COMMERCE DEPARTMENT

February 28, 2018

Daniel P. Wolf
Executive Secretary
Minnesota Public Utilities Commission
121 7th Place East, Suite 350
St. Paul, Minnesota 55101

RE: **Reply Comments of the Minnesota Department of Commerce, Division of Energy Resources**
Docket No. E002/M-17-777

Dear Mr. Wolf:

Attached are the reply comments of the Minnesota Department of Commerce, Division of Energy Resources (Department) in the following matter:

> Northern States Power, d/b/a Xcel Energy's 2017 Distribution System Hosting Capacity Study.

The report was filed on November 1, 2017 by:

> Bria E. Shea
> Director, Regulatory & Strategic Analysis
> Northern States Power Company d/b/a/ Xcel Energy Services, Inc.
> 414 Nicollet Mall
> Minneapolis, MN 55401

The Department is available to respond to any questions the Minnesota Public Utilities Commission may have on this matter.

Sincerely,

/s/ MATTHEW LANDI
Rates Analyst

/s/ LISE TRUDEAU
Senior Engineering Specialist

ML/LT/lt
Attachment

COMMERCE DEPARTMENT

Before the Minnesota Public Utilities Commission

Reply Comments of the Minnesota Department of Commerce Division of Energy Resources

Docket No. E002/M-17-777

I. SUMMARY

On November 1, 2017, Xcel Energy (Xcel or the Company) filed its 2017 Distribution System Hosting Capacity Report (the 2017 Report) as required by Minn. Stat. §216B.2425, subd. 8 (the Statute) and the Minnesota Public Utility Commission's (Commission) August 1, 2017 Order in Docket No. E002/M-15-962 (the Order).

On November 17, 2017, the Commission issued its Notice for Comment Period (Notice). The Notice requested comments on the Report regarding the following topics:

- Are there questions about the foundational elements or assumptions used in Xcel's hosting capacity report?
- Are there areas of improvement or modification that would make future hosting capacity reports more useful?
- Other issues or concerns related to this matter.

The initial round of comments were due on February 2, 2018. In addition to the Department's comments, two organizations filed comments on February 2, 2018: Interstate Renewable Energy Council, Inc. (IREC), and Fresh Energy. On February 22, 2018, Commission staff submitted a report facilitated by Lawrence Berkeley National Labs (LBNL) and produced by Power System Consultants (PSC). This report was produced as a result of an award of analytic support that the Commission received from the Department of Energy to assist in the review of Xcel's 2017 Hosting Capacity Report. The Department offers these reply comments in response to the initial comments submitted by IREC and Fresh Energy, and the LBNL/PSC report.

II. DEPARTMENT ANALYSIS

The Department's reply comments focus on three aspects: (1) points of agreement with aspects of the initial comments from IREC and Fresh Energy and the LBNL/PSC report that supplement the Department's position; (2) points of disagreement with aspects of the initial comments from IREC and Fresh Energy and the LBNL/PSC report for which the Department offers critical

insight; and (3) clarifications to certain aspects of the Department's initial comments that may be helpful to the Commission and other stakeholders.

A. POINTS OF AGREEMENT

1. Accuracy of the Hosting Capacity Analysis (HCA)

Page 9 of IREC's comments stated the following, in part:

> IREC requests that Xcel and the Commission consider a more comprehensive analysis that looks globally at Xcel's system and identifies representative circuits to test. Xcel could then run a power-flow based analysis to determine the actual hosting capacity of those circuits and compare those results to its DRIVE-based hosting capacity results.

The Department agrees that the identification of representative circuits to test is an ideal path forward in assessing the accuracy of the Hosting Capacity Analysis (HCA). Further, IREC's suggestion that a comparison of a power-flow-based analysis to Xcel's DRIVE-based hosting capacity results may result in a better understanding of the capabilities, limitations, and opportunities of the DRIVE tool.

At present, it is unclear what the full range of options are available to Xcel to measure the accuracy of the HCA, whether a third-party assessment is needed or valuable, or what other utilities in other jurisdictions are doing to validate the results of their HCA efforts. The Department notes that a California utility is finalizing publication of their comparative analysis of the DRIVE tool and the iterative capacity analysis method, in which the utility is assessing the accuracy of both methods.

The Department recommends that Xcel include in its next report: (1) the methodological options available to measure the accuracy of the HCA; (2) an explanation of why Xcel chose the approach taken to measure the accuracy of the 2017 report, and; (3) identification and analysis of industry best practices regarding measuring the accuracy of HCAs.[1]

2. Sensitivity Analysis

On page 7 of Fresh Energy's comments, they identify a number of Xcel's assumptions that Fresh Energy is concerned may understate minimum hosting capacity. Fresh Energy then suggest that conducting a sensitivity analysis could show the impact of varying these assumptions.

