analysis. Hosting capacity analysis may also be used within the study process (for projects that fall outside the existing hosting capacity), including allowing utilities to provide applicants with potential project alternatives that would help them stay within hosting capacity limits.

Once the goals for hosting capacity have been identified, the Commission could then more effectively evaluate whether or not Xcel's methodology and analysis can, or eventually will, be able to achieve those goals. The questions raised by parties in initial comments will provide a good starting point for that process. IREC suggests that a helpful next step would be for Xcel to submit a filing explaining in detail: (1) how its hosting capacity methodology can meet the Commission's identified goals; (2) where it requires modifications to do so, and when Xcel will be able to incorporate those changes; and (3) if applicable, where the methodology inherently cannot meet the identified needs. As part of this filing, Xcel could respond to stakeholder questions raised in initial and reply comments, incorporating any responses it will already have provided in its own reply comments.

After reviewing Xcel's filing, the Commission could assess how best to move forward. IREC suggests that it would likely be valuable to solicit an additional round of written initial and reply comments from stakeholders on Xcel's filing before the Commission makes a decision. Ultimately, IREC emphasizes that the development of an effective hosting capacity methodology is likely to be a gradual, iterative process, and we are not suggesting that the Commission or Xcel should be able to implement a complete, final solution in the near term. In the interim, however, it is critical that Xcel is developing a methodology that brings it closer towards meeting the longer-term goals and use cases for hosting capacity. As discussed in our initial comments, at this stage it is not clear that Xcel is on such a path. IREC hopes that with additional guidance regarding the Commission's goals, and additional information from Xcel regarding its methodology and its ability to meet those goals, we will be able to have more confidence that the utility is moving in a productive direction, or at least be able to identify more clearly the areas for improvement.

IREC recognizes that Xcel is currently expected to file the next iteration of its hosting capacity analysis on November 1, 2017, and that Xcel has indicated that improvements to the methodology are already underway.[7] As this proceeding and Docket No. 15-556 move forward, and the Commission gathers additional info from utilities and stakeholders, and refines its hosting capacity goals, IREC suggests that it could reassess the appropriate timeline for modifications to Xcel's methodology, the next iteration of a report, and any other necessary next steps. Regardless, as IREC emphasized in our initial comments, we urge the Commission to

[7] *See, e.g.*, Xcel Distribution System Study at 11 (Dec. 1, 2016) (indicating that the next release of the DRIVE tool in the first half of 2017 would incorporate existing DER).

require Xcel to provide a hosting capacity or comparable map by November 1, 2017, as such a map will be immediately useful for DER providers and other stakeholders.[8]

IREC appreciates the opportunity to submit these reply comments, and looks forward to continuing our engagement in this proceeding and Docket No. 15-556.

DATED: May 5, 2017

SHUTE, MIHALY & WEINBERGER LLP

By: /s/ Erica S. McConnell

ERICA S. McCONNELL
TORI BALLIF GIBBONS
396 Hayes Street
San Francisco, California 94102
Telephone: (415) 552-7272
Facsimile: (415) 552-5816
mcconnell@smwlaw.com
gibbons@smwlaw.com

Attorneys for Interstate Renewable Energy Council, Inc.

[8] IREC Initial Comments at 13-14.

CERTIFICATE OF SERVICE

Docket No. E002/M-15-962

I, the undersigned, state that I am a citizen of the United States and am employed in the City and County of San Francisco; that I am over the age of eighteen (18) years and not a party to the within cause; and that my business address is 396 Hayes Street, San Francisco, CA 94102.

On May 5, 2017, I served a true and correct copy of

REPLY COMMENTS OF THE INTERSTATE RENEWABLE ENERGY COUNCIL, INC. REGARDING XCEL ENERGY'S HOSTING CAPACITY ANALYSIS AND SUPPLEMENTAL COMMENTS

on the parties in this action as follows:

SEE ATTACHED SERVICE LIST

BY ELECTRONIC FILING: I caused a copy of the document(s) to be sent to the e-mail addresses of the persons designated as accepting electronic service on the Official Service List by using the eService feature of the eFiling application of the Minnesota Public Utilities Commission.

