BEFORE THE MINNESOTA PUBLIC UTILITIES COMMISSION

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In the Matter of Xcel's 2018 Hosting Capacity Study

ISSUE DATE: August 15, 2019

DOCKET NO. E-002/M-18-684

ORDER ACCEPTING STUDY AND SETTING FURTHER REQUIREMENTS

## PROCEDURAL HISTORY

On November 1, 2018, Northern States Power Company d/b/a Xcel Energy (Xcel) filed its 2018 Hosting Capacity Study (Study), including its hosting capacity analysis (HCA).

On February 28, 2019, the Commission received comments on the Study from Fresh Energy and the Department of Commerce, Division of Energy Resources (the Department).

By March 29, 2019, the Commission had received reply comments from the Department, the Interstate Renewable Energy Council (IREC), and Xcel.

On May 30, 2019, the Study came before the Commission.

## FINDINGS AND CONCLUSIONS

### I. Summary

The Commission accepts Xcel's 2018 Study as fulfilling statutory requirements, and notes that additional analysis will be warranted in the future. Accordingly, the Commission provides direction for Xcel's future hosting capacity studies.

### II. Background

The Electric Power Research Institute (EPRI) defines hosting capacity as the amount of distributed energy resources (DER) that can be accommodated on the existing system without adversely affecting power quality or reliability under existing control configurations and without requiring infrastructure upgrades.[1] A hosting capacity analysis evaluates a utility's distribution

[1] EPRI, *Impact Factors, Methods and Considerations for Calculating and Applying Hosting Capacity, 2018 Technical Update*, at v.

system to find locations where DER may interconnect, as well as mitigation measures that might enhance the distribution system's capacity to accommodate interconnection.

In 2015 the Legislature adopted Minn. Stat. § 216B.2425, subdivision 8, as follows:[2]

> Each entity subject to this section that is operating under a multiyear rate plan approved under section 216B.16, subdivision 19, 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, and shall include the study in its report required under subdivision 2 [the Biennial Transmission Projects Report].

Xcel, as the only utility operating under a multi-year rate plan, then began filing its "hosting capacity studies." At parties' request, Xcel agreed to file this study annually, and therefore files it separately from its Biennial Transmission Projects Report.[3] The Commission issued orders reviewing Xcel's hosting capacity studies in 2017 (2017 Order)[4] and 2018 (2018 Order),[5] each time establishing additional requirements for the subsequent study.

## III. Xcel's 2018 Study

As with prior hosting capacity studies, Xcel continues to rely on EPRI's Distributed Resource Integration and Value Estimation (DRIVE) tool. The tool develops a model of Xcel's distribution system and analyzes where interconnecting a new source of generation might trigger a range of problems that would require mitigation.

In response to the Commission's 2018 Order, Xcel evaluated and modeled its 228 distribution substations and 1,049 feeders in Minnesota, and provided a spreadsheet with the results of the analysis. A distribution substation is a part of the utility's distribution system that transforms voltage from high to low, or the reverse, among other functions. Feeders are cables that branch out from the substation to distribution transformers. Secondary conductors then extend from the transformer at secondary voltage, and deliver electricity to customers via service drops.

The DRIVE tool incorporates Xcel's data and assumptions about its distribution system—such as each substation's and feeder's peak load, and the location and operating characteristics of DER seeking to interconnect—to identify where mitigation measures may be needed to accommodate new DER. Xcel analyzed various scenarios involving adding generators to its distribution

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[2] 1 Laws Sp. 2015, Ch. 1, Art. 3, § 22.

[3] *See In the Matter of Xcel's 2017 Hosting Capacity Study*, Docket No. E-002/M-17-777 (July 19, 2018) (2018 Order), Ordering Paragraph 8.

[4] *In the Matter of Xcel Energy's Biennial Transmission and Distribution Plan: Distribution System Study – Hosting Capacity Report*, Docket No. E-002/M-15-962, Order Setting Additional Requirements for Xcel's 2017 Hosting Capacity Report (August 1, 2017).