[1] To the extent that the study in California is instructive to this proceeding and future HCAs, it should be included in Xcel's analysis of the accuracy of the DRIVE tool and future HCAs if possible.

The Department agrees that a sensitivity analysis may be useful for future HCAs. The Department notes that many of the assumptions from the 2016 HCA were updated for the 2017 HCA, but the impacts of the change in these assumptions were not specifically measured. For instance, Xcel assumed that power factor was unity in the 2016 HCA, but then assumed a 0.98 leading power factor for all new installations, concluding that this can have a "fairly large effect."[2] Xcel did not define or further explain what impact varying this assumption can have on the results of the HCA. A sensitivity analysis is one way to measure that impact.

The Department is also interested in the impact that other assumptions can have on the HCA, and whether a sensitivity analysis of other assumptions are appropriate to perform. It may be best to select a few representative feeders in Xcel's distribution system, perform a sensitivity analysis, and compare the results. The specific methodology requires consideration of the usefulness of performing sensitivity analysis on a given variable, the time and resources that go into performing the sensitivity analysis, and whether meaningful changes are likely to result from performing a sensitivity analysis that improves the HCA overall.

The Department recommends that Xcel incorporate a sensitivity analysis into the HCA after consideration of, but not limited to, the factors listed above.

3. Zero-capacity Feeders

Both IREC and Fresh Energy identified what may be a peculiar result within the HCA results: there are certain feeders with zero hosting capacity.[3,4] Fresh Energy suggested the following as a potential explanation:

> Our review of Xcel's recent community solar DG Queue suggests a correlation between substations with large amounts of solar gardens active or in development and substations with zero minimum hosting capacity. Although the report's inputs are now lagging the published DG Queue by many months, it appears that all but nine[9] of these "zero" substations could be related to a community solar project.

[9] Averill, Lake City, Lake Lillian, Lester Prairie, Maple Lake, Medford Junction, Red River, Tracy Switching St, and Vesli have zero minimum hosting capacity but no community solar projects in the queue

[2] 2017 Xcel Distribution System Hosting Capacity Report (2017 Report), page 18.
[3] IREC Comments, page 23.
[4] Fresh Energy Comments, page 7.

The Department is supportive of eliciting a response from Xcel and of the questions stated on page 8 of Fresh Energy's comments immediately succeeding the paragraph referenced above.

As IREC notes, the relatively low penetration of Distributed Energy Resources (DERs) in Minnesota suggest that this result may be an aberration. Fresh Energy's helpful analysis suggests that it may be explained by Xcel's Community Solar Gardens. **The Department agrees that a further explanation of these feeders would be useful for stakeholders.**

4. Definition of Distributed Energy Resources

Both IREC and LBLN/PSC commented on Xcel's definition of DERs. On page 4 of the LBLN/PSC report, it states:

> PSC notes that Xcel's definition of DER is relatively narrow.[14] In PSC's opinion, Xcel's definition of DER is suited to the rapid growth in PV generation. However, it would not address the effects of possible rapid growth in domestic battery storage and electric vehicles.

14 For example, the California PUC's definition of DERs for the purpose of hosting capacity analysis includes distributed renewable generation such as PV and wind, energy efficiency, energy storage, electric vehicles, and demand response. However, the California utilities have not yet addressed all of these types of DERs in their hosting analysis. CPUC, Aug. 14, 2014.

On pages 21 and 22 of IREC's comments, it states:

> IREC is concerned by Xcel's narrow definition of DER and view of the behavior these technologies exhibit on the distribution system. Xcel defines DER as only including "sources of electric power," and states that "it did not take the load characteristics of DER devices such as energy storage into consideration" in its analysis [footnote omitted]. This is in contrast to common definitions of DER, which include both supply and demand side resources [footnote omitted]. Xcel's narrow analytic framework fails to account for the actual operating characteristics of energy storage—which frequently act only or primarily as a source of load—and consequently significantly limits how instructive the results are regarding the grid's capacity to host storage technologies [footnote omitted].

The Department also noted (initial comments, page 14) that Xcel did not include energy storage in its HCA. The Department considers this to be a limitation of the DRIVE tool used by Xcel to conduct the HCA. The Department shares IREC's concern, and endorses a broader definition of DER suggested by LBLN/PSC and IREC for the purposes of future HCAs. However, the Department does not believe that this issue is imperative at this time, due to the still immature market for energy storage in Minnesota.