BY MAIL: I enclosed the document(s) in a sealed envelope addressed to the persons designated as requiring paper service on the Official Service List. I am readily familiar with Shute, Mihaly & Weinberger LLP's practice for collecting and processing correspondence for mailing. On the same day that the correspondence is placed for collection and mailing, it is deposited in the ordinary course of business with the United States Postal Service, in a sealed envelope with postage fully prepaid.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Executed in San Francisco, California on May 5, 2017.

/s/ Amy Zehring

Amy Zehring

890030.3

CERTIFICATE OF SERVICE

Docket No. E999/CI-15-556

I, the undersigned, state that I am a citizen of the United States and am employed in the City and County of San Francisco; that I am over the age of eighteen (18) years and not a party to the within cause; and that my business address is 396 Hayes Street, San Francisco, CA 94102.

On August 21, 2017, I served a true and correct copy of

COMMENTS OF THE INTERSTATE RENEWABLE ENERGY COUNCIL, INC. ON DISTRIBUTION SYSTEM PLANNING EFFORTS AND CONSIDERATIONS

on the parties in this action as follows:

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I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Executed in San Francisco, California on August 21, 2017.

/s/ Amy Zehring
Amy Zehring

904871.9

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Michael	Allen	michael.allen@allenergysolar.com	All Energy Solar	721 W 26th st Suite 211 Minneapolis, Minnesota 55405	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
David	Amster Olzweski	david@mysunshare.com	SunShare, LLC	1774 Platte St Denver, CO 80202	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Julia	Anderson	Julia.Anderson@ag.state.mn.us	Office of the Attorney General-DOC	1800 BRM Tower 445 Minnesota St St. Paul, MN 551012134	Electronic Service	Yes	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Christopher	Anderson	canderson@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022191	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Ellen	Anderson	ellena@umn.edu	325 Learning and Environmental Sciences	154 Buford Ave St. Paul, MN 55155	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Alison C	Archer	aarcher@misoenergy.org	MISO	2985 Ames Crossing Rd Eagan, MN 55121	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Donna	Attanasio	dattanasio@law.gwu.edu	George Washington University	2000 H Street NW Washington, DC 20052	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
John	Bailey	bailey@ilsr.org	Institute For Local Self-Reliance	1313 5th St SE Ste 303 Minneapolis, MN 55414	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Kenneth	Baker	Ken.Baker@walmart.com	Wal-Mart Stores, Inc.	2001 SE 10th St. Bentonville, AR 72716-5530	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Sara	Baldwin Auck	sarab@irecusa.org	Interstate Renewable Energy Council, Inc.	PO Box 1156 Latham, NY 12110	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Gail	Baranko	gail.baranko@xcelenergy.com	Xcel Energy	414 Nicollet Mall7th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
James J.	Bertrand	james.bertrand@stinson.com	Stinson Leonard Street LLP	150 South Fifth Street, Suite 2300 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Derek	Bertsch	derek.bertsch@mrenergy.com	Missouri River Energy Services	3724 West Avera Drive PO Box 88920 Sioux Falls, SD 57109-8920	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
William	Black	bblack@mmua.org	MMUA	Suite 400 3025 Harbor Lane North Plymouth, MN 554475142	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
William A.	Blazar	bblazar@mnchamber.com	Minnesota Chamber Of Commerce	Suite 1500 400 Robert Street North St. Paul, MN 55101	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Kenneth	Bradley	kbradley1965@gmail.com		2837 Emerson Ave S Apt CW112 Minneapolis, MN 55408	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Jon	Brekke	jbrekke@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 553694718	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Sydney R.	Briggs	sbriggs@swce.coop	Steele-Waseca Cooperative Electric	2411 W. Bridge St PO Box 485 Owatonna, MN 55060-0485	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Mark B.	Bring	mbring@otpco.com	Otter Tail Power Company	215 South Cascade Street PO Box 496 Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Tony	Brunello	BADEMAIL-tbrunello@greentechleadership.org	Greentech Leadership Group	426 17th St Ste 700 Oakland, CA 94612-2850	Paper Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Christina	Brusven	cbrusven@fredlaw.com	Fredrikson Byron	200 S 6th St Ste 4000 Minneapolis, MN 554021425	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Michael J.	