[5] *See* 2018 Order, *supra*, n.3.

system, but did not analyze scenarios involving new sources of DER load—load which could include energy storage and electric vehicles. Xcel explains that it regards that kind of analysis as more appropriate to its Integrated Distribution Plan docket.[6] Nevertheless, Xcel notes that the DRIVE tool has the capacity to analyze these newer forms of DER, and plans to explore these more sophisticated functions in the future.

Based on the DRIVE tool's analysis, Xcel reports each feeder's minimum and maximum hosting capacity. These figures are intended to provide useful signals to a DER developer, indicating that a feeder may be able to accommodate a new generator with capacity below the minimum hosting capacity, and would not be able to accommodate a new generator with capacity above the feeder's maximum hosting capacity, without additional mitigation measures. A feeder might be able to accommodate a generator with capacity between the minimum and maximum, depending on additional analyses.

Xcel offers a number of provisos regarding these figures, however. The total system figures reflect the sum of the capacity calculations on individual feeders, without considering their cumulative effect: If every feeder added generation up to its maximum hosting capacity, this could overwhelm the substation's capacity. And out of the 1,049 feeders, Xcel identified 95 that had no remaining capacity to host additional DERs.

Consistent with the 2017 Order, Xcel makes the results of its hosting capacity analysis available via a spreadsheet as well as on a public-facing, color-coded online map. The map shows areas marked in green, yellow, and red, indicating where, as of the time of the analysis, the local feeders had capacity, might have had capacity, or lacked capacity. Finally, Xcel's 2018 Study provides a table identifying where it addresses each of the requirements of the Commission's 2018 Order.

## IV. Comments on the Study

The Commission received comments on, among other topics, (a) whether Xcel's report fulfilled the requirements of the statute and Commission orders, (b) the kinds of data to be generated, (c) the purpose of the Study, and the precision required, and (d) methods to improve the Study.

### A. Completeness and Compliance with Statute and Commission Order

According to Xcel, the 2018 HCA fulfills the requirements of statute and prior Commission orders. Having reviewed the Study, the Department concludes that it satisfies the two primary statutory objectives: identifying a reasonable and sufficient number of interconnection points on the distribution system, and identifying upgrades necessary to support continued development of distributed generation. After acknowledging that this year the Study did not accompany Xcel's Biennial Transmission Projects Report, as authorized by Commission order, the Department concludes that the statute's requirements have been satisfied.

In contrast, Fresh Energy argues that Xcel's HCA fails to fulfill the requirements of the 2018 Order, Ordering paragraphs 2, 3, 4, 6, and 7(d), (f), and (g), as discussed further below. And more generally, both Fresh Energy and IREC question whether Xcel's HCA fulfills the statutory obligation of Minn. Stat. § 216B.2425, subd. 8, to –

[6] *See* Docket No. E-002/CI-18-251, *In the Matter of Xcel Energy's 2018 Integrated Distribution Plan.*

> identify interconnection points on its distribution system for small-scale distributed generation resources and … identify necessary distribution upgrades to support the continued development of distributed generation resources….

These commenters argue that Xcel's 2018 Study does little to identify workable points for interconnecting small-scale generators, or to identify useful upgrades or other mitigation strategies to facilitate the continued development of DERs.

## B. Substation and Feeder Data

### 1. Overview

The 2018 Order directed Xcel as follows:

> 7.f. [Xcel must] file more detailed data on load profile assumptions used in the analysis, including peak load … by substation and feeder.

The Department, Fresh Energy, and IREC recommend that Xcel include in its HCA additional location-specific information both in the spreadsheets and in the public facing hosting capacity map. Specifically, they recommend that the Study reveal data by substation and feeder not only for (a) peak load, but also for (b) minimum daytime loads, (c) DER that are already installed, and (d) proposed DER that are in queue awaiting analysis for installation. IREC clarifies that it supports disclosing each DER's actual generation profile rather than nameplate generating capacity, and disclosing each feeder's voltage.