As Xcel is forecasting greater penetration of both energy storage and other technologies, such as electric vehicles, the underlying tools and methodologies of the HCA should be able to model and account for these technologies. Currently, it appears that the EPRI DRIVE tool is unable to incorporate energy storage in its modeling. If that persists in future iterations of the model, and further, if other technologies are not able to be captured by the EPRI DRIVE tool, then the concerns raised by IREC become prescient.

The Department recommends that Xcel rely on a broadened definition of DERs to account for the suite of technologies that ultimately will impact the hosting capacity of Xcel's distribution system, including, but not limited to: traditional DER technologies such as solar PV and wind energy systems, energy efficiency, energy storage, electric vehicles, and demand response. Further, the Department recommends that Xcel provide an update in each report on the evolving capability of the EPRI DRIVE tool and whether it is capable of incorporating the technologies included in the broadened definition of DERs.

5. DER Allocation Method

On pages 5 and 6 of the LBNL/PSC report, PSC stated the following:

> Xcel states that it is responding to stakeholder feedback in changing to the Large Centralized method in its 2017 analysis. Xcel's forecasts suggest that new DER connection will be mostly large commercial installations instead of small domestic connections. PSC believes that this approach may overlook any rapid (and often viral) uptake in domestic rooftop PV that is prevalent in other jurisdictions. Some developers in other jurisdictions are installing PV on multiple household rooftops, owned by the developer and rented by the homeowner. In Minnesota, projects are being facilitated by a third party, but owned by a community or homeowner. In terms of total capacity (megawatts), small and distributed domestic PV has the potential to be large than the large centralized commercial PV. PSC suggests that in future hosting capacity analysis, Xcel include results using both the Small Distributed method and the Large Centralized method.

The Department notes that the Large Centralized method was chosen by Xcel to better capture the types of solar PV projects that developers are interconnecting, including Xcel's own

Solar*Rewards Community program.[5] This method, however, could fail to accurately capture a future scenario whereby smaller scale solar PV projects see an increase in interconnection, and could also fail to accurately capture other DERs such as energy efficiency, energy storage, electric vehicles, and demand response, as those are likely to be smaller and more distributed throughout Xcel's distribution system.

Toward that end, the Department understands that LBNL/PSC report's recommendation could be useful for future hosting capacity analyses and agrees that it would be ideal for Xcel to include results using both the Small Distributed method and Large Centralized method. It is not known whether this is technically feasible or economically practical. **Therefore, at this time, the Department recommends that Xcel consider the feasibility and practicality of including the results of both the Small Distributed methodology and the Large Centralized methodology in future hosting capacity analyses.**

B. POINTS OF DISAGREEMENT

1. Frequency of Analysis

On pages 13 and 14 of IREC's comments, they stated the following:

> …IREC urges the Commission to require Xcel to update its results more frequently, ideally on a monthly basis to start. The Commission could also consider somewhat less frequent updates for the entire grid, coupled with incremental updating of particular grid segments each time the hosting capacity of a feeder is assessed as part of the interconnection process.[27] Or it could consider a phased approach, requiring Xcel to gradually increase the frequency of its updating as it refines its methodology and works improves on software and hardware constraints. Ultimately, the frequency of updates should align with the Commission's goals and use cases for the hosting capacity: in particular, the closer to real-time, the more useful the results will be to streamline interconnection.

[27] *See [*Sky Stanfield & Stephanie Safdi*, Optimizing the Grid: A Regulator's Guide to Hosting Capacity Analyses for Distributed Energy Resources,* Interstate Renewable Energy Council, Inc. (Dec. 2017), available at https://irecusa.org/2017/12/tools-to-build-the-modern-grid] at 20 (discussing options to increase the frequency of updating)

The Department believes that IREC's proposals for the frequency of updating the HCA are an ideal goal in the long run. Currently, the value of the HCA decreases over the course of the year, and becomes less reliable and useful to developers as the year progresses. While this

[5] 2017 Report, pages 2-3.

may not be an urgent issue given that Minnesota isn't facing high levels of DER penetration, the time lag is a potential issue that can be addressed by proposals such as those offered by IREC.