Bull	mbull@mncee.org	Center for Energy and Environment	212 Third Ave N Ste 560 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Jessica	Burdette	jessica.burdette@state.mn.us	Department of Commerce	85 7th Place East Suite 500 St. Paul, MN 55101	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Jason	Burwen	j.burwen@energystorage.org	Energy Storage Association	1155 15th St NW, Ste 500 Washington, DC 20005	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Joel	Cannon	jcannon@tenksolar.com	Tenk Solar, Inc.	9549 Penn Avenue S Bloomington, MN 55431	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Douglas M.	Carnival	dmc@mcgrannshea.com	McGrann Shea Carnival Straughn & Lamb	N/A	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Ray	Choquette	rchoquette@agp.com	Ag Processing Inc.	12700 West Dodge Road PO Box 2047 Omaha, NE 68103-2047	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Kenneth A.	Colburn	kcolburn@symbioticstrategies.com	Symbiotic Strategies, LLC	26 Winton Road Meredith, NH 32535413	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
George	Crocker	gwillc@nawo.org	North American Water Office	PO Box 174 Lake Elmo, MN 55042	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Carl	Cronin	Regulatory.records@xcelenergy.com	Xcel Energy	414 Nicollet Mall FL 7 Minneapolis, MN 554011993	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Arthur	Crowell	Crowell.arthur@yahoo.com	A Work of Art Solar	14333 Orchard Rd. Minnetonka, MN 55345	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Leigh	Currie	lcurrie@mncenter.org	Minnesota Center for Environmental Advocacy	26 E. Exchange St., Suite 206 St. Paul, Minnesota 55101	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
David	Dahlberg	davedahlberg@nweco.com	Northwestern Wisconsin Electric Company	P.O. Box 9 104 South Pine Street Grantsburg, WI 548400009	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
James	Denniston	james.r.denniston@xcelenergy.com	Xcel Energy Services, Inc.	414 Nicollet Mall, Fifth Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Curt	Dieren	curt.dieren@dgr.com	L&O Power Cooperative	1302 S Union St Rock Rapids, IA 51246	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Ian	Dobson	Residential.Utilities@ag.state.mn.us	Office of the Attorney General-RUD	1400 BRM Tower 445 Minnesota St St. Paul, MN 551012130	Electronic Service	Yes	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Brian	Draxten	bhdraxten@otpco.com	Otter Tail Power Company	P.O. Box 496 215 South Cascade Street Fergus Falls, MN 565380498	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Mike	Eggl	meggl@bepc.com	Basin Electric Power Cooperative	1717 East Interstate Avenue Bismarck, ND 58503	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Kristen	Eide Tollefson	N/A	R-CURE	28477 N Lake Ave Frontenac, MN 55026-1044	Paper Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Bob	Eleff	bob.eleff@house.mn	Regulated Industries Cmte	100 Rev Dr Martin Luther King Jr Blvd Room 600 St. Paul, MN 55155	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Betsy	Engelking	betsy@geronimoenergy.com	Geronimo Energy	7650 Edinborough Way Suite 725 Edina, MN 55435	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Oncu	Er	oncu.er@avantenergy.com	Avant Energy, Agent for MMPA	220 S. Sixth St. Ste. 1300 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
James C.	Erickson	jericksonkbc@gmail.com	Kelly Bay Consulting	17 Quechee St Superior, WI 54880-4421	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
John	Farrell	jfarrell@ilsr.org	Institute for Local Self-Reliance	1313 5th St SE #303 Minneapolis, MN 55414	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Sharon	Ferguson	sharon.ferguson@state.mn.us	Department of Commerce	85 7th Place E Ste 280 Saint Paul, MN 551012198	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
John	Fernandes	john.fernandes@res-americas.com	RES	11101 W. 120th Ave Suite 400 Broomfield, CO 80021	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Nathan	Franzen	nathan@geronimoenergy.com	Geronimo Energy	7650 Edinborough Way Suite 725 Edina, MN 55435	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Amy	Fredregill	Amy.S.Fredregill@xcelenergy.com	Xcel Energy	414 Nicollet Mall Minneapolis, MN 55401	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
John	Fuller	john.fuller@senate.mn	MN Senate	75 Rev Dr Martin Luther King Jr Blvd Room G-17 St. Paul, MN 55155	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Hal	Galvin	halgalvin@comcast.net	Provectus Energy Development llc	1936 Kenwood Parkway Minneapolis, MN 55405	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Edward	Garvey	garveyed@aol.com	Residence	32 Lawton St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Bruce	Gerhardson	bgerhardson@otpco.com	Otter Tail Power Company	PO Box 496 215 S Cascade St Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Allen	Gleckner	gleckner@fresh-energy.org	Fresh Energy	408 St. Peter Street Ste 220 Saint Paul, Minnesota 55102	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Bryan	Gower	bgower@apx.com	APX, Inc.	N/A	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Timothy	Gulden	info@winonarenewableenergy.com	Winona Renewable Energy, LLC	1449 Ridgewood Dr Winona, MN 55987	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Tony	Hainault	anthony.hainault@co.hennepin.mn.us	Hennepin County DES	701 4th Ave S Ste 700 Minneapolis, MN 55415-1842	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Todd	Headlee	theadlee@dvigridsolutions.com	Dominion Voltage, Inc.	701 E. Cary Street Richmond, VA 23219	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Duane	Hebert	duane.hebert@novelenergy.biz	Novel Energy Solutions	1628 2nd Ave SE Rochester, MN 55904	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Kimberly	Hellwig	kimberly.hellwig@stoel.com	Stoel Rives LLP	33 South Sixth Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