Xcel states that it did not include peak load data for each substation and feeder out of concern that bad actors might use this information to target attacks on the distribution grid where they could do the most damage. And Xcel claims that it currently lacks an efficient method to forecast load profiles, but that it is exploring this matter further in the context of its Integrated Distribution Plan.

### 2. Minimum Daytime Load

Adding a new source of energy to a feeder can lead to unintentional islanding, voltage deviations, protection mis-coordination, and other harms. But those risks may be reduced when the amount of power added to a feeder is no more than the feeder's minimum daytime demand. Consequently developers value knowing each feeder's minimum daytime load.

Xcel claims that it lacks any automated method to determine each feeder's minimum daytime load. Xcel reports that its Supervisory Control and Distribution Automation (SCADA) system does not collect this data for 39 % of its feeders—although these feeders serve only 10 % of Xcel's customers. Xcel estimates that automating data collection on all of its remaining feeders would cost $30–40 million, while generating this data manually would require engineers to spend an additional 1250–1600 hours. So instead, Xcel estimates the daytime minimum load at

20 % of each feeder's peak load, based on a paper by the National Renewable Energy Laboratory[7] and Xcel's analysis of its own system.

The Department, Fresh Energy, and IREC recommend that Xcel add daytime minimum load data to the HCA Report. According to Fresh Energy, the limiting factor on 84 % of Xcel's feeders relates to "reverse power flow" which may arise when a feeder's power supply exceeds the power demand; a more precise assessment of a feeder's minimum daytime load would permit a more precise assessment of a feeder's limitations.

However, given the cost of determining each feeder's minimum daytime load, the Department concludes that Xcel should pursue greater precision through working with EPRI, not by extending Xcel's SCADA systems to every feeder.

### 3. Distributed Generators, Installed and in Queue

In seeking a location to interconnect with Xcel's distribution grid, a developer will want to know not only the amount of load on the feeder, but the amount of generation supplying that feeder. In particular, they want to know how much DER capacity has already connected to a given feeder, and how much capacity is in queue awaiting further action. Accordingly, the Department, Fresh Energy, and IREC ask that the Study provide this information in the HCA's spreadsheet and on its map.

Xcel emphasizes that its annual hosting capacity studies merely provide information about the status of its distribution network at a point in time. Xcel argues that its annual HCA combined with the information available in Xcel's Solar*Rewards Community interconnection queue[8]—which Xcel updates monthly—already provides much of the information the commenters seek. And because the queue will now reflect all pending DER interconnection applications, Xcel argues that it should prove more useful than ever.

That said, Xcel expressed concerns about developers placing undue reliance on the map. Xcel intends the map to provide information about the hosting capacity at a "given general location."[9] Xcel did not design it to displace the need to consult the feeder spreadsheet or take subsequent steps in the interconnection process, as discussed further below.

### 4. Security and Customer Privacy

The 2018 Order directed Xcel as follows:

> 4. Xcel must file 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

[7] "Updating Interconnection Screens for PV System Integration." The file can be found online at https://www.nrel.gov/docs/fy12osti/54063.pdf (last accessed May 2, 2019).

[8] *See generally* Docket No. E-002/M-13-867, *In the Matter of the Petition of Northern States Power Company, d/b/a Xcel Energy, for Approval of its Proposed Community Solar Garden Program.*

[9] Xcel's 2018 HCA, at 21.

> security concerns arise, Xcel must explain in detail the basis for those concerns.
>
> 7.d. [Xcel must] explore a range of options for better presenting the public-facing results of the Hosting Capacity Analysis after consideration of, but not limited to, any security and privacy issues that may be implicated in providing more detailed information and what information might be useful to developers and stakeholders….

IREC and Fresh Energy argue that Xcel's HCA maps fail to disclose the level of hosting capacity per feeder. IREC cites with approval the hosting capacity maps issued by utilities in California and New York, as well as by Exelon Corporation utilities. While addressing privacy and security concerns, these utilities also present maps that identify, for each feeder, information on the name of the feeder's substation, the substation's capacity, the capacity of distributed generation connected, the capacity of distributed generation in queue, and the load profile. Fresh Energy gives special attention to the hosting capacity maps offered by the utilities in Exelon's Pepco Holding Company, including the utilities that serve Washington, DC. Fresh Energy questions the suggestion that Minnesota utilities have a greater need for security than Washington DC utilities do.