The Department notes that it may be premature to require more frequent updating of the HCA. There are two primary reasons for this: (1) Xcel's methodology and assumptions are continuing to be refined as the Company learns from its experience in performing the HCA, from other stakeholders, and from utilities in other jurisdictions who are also engaged in this area; and (2) the accuracy and reliability of the DRIVE tool, and more importantly, of Xcel's model of its distribution system, are not fully validated. More frequent updates of an analysis with a flawed assumption, or of a model that isn't accurate, does not serve any of the stakeholders well, and can actually lead to increased interconnection costs for developers.

The Department recommends that the current, annual update of the HCA is appropriate at this time and until such time that Xcel's approach to the HCA is confirmed to be reliable and accurate.

2. Hosting Capacity Map Capabilities and Design

On pages 5 and 6 of Fresh Energy's comments, they made the following recommendations:

- Include "pop-up" windows to provide HC details, including limiting factors, for each node or line section. Figure 2 below shows a screenshot [not incorporated here] of some of the easily-accessible information on Southern California Edison's map, as an example.
- In addition to the color-coded maps, provide the HCA results in downloadable files, allowing customers and developers to perform analysis of the HCA results and to more easily identify DER opportunities and constraints.
- Provide downloadable feeder load profiles during peak and minimum load days to help customers and developers better understand circuit characteristics and associated DER opportunities and constraints.

Here, similar to the Department's position regarding the frequency at which the HCA is updated, the Department agrees that Fresh Energy's recommendations are ideal goals in the long run. However, at this time, the Department prefers that Xcel focus its resources on improving the underlying analysis and not on the public-facing presentation of the results. While this position may seem vulnerable to a false choice challenge, the Department's reasoning here is similar to our reasoning in our position regarding the frequency at which the HCA is updated: improving the public-facing presentation of an analysis with a flawed assumption, or a model that isn't accurate, does not serve any of the stakeholders well. In fact, it may mislead stakeholders into making investment decisions based on faulty criteria.

While the Department agrees that much more can be done to improve the public-facing presentation of the HCA, such as in a form similar Southern California Edison's map, it is premature to require Xcel to invest time and resources into creating a sophisticated presentation of the HCA. Incremental progress can and should be made, however, and exploring potential improvements to the hosting capacity map seems prudent. **Therefore, the Department recommends that Xcel explore a range of options for better presenting the public-facing results of the HCA after consideration of, but not limited to, any security and privacy issues may be implicated in providing more detailed information, and what information may be useful to developers and stakeholders.**

3. Interative Capacity Analysis

On pages 11 and 12 of IREC's comments, they stated the following:

> IREC would be pleased if the DRIVE tool, in which Xcel has already invested considerable time and resources, were able to achieve all identified hosting capacity use cases, including interconnection streamlining and improved planning. If Xcel is unable to demonstrate that this is the case, however, IREC encourages the Commission to consider implementation of other, more accurate methodologies. IREC notes that Xcel recognizes that an additional tool may be needed for the interconnection streamlining use case [footnote omitted].

One of the alternatives is the iterative approach, as discussed in the Department's initial comments.[6] This approach is explained by Xcel on page 8 of Xcel's 2017 Report:

> ...Iterative Capacity Analysis (ICA)…is an intensive analysis that tries to precisely answer the specific level of DER that can be accommodated at each node, through detailed power flow analysis that is similar to an interconnection engineering study. While this process is still being fully developed and refined, the intent is to enable bypassing an interconnection study altogether—with the rigorous analysis being done prior to application.

While the iterative method aims to streamline the interconnection process, it is computationally more time intensive. It seems that the DRIVE approach is the right stage of analysis given that Xcel is still working to improve the accuracy of their system model. It would not make sense to perform a resource-intensive analysis when the underlying system model still needs significant work.

[6] Department comments, pages 5 and 11.

For example, Xcel indicated that it will take significant additional time and investment to model the secondary voltage system where many small and distributed PV systems are interconnecting.[7] Xcel has indicated that it will need to develop a more detailed system model as a part of implementing Advanced Distribution Management System (ADMS) technology. Once this detailed system model is in place, and given the likelihood that penetration of PV on Xcel's system will be higher at that point, both on the primary and secondary voltage levels, it may make sense to leverage the detailed system model from ADMS in an iterative analysis approach once that becomes available.

The LBNL/PSC report also discusses the iterative method in contrast to the DRIVE tool. LBNL/PSC note that "DRIVE's analytical approach is fast but yields approximate solutions, while iterative power flow approaches are slower but yield more accurate solutions."[8] The report then goes on to say that access to the DRIVE tool and supporting documentation is limited by its costs to third-parties. While this is a concern for the transparency of the model, the LBNL/PSC report does not discuss the cost of access to the iterative method software or documentation. The Department expects that there is likely to be a similar barrier to transparency even if Xcel instead used the iterative method in its HCA.