John	Helmers	helmers.john@co.olmsted.mn.us	Olmsted County Waste to Energy	2122 Campus Drive SE Rochester, MN 55904-4744	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Jared	Hendricks	hendricksj@owatonnautilities.com	Owatonna Public Utilities	PO Box 800 208 S Walnut Ave Owatonna, MN 55060-2940	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Annete	Henkel	mui@mnutilityinvestors.org	Minnesota Utility Investors	413 Wacouta Street #230 St.Paul, MN 55101	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Shane	Henriksen	shane.henriksen@enbridge.com	Enbridge Energy Company, Inc.	1409 Hammond Ave FL 2 Superior, WI 54880	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Paul	Hernandez	Paul.Hernandez@energycenter.org	Center for Sustainable Energy	426 17th Street, Suite 700 Oakland, CA 94612	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Michael	Hoppe	il23@mtn.org	Local Union 23, I.B.E.W.	932 Payne Avenue St. Paul, MN 55130	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Jim	Horan	Jim@MREA.org	Minnesota Rural Electric Association	11640 73rd Ave N Maple Grove, MN 55369	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Lori	Hoyum	lhoyum@mnpower.com	Minnesota Power	30 West Superior Street Duluth, MN 55802	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Jan	Hubbard	jan.hubbard@comcast.net		7730 Mississippi Lane Brooklyn Park, MN 55444	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Casey	Jacobson	cjacobson@bepc.com	Basin Electric Power Cooperative	1717 East Interstate Avenue Bismarck, ND 58501	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
John S.	Jaffray	jjaffray@jjrpower.com	JJR Power	350 Highway 7 Suite 236 Excelsior, MN 55331	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Alan	Jenkins	aj@jenkinsatlaw.com	Jenkins at Law	2265 Roswell Road Suite 100 Marietta, GA 30062	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Richard	Johnson	Rick.Johnson@lawmoss.com	Moss & Barnett	150 S. 5th Street Suite 1200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Nate	Jones	njones@hcpd.com	Heartland Consumers Power	PO Box 248 Madison, SD 57042	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Michael	Kampmeyer	mkampmeyer@a-e-group.com	AEG Group, LLC	260 Salem Church Road Sunfish Lake, Minnesota 55118	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Mark J.	Kaufman	mkaufman@ibewlocal949.org	IBEW Local Union 949	12908 Nicollet Avenue South Burnsville, MN 55337	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
John	Kearney	jmkearney@MnSEIA.org	MnSEIA	2512 33rd Ave S Minneapolis, MN 55406	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Jennifer	Kefer	jennifer@dgardiner.com	Alliance for Industrial Efficiency	David Gardiner & Associates, LLC 2609 11th St N Arlington, VA 22201-2825	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Julie	Ketchum	N/A	Waste Management	20520 Keokuk Ave Ste 200 Lakeville, MN 55044	Paper Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Madeleine	Klein	mklein@socoreenergy.com	SoCore Energy	225 W Hubbard Street Suite 200 Chicago, IL 60654	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Brad	Klein	bklein@elpc.org	Environmental Law & Policy Center	35 E. Wacker Drive, Suite 1600 Suite 1600 Chicago, IL 60601	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
John	Kluempke	BADEMAIL-jwkluempke@winlectric.com	Elk River Winlectric	12777 Meadowvale Rd Elk River, MN 55330	Paper Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Thomas	Koehler	TGK@IBEW160.org	Local Union #160, IBEW	2909 Anthony Ln St Anthony Village, MN 55418-3238	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Brian	Krambeer	bkrambeer@tec.coop	Tri-County Electric Cooperative	PO Box 626 31110 Cooperative Way Rushford, MN 55971	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Jon	Kramer	sundialjon@gmail.com	Sundial Solar	3209 W 76th St Edina, MN 55435	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Michael	Krause	michaelkrause61@yahoo.com	Kandiyo Consulting, LLC	433 S 7th Street Suite 2025 Minneapolis, Minnesota 55415	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Michael	Krikava	mkrikava@briggs.com	Briggs And Morgan, P.A.	2200 IDS Center 80 S 8th St Minneapolis, MN 55402	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List