Xcel argues that revealing this level of detail could threaten grid security and customer privacy because detailed grid information would enable a bad actor to target attacks on the distribution grid where they could do the most damage. In addition, disclosing this information in a publicly available forum such as the HCA could reveal sensitive information about customers connected to a given feeder. While the Commission's orders governing personally identifiable information and customer energy usage data do not specifically apply to Xcel's HCA, Xcel argues that these policies instruct Xcel to balance privacy concerns with other public policy objectives. Given Xcel's relatively modest expectations for the HCA, Xcel elects to err on the side of security and privacy.

### C. Study's Use for Guiding Investment in Distribution System

The 2018 Order directed Xcel as follows:

> 3. Xcel's 2018 Hosting Capacity Report must be detailed enough to inform future distribution system planning efforts and upgrades necessary to facilitate the continued efficient integration of distributed generation.
>
> 7.g. [Xcel must] file supplemental information that would result in a broader understanding of how to guide distribution upgrades for additional hosting capacity.

The Department and Fresh Energy question whether the 2018 HCA achieves the objective of guiding Xcel's investment in distribution plant in a manner that would best facilitate adding DERs. More specifically, they question whether the DRIVE tool selected by Xcel has the capacity to identify appropriate upgrades to Xcel's distribution system.

The Department recommends that the HCA provide information on how often a given feeder faces constraints, options for mitigating the constraints (including a range of costs) for the feeder, and the amount of hosting capacity that might be gained thereby, among other things.

Fresh Energy recommends that Xcel analyze each of the 95 feeders that the HCA reports as having no capacity to host distributed generation. According to Fresh Energy, this analysis could inform an evaluation of various options for increasing hosting capacity where it is most constrained.

Xcel claims that some of the information commenters seek is already available; for example, its spreadsheet already lists how often a constraint occurs across its system. But Xcel argues that much of the other information could be found only via an engineering study. In general, Xcel estimates that the cost to mitigate a feeder's constraints may range from $50,000 to $1 million. More specific estimates—and a fuller understanding of the consequences of implementing various mitigation strategies—would require conducting an interconnection study on a specific DER proposal.

### D. Analysis of Small Distributed Generators vs. Large Centralized Generators

The 2018 Order directed Xcel as follows:

> 7.b. [Xcel must] 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….

The DRIVE tool permits Xcel to analyze its system with a focus on the needs of either small distributed generators (for example, a residence's rooftop solar panels), or larger, centralized generators (for example, a one-MW community solar garden). In creating its first HCA, Xcel conducted an analysis focusing on small distributed generators. But in subsequent HCAs, Xcel has focused on large centralized generators. As a consequence, the HCA provides less guidance for interconnecting small distributed generators.

Xcel cites three rationales for its choice to analyze larger, centralized generators rather than smaller ones. First, most of the generating capacity connecting to Xcel's system comes from large centralized generation. Second, Xcel lacks data on the many kinds of secondary voltage equipment used to connect some small distributed generators. And third, preparing a HCA for both small and larger generators would be prohibitively burdensome—basically requiring Xcel to conduct large amounts of the analysis twice.

Having reviewed Xcel's arguments, the Department supports Xcel's choice to conduct its DRIVE tool analysis focusing on large centralized generators rather than smaller distributed ones. Nevertheless, the Department recommends that Xcel review this choice in its next HCA. Specifically, the Department recommends that the study include updated analyses of –

- the appropriateness of the methodological choice of the hosting capacity analysis,
- a discussion of Xcel's ability to obtain more detailed data on secondary voltage equipment,

- the types of DER being interconnected to Xcel's system, and

- the evolving capabilities of the DRIVE tool, including its capacity to take account of technologies included in the broadened definition of DER—technologies such as energy storage and electric vehicles.