While the Department shares concerns over the viability of the DRIVE tool in the long-run, at this time, it may be imprudent to invest in the iterative method given Xcel's limited ability to model its distribution system. Once Xcel has in place a better model of its system, facilitated by ADMS technology and other smart grid investments, a serious discussion should be entertained as to whether the DRIVE tool is capable of leveraging the more detailed understanding of the distribution system and how accurate and useful it is relative to the iterative method.

Therefore, at this time, the Department recommends that Xcel continue using the DRIVE tool in partnership with EPRI.

C. CLARIFICATIONS TO INITIAL COMMENTS

1. Load Profile Data and Feeder Characteristics

After further consideration of our request for additional information regarding load profile data and feeder characteristics that was made in our initial comments, and in an effort to ensure that parties understand the precise nature of our request, the Department provides the following clarification of our request.[9]

[7] Xcel response to PUC IR No. 7, dated January 22, 2018.
[8] LBNL/PSC report, page 7.
[9] Department comments, page 10.

For DER siting and long-term distribution planning, it would be helpful to have more detailed data on load profile assumptions used in the analysis, including:

- Peak load (kW and kWh) by substation and feeder
- Customer sector characteristics by feeder (*e.g.*, % residential, % commercial)
- Any reasonable information for hourly load profile assumptions and the basis for such assumptions (SCADA, metered data, etc.).

III. CONCLUSION

The Department appreciates the opportunity to comment further on Xcel's 2017 Distribution System Hosting Capacity Report and looks forward to working with all stakeholders to improve future HCAs.

Based on review of stakeholder comments, the Department makes the following recommendations:

(1) *Accuracy.* The Department recommends that Xcel include in its future reports: (1) the methodological options available to measure the accuracy of the HCA; (2) an explanation of why Xcel chose the approach taken to measure the accuracy of the 2017 report, and; (3) identification and analysis of industry best practices regarding measuring the accuracy of HCAs.

(2) *Sensitivity Analysis.* The Department recommends that, for future reports, Xcel consider incorporating sensitivity analysis into future HCAs where appropriate.

(3) *Zero-Capacity Feeders.* The Department recommends that Xcel provide an explanation in future reports of why the results of the HCA suggest that a sizable number of feeders report having zero hosting capacity, including whether these are a potential source of modeling error, whether they are related to Xcel's Community Solar Garden program, and/or other explanation.

(4) *Definition of DER.* The Department recommends that in its future reports Xcel rely on a broadened definition of DERs to account for the suite of technologies that ultimately will impact the hosting capacity of Xcel's distribution system, including, but not limited to: traditional DER technologies such as solar PV and wind energy systems, energy efficiency, energy storage, electric vehicles, and demand response technologies. Further, the Department recommends that Xcel provide an update in each report on the evolving capability of the EPRI DRIVE tool and whether it is capable of incorporating additional technologies that affect hosting capacity.

(5) *DER Allocation Method.* The Department recommends Xcel consider the feasibility and practicality of including the results of both the Small Distributed methodology and the Large Centralized methodology in future hosting capacity analyses.

(6) *Frequency of Analysis.* The Department recommends no change in the current, annual update of the HCA at this time.
(7) *Hosting Capacity Map Capabilities and Design.* In its next report, the Department recommends that Xcel consider the options available to improve the capabilities and design of the current hosting capacity map after consideration of security and privacy issues, and what information may be most useful to developers and stakeholders.
(8) *Iterative Capacity Analysis.* The Department recommends that Xcel continue using the DRIVE tool in partnership with EPRI.
(9) *Load Profile Data and Feeder Characteristics.* The Department clarifies our request that Xcel provide additional information on load profile assumptions and feeder characteristics:
    - Peak load (kW and kWh) by substation and feeder
    - Customer sector characteristics by feeder (*e.g.*, % residential, % commercial)
    - Any reasonable information for hourly load profile assumptions and the basis for such assumptions (SCADA, metered data, etc.).

/lt

CERTIFICATE OF SERVICE

I, Sharon Ferguson, hereby certify that I have this day, served copies of the following document on the attached list of persons by electronic filing, certified mail, e-mail, or by depositing a true and correct copy thereof properly enveloped with postage paid in the United States Mail at St. Paul, Minnesota.

Minnesota Department of Commerce
Reply Comments

Docket No. E002/M-17-777

Dated this 28th day of February 2018

/s/Sharon Ferguson

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