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Matthew	Lacey	Mlacey@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 553694718	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
James D.	Larson	james.larson@avantenergy.com	Avant Energy Services	220 S 6th St Ste 1300 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Douglas	Larson	dlarson@dakotaelectric.com	Dakota Electric Association	4300 220th St W Farmington, MN 55024	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Dean	Leischow	dean@sunriseenergyventures.com	Sunrise Energy Ventures	601 Carlson Parkway, Suite 1050 Minneapolis, MN 55305	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Benjamin	Lowe	ben.lowe@alevo.com	Alevo USA Inc.	2321 Concord Parkway South Concord, North Carolina 28027	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Susan	Ludwig	sludwig@mnpower.com	Minnesota Power	30 West Superior Street Duluth, MN 55802	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Kavita	Maini	kmaini@wi.rr.com	KM Energy Consulting LLC	961 N Lost Woods Rd Oconomowoc, WI 53066	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Pam	Marshall	pam@energycents.org	Energy CENTS Coalition	823 7th St E St. Paul, MN 55106	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Samuel	Mason	smason@beltramielectric.com	Beltrami Electric Cooperative, Inc.	4111 Technology Dr. NW PO Box 488 Bemidji, MN 56619-0488	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Erica	McConnell	mcconnell@smwlaw.com	Shute, Mihaly & Weinberger LLP	396 Hayes St San Francisco, California 94102-4421	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Dave	McNary	David.McNary@hennepin.us	Hennepin County DES	701 Fourth Ave S Ste 700 Minneapolis, MN 55415-1842	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
John	McWilliams	jmm@dairynet.com	Dairyland Power Cooperative	3200 East Ave SPO Box 817 La Crosse, WI 54601-7227	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Thomas	Melone	Thomas.Melone@AllcoUS.com	Minnesota Go Solar LLC	222 South 9th Street Suite 1600 Minneapolis, Minnesota 55120	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Herbert	Minke	hminke@allete.com	Minnesota Power	30 W Superior St Duluth, MN 55802	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
David	Moeller	dmoeller@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022093	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Dalene	Monsebroten	dalene@mncable.net	Northern Municipal Power Agency	123 2nd St W Thief River Falls, MN 56701	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Andrew	Moratzka	andrew.moratzka@stoel.com	Stoel Rives LLP	33 South Sixth St Ste 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Martin	Morud	mmorud@trunorthsolar.com	Tru North Solar	5115 45th Ave S Minneapolis, MN 55417	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Michael	Murray	mmurray@missiondata.org	Mission:Data Coalition	1020 16th St Ste 20 Sacramento, CA 95814	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Ron	Nelson	ron.nelson@ag.state.mn.us	Office of the Attorney General-RUD	Bremer Tower, Suite 1400 445 Minnesota Street Saint Paul, Minnesota 55101	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Carl	Nelson	cnelson@mncee.org	Center for Energy and Environment	212 3rd Ave N Ste 560 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Ben	Nelson	benn@cmpasgroup.org	CMMPA	459 South Grove Street Blue Earth, MN 56013	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
David	Niles	david.niles@avantenergy.com	Minnesota Municipal Power Agency	220 South Sixth Street Suite 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Rolf	Nordstrom	rnordstrom@gpisd.net	Great Plains Institute	2801 21ST AVE S STE 220 Minneapolis, MN 55407-1229	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Samantha	Norris	samanthanorris@alliantenergy.com	Interstate Power and Light Company	200 1st Street SE PO Box 351 Cedar Rapids, IA 524060351	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