### E. Limitations of the DRIVE Tool

The 2018 Order directed Xcel as follows:

> 7.e. [Xcel must] 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….

The Department recommends that Xcel continue reporting on the DRIVE tool's evolution. In addition, the Department recommends that Xcel include in its next hosting capacity analysis a discussion of how the HCA can be used to assist state energy policy goals related to increased use of renewable energy, and clarify how the analysis can take account of distributed resources with new load characteristics.[10]

Fresh Energy and IREC expressed concerns about the DRIVE tool's inability to incorporate load data into its analysis—especially regarding energy storage and electric vehicles—and its limitations in generating data for individual feeders. Fresh Energy identifies a number of criteria for evaluating the DRIVE tool.

And all commenters recommend that Xcel conduct a cost/benefit analysis of its HCA. They note that Xcel acknowledges spending 2000 hours to run its current analysis, and even with the benefit of greater experience, Xcel does not expect to be able to reduce that figure below 1000 hours. Accordingly, the commenters recommend that Xcel evaluate the money and time invested in conducting its analysis, disaggregated by category and personnel involved, and also survey the HCA's potential users to determine what value they derive from it.

### F. Purpose of Hosting Capacity Study, and Corresponding Need for Precision

Questions about the DRIVE tool's limitations are part of a larger discussion about the purpose of Xcel's Hosting Capacity Study. Commenters disagree about the HCA's purpose, and therefore about the degree of precision required to achieve that purpose. In its 2018 Order the Commission provided the following instructions:

> 2. Xcel's 2018 Hosting Capacity Report must be detailed enough to provide developers with a reliable estimate of the available level of hosting capacity per feeder at the time of submittal of the report to the extent practicable. The information should be sufficient to provide developers with a starting point for interconnection applications.

[10] Department reply comments, at 4.

. . . .

6. Xcel must provide information on the accuracy of the Hosting Capacity Report information; both estimates on the accuracy of the 2018 report and an analysis of the 2017 results compared to actual hosting capacity determined through any interconnection studies or other reasonable metric.

7.a. [Xcel must] consider the methodological options to both improve and measure accuracy of the hosting capacity analysis, including identification and analysis of industry best practices and an explanation of Xcel's methodological choice….

Fresh Energy and IREC question whether Xcel's HCA meets these standards. IREC reported that developers are not using and do not trust Xcel's hosting capacity maps or analysis to provide them with a useful starting point for preparing an interconnection application.[11] And according to Fresh Energy, the Study does not provide developers with a reliable estimate of the available level of hosting capacity at a given feeder. Surveying six developers of DER projects, Fresh Energy claimed that many found the hosting capacity analysis map to be "of almost no value at all," and found that most of the time Xcel's interconnection screening process (discussed below) indicated more capacity than the HCA map did.[12]

Fresh Energy recommends that Xcel analyze a representative assortment of feeders using its DRIVE tool and other methodologies, and would recommend discontinuing reliance on the DRIVE tool if it cannot generate results that match the results of interconnection studies.

Xcel defends the accuracy of its HCA, reporting that the results corresponded with the results of the application screening process in 19 of 21 locations tested. Nevertheless, Xcel proposes to continue working with EPRI on developing best practices as HCA, interconnection processes, and tools continue to evolve.

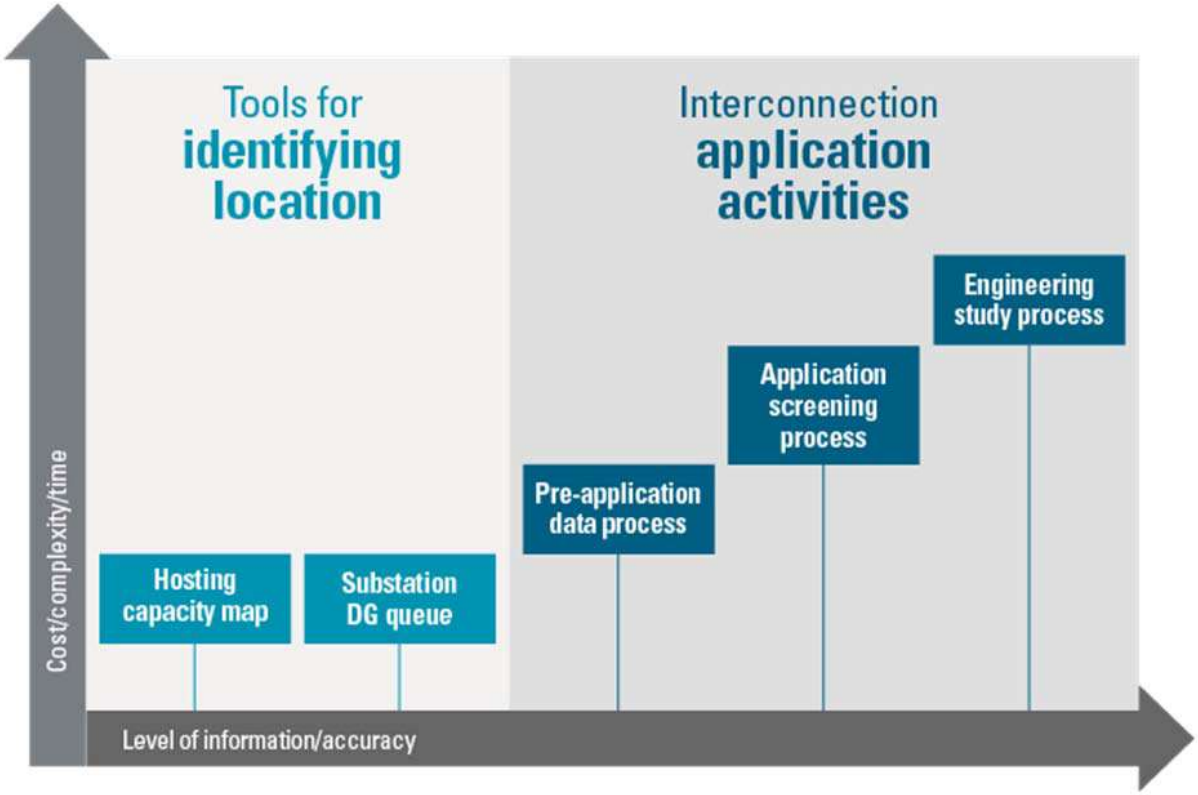
More generally, Xcel states that commenters' expectations for the HCA exceed Xcel's, in that commenters appear to expect it to replace portions of the Minnesota DER Interconnection Process (MN DIP).[13] Xcel provided Figure 1 to describe the relationship between various steps in the interconnection process.

[11] IREC replies, at 3.

[12] Fresh Energy comments, at 2.

[13] *See In the Matter of Updating the Generic Standards for the Interconnection and Operation of Distributed Generation Facilities Established Under Minn. Stat. § 216B.1611,* Docket No. E-999/CI-16-521, Order Approving Tariffs with Modifications and Requiring Compliance Filings (April 19, 2019).

**Figure 1: Tools and processes for interconnecting Distributed Energy Resources with Xcel's distribution system[14]**




Xcel offers the hosting capacity map and tabular data free of charge with the expectation that it, combined with the list of community solar garden projects already queued up for interconnection with Xcel's distribution system, will provide a quick estimate of the available capacity for adding DER at a general location. But Xcel states that it never intended the HCA to substitute for the later interconnection processes, which entail increasing cost and complexity based on the details of a specific DER proposal. According to Xcel, software developers have only begun exploring how to create a fully automated interconnection process—and designing the hosting capacity analysis for this purpose would limit its use` for other purposes.

But if the Commission were to conclude that the HCA should become part of the MN DIP, Xcel argued, then all electric utilities in Minnesota would need to generate HCAs.