David	O'Brien	david.obrien@navigant.com	Navigant Consulting	77 South Bedford St Ste 400 Burlington, MA 01803	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Jeff	O'Neill	jeff.oneill@ci.monticello.mn.us	City of Monticello	505 Walnut Street Suite 1 Monticelllo, Minnesota 55362	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Russell	Olson	rolson@hcpd.com	Heartland Consumers Power District	PO Box 248 Madison, SD 570420248	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Dan	Patry	dpatry@sunedison.com	SunEdison	600 Clipper Drive Belmont, CA 94002	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Jeffrey C	Paulson	jeff.jcplaw@comcast.net	Paulson Law Office, Ltd.	4445 W 77th Street Suite 224 Edina, MN 55435	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Mary Beth	Peranteau	mperanteau@wheelerlaw.com	Wheeler Van Sickle & Anderson SC	44 E. Mifflin Street, 10th Floor Madison, WI 53703	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Jennifer	Peterson	jjpeterson@mnpower.com	Minnesota Power	30 West Superior Street Duluth, MN 55802	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Hannah	Polikov	hpolikov@aee.net	Advanced Energy Economy Institute	1000 Vermont Ave, Third Floor Washington, DC 20005	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
David G.	Prazak	dprazak@otpco.com	Otter Tail Power Company	P.O. Box 496 215 South Cascade Street Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Gayle	Prest	gayle.prest@minneapolismn.gov	City of Mpls Sustainability	350 South 5th St, #315 Minneapolis, MN 55415	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Gregory	Randa	granda@lakecountrypower.com	Lake Country Power	2810 Elida Drive Grand Rapids, MN 55744	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Mark	Rathbun	mrathbun@grenergy.com	Great River Energy	12300 Elm Creek Blvd Maple Grove, MN 55369	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Michael	Reinertson	michael.reinertson@avantenergy.com	Avant Energy	220 S. Sixth St. Ste 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
John C.	Reinhardt		Laura A. Reinhardt	3552 26Th Avenue South Minneapolis, MN 55406	Paper Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Kevin	Reuther	kreuther@mncenter.org	MN Center for Environmental Advocacy	26 E Exchange St, Ste 206 St. Paul, MN 551011667	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Craig	Rustad	crustad@minnkota.com	Minnkota Power	1822 Mill Road PO Box 13200 Grand Forks, ND 582083200	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Robert K.	Sahr	bsahr@eastriver.coop	East River Electric Power Cooperative	P.O. Box 227 Madison, SD 57042	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Richard	Savelkoul	rsavelkoul@martinsquires.com	Martin & Squires, P.A.	332 Minnesota Street Ste W2750 St. Paul, MN 55101	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Thomas	Scharff	thomas.scharff@versoco.com	Verso Corp	600 High Street Wisconsin Rapids, WI 54495	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Larry L.	Schedin	Larry@LLSResources.com	LLS Resources, LLC	332 Minnesota St, Ste W1390 St. Paul, MN 55101	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Christopher	Schoenherr	cp.schoenherr@smmpa.org	SMMPA	500 First Ave SW Rochester, MN 55902-3303	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Dean	Sedgwick	N/A	Itasca Power Company	PO Box 457 Bigfork, MN 56628-0457	Paper Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Maria	Seidler	maria.seidler@dom.com	Dominion Energy Technology	120 Tredegar Street Richmond, Virginia 23219	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
William	Seuffert	Will.Seuffert@state.mn.us		75 Rev Martin Luther King Jr Blvd 130 State Capitol St. Paul, MN 55155	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
David	Shaffer	DShaffer@MnSEIA.org	Minnesota Solar Energy Industries Project	1005 Fairmount Ave Saint Paul, MN 55105	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Patricia	Sharkey	psharkey@environmentallawcounsel.com	Midwest Cogeneration Association.	180 N. LaSalle Street Suite 3700 Chicago, Illinois 60601	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Bria	Shea	bria.e.shea@xcelenergy.com	Xcel Energy	414 Nicollet Mall Minneapolis, MN 55401	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Doug	Shoemaker	dougs@mnRenewables.org	MRES	2928 5th Ave S Minneapolis, MN 55408	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Mrg	Simon	mrgsimon@mrenergy.com	Missouri River Energy Services	3724 W. Avera Drive P.O. Box 88920 Sioux Falls, SD 571098920	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Anne	Smart	anne.smart@chargepoint.com	ChargePoint, Inc.	254 E Hacienda Ave Campbell, CA 95008	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Ken	Smith	ken.smith@districtenergy.com	District Energy St. Paul Inc.	76 W Kellogg Blvd St. Paul, MN 55102	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Joshua	Smith	joshua.smith@sierraclub.org		85 Second St FL 2 San Francisco, California 94105	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Trevor	Smith	trevor.smith@avantenergy.com	Avant Energy, Inc.	220 South Sixth Street Suite 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Ken	Smith	ken.smith@ever-greenenergy.com	Ever Green Energy	1350 Landmark Towers 345 St. Peter St St. Paul, MN 55102	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Beth H.	