## V. Commission Action

### A. Acceptance of 2018 Hosting Capacity Study

Although the Study is not subject to approval, the Commission reviews it for compliance with the requirements of statute and past orders, and takes the opportunity to provide guidance for future studies. Identifying changes that can improve the quality of the study furthers the statute's underlying policy objectives, and the Commission appreciates the thorough and incisive analyses of the parties and their continuing participation in this ongoing process.

[14] Xcel comments, at 18; Xcel reply comments, at 17.

The Commission concurs with the Department that the Study complies with the Commission's 2018 HCA Order, and will therefore accept the Study. However, the Commission shares the commenters' concerns that the HCA may not be fulfilling the Commission's overall objective of providing meaningful assistance to developers seeking to identify locations on Xcel's distribution grid to interconnect their DER. Therefore, consistent with its past HCA orders, the Commission will identify areas for additional focus in Xcel's next HCA.

### B. Data Acquisition and Display

The Commission is persuaded to adopt many of the Department's recommendations for improving Xcel's HCA in the future. Broadly, the Commission will direct Xcel to work with stakeholders to improve the value of Xcel's HCA, including but not limited to the provision of more detailed substation, feeder, and other equipment data in the hosting capacity map.

More specifically, the Commission will continue to require Xcel to provide resource developers with data disaggregated by substation and feeder, in both spreadsheet format and in its color-coded hosting capacity map. But prospectively this obligation will include the duty to provide, when available, data on each feeder's peak load, daytime minimum load, installed generation capacity, and queued generation capacity. Consistent with this objective, the Commission will direct Xcel to give priority to tracking and updating actual feeder daytime minimum load data for each feeder. Xcel may append appropriate disclaimers about the data's lack of accuracy, precision, and timeliness.

That said, the Commission acknowledges the tension between the need to provide information to support the continued development of DER, and the need to protect customer privacy and system security. Accordingly, the Commission will qualify Xcel's duty to provide the information specified above when providing the information publicly would violate a specific data privacy requirement or pose a significant security risk to Xcel's system or its customers. In that event, Xcel must provide the Commission with a full description and specific basis for withholding that information, including any claim that the information is Trade Secret.

### C. Pro-active Exploration of Mitigation Options

Minn. Stat. § 216B.2425, subd. 8, does not merely require Xcel to identify hosting capacity, but also to "identify necessary distribution upgrades to support the continued development of distributed generation resources." To this end, the Department proposes that Xcel analyze each feeder and report the following:

- The frequency at which the constraints to individual feeders occur throughout the distribution system.

- A range of potential costs for the full range of mitigation options available for an individual feeder and a range of total costs.

- How much additional hosting capacity could be obtained by implementing the identified mitigation options on a technical and economic basis (that is, the technical potential of the mitigation options and the economic potential of the mitigation options).

- Whether there would be a cost-effective impact on the value of DERs if such mitigation options were pursued (that is, identify the effect of the potential mitigation options on the value proposition of DERs).

Fresh Energy identifies a variety of strategies to increase hosting capacity, including advanced voltage regulation, incremental distribution system capacity, sensors, and automation. And Fresh Energy proposes that Xcel conduct an analysis of the 95 feeders that Xcel identified as having no capacity to host additional DER.

Xcel emphasizes the DRIVE tool's flexibility and utility in providing analyses not merely for facilitating interconnection for individual developers, but for finding optimal strategies for achieving state clean energy goals. Moreover, Xcel reports that EPRI is constantly developing the DRIVE tool's capabilities; for example, the tool can now anticipate "reverse power flow" dynamics that might limit interconnection. On the other hand, Xcel argues that it would be prohibitively burdensome to evaluate every mitigation strategy for every substation and feeder, even with benefit of the DRIVE tool.

Balancing these concerns, the Commission will decline to adopt the Department's recommendation. Instead, the Commission will adopt Fresh Energy's proposal to have Xcel analyze the 95 feeders identified as having no hosting capacity. These are where the capacity constraints are greatest, and an analysis may permit Xcel to explore various strategies for alleviating constraints. As part of this analysis, the Commission will direct Xcel to answer the Department's list of questions. To be clear, when Xcel assesses the range of potential costs for the full range of mitigation options available for an individual feeder, it should consider how the capabilities of various DER affect these options.