Soholt	bsoholt@windonthewires.org	Wind on the Wires	570 Asbury Street Suite 201 St. Paul, MN 55104	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Benjamin	Stafford	bstafford@aee.net	Advanced Energy Economy	1000 Vermont NW Floor 3 Washington, DC 20005	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Sky	Stanfield	stanfield@smwlaw.com	Shute, Mihaly & Weinberger	396 Hayes Street San Francisco, CA 94102	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Tom	Stanton	tstanton@nrri.org	NRRI	1080 Carmack Road Columbus, OH 43210	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Byron E.	Starns	byron.starns@stinson.com	Stinson Leonard Street LLP	150 South 5th Street Suite 2300 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
James M.	Strommen	jstrommen@kennedy-graven.com	Kennedy & Graven, Chartered	470 U.S. Bank Plaza 200 South Sixth Street Minneapolis, MN 55402	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Eric	Swanson	eswanson@winthrop.com	Winthrop & Weinstine	225 S 6th St Ste 3500 Capella Tower Minneapolis, MN 554024629	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Thomas P.	Sweeney III	tom.sweeney@easycleanenergy.com	Clean Energy Collective	P O Box 1828 Boulder, CO 80306-1828	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Steve	Thompson	stevet@cmpasgroup.org	Central Minnesota Municipal Power Agency	459 S Grove St Blue Earth, MN 56013-2629	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Stuart	Tommerdahl	stommerdahl@otpco.com	Otter Tail Power Company	215 S Cascade St PO Box 496 Fergus Falls, MN 56537	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Pat	Treseler	pat.jcplaw@comcast.net	Paulson Law Office LTD	4445 W 77th Street Suite 224 Edina, MN 55435	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Lise	Trudeau	lise.trudeau@state.mn.us	Department of Commerce	85 7th Place East Suite 500 Saint Paul, MN 55101	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Karen	Turnboom	karen.turnboom@versoco.com	Verso Corporation	100 Central Avenue Duluth, MN 55807	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Lisa	Veith	lisa.veith@ci.stpaul.mn.us	City of St. Paul	400 City Hall and Courthouse 15 West Kellogg Blvd. St. Paul, MN 55102	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Roger	Warehime	warehimer@owatonnautilities.com	Owatonna Public Utilities	208 South WalnutPO Box 800 Owatonna, MN 55060	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Jenna	Warmuth	jwarmuth@mnpower.com	Minnesota Power	30 W Superior St Duluth, MN 55802-2093	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Karlee	Weinmann	kweinmann@ilsr.org	Institute for Local Self-Reliance	1313 5th St SE #303 Minneapolis, MN 55414	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Jason	Willett	jason.willett@metc.state.mn.us	Metropolitan Council	390 Robert St N Saint Paul, MN 55101-1805	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Cam	Winton	cwinton@mnchamber.com	Minnesota Chamber of Commerce	400 Robert Street North Suite 1500 St. Paul, Minnesota 55101	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Robyn	Woeste	robynwoeste@alliantenergy.com	Interstate Power and Light Company	200 First St SE Cedar Rapids, IA 52401	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Daniel P	Wolf	dan.wolf@state.mn.us	Public Utilities Commission	121 7th Place East Suite 350 St. Paul, MN 551012147	Electronic Service	Yes	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Thomas J.	Zaremba	TZaremba@wheelerlaw.com	WHEELER, VAN SICKLE & ANDERSON	44 E. Mifflin Street, 10th Floor Madison, WI 53703	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List
Christopher	Zibart	czibart@atcllc.com	American Transmission Company LLC	W234 N2000 Ridgeview Pkwy Court Waukesha, WI 53188-1022	Electronic Service	No	OFF_SL_15-556_OFF_SL_15-556_Official Service List