The Commission will also direct Xcel to provide an update on the evolving capabilities of the DRIVE tool. This update should include a discussion of whether the tool can incorporate data on the broader range of technologies included within the definition of DERs, and discuss how Xcel's hosting capacity analysis can help achieve state energy policy goals related to beneficial electrification. As a point of comparison, Xcel must also provide a discussion of the tools and analyses used by utilities in other jurisdictions—in particular, Pepco Holdings and other Exelon Corporation utilities.

Finally, the Commission agrees with Fresh Energy and IREC that Xcel's 2019 Study provides limited information on how new forms of DER load—such as energy storage and electric vehicles—affect a feeder's hosting capacity, or about how the choice of interconnection point along a feeder affect hosting capacity. While relatively few customers have adopted energy storage and electric vehicles to date, Xcel should be preparing for the contingency when these technologies are more widely used. Accordingly, the Commission will direct Xcel to demonstrate if the DRIVE tool is able to identify a feeder's hosting capacity while incorporating information about different locations and levels of generation and load.

### D. Accuracy and Precision of the HCA

Xcel and the commenters have quite different ambitions for a HCA, and seek Commission guidance on which objectives Xcel should pursue. More sophisticated objectives will entail greater cost and effort—but the relative costs and benefits have not been well developed in the record.

Accordingly, the Commission will direct Xcel to collaborate with stakeholders in evaluating the costs and benefits associated with developing and implementing a HCA with increasing levels of sophistication—that is,

- A HCA able to provide an early indicator of possible locations for interconnection;
- A HCA able to replace or augment initial review screens and/or supplemental review in the interconnection process; and
- A HCA able to automate interconnection studies.

This information will inform further discussions about the appropriate expectations for the HCA, which is a necessary first step in evaluating the appropriate methods for developing the HCA.

## E. Compliance Filings

### 1. 2019 Hosting Capacity Study

In addition to the requirements the Commission has already discussed, the Commission will direct Xcel to provide the following further information in its next hosting capacity study:

- Updates on the appropriateness of the methodological choice of the hosting capacity analysis, a discussion of Xcel's ability to obtain more detailed secondary voltage equipment data, and the types of DERs being interconnected in future reports.
- All costs related to the hosting capacity exercise, including the time of Xcel's engineering staff and any efforts Xcel is making to reduce the costs over time.
- Information on the number of pre-application capacity screens conducted in the previous year, the amount collected for each, and the total amount collected to conduct the pre-application screens, in the previous year.

### 2. Future Hosting Capacity Studies in General

Finally, the Commission will direct Xcel to do the following as part of all its hosting capacity studies:

- Re-evaluate Xcel's choice to focus its hosting capacity analysis on large centralized DERs rather than smaller ones.
- Discuss Xcel's ability to obtain more detailed data on secondary voltage equipment, and the types of DERs being interconnected to Xcel's system.
- Continue to consider and address relevant requests from parties.
- Continue to consider and address the requirements from all prior hosting capacity orders, including this one.

In this manner, Xcel will provide the Commission and all interested stakeholders with information not only to facilitate interconnection, but to evaluate the hosting capacity analysis going forward.

## ORDER

1. The Commission accepts the 2018 Hosting Capacity Study filed by Northern States Power Company d/b/a Xcel Energy as satisfying the requirements of the Commission's Order Accepting Study and Setting Further Requirements (July 18, 2018) in Docket No. E-002/M-17-777, *In the Matter of Xcel's 2017 Hosting Capacity Study*, but finds that improved and additional information is necessary in future reports to satisfy the requirements of Minn. Stat. § 216B.2425, subd. 8.

2. Regarding data acquisition and display,

   A. Xcel shall work with stakeholders to improve the value of Xcel's hosting capacity analysis, including but not limited to the provision of more detailed substation, feeder, and other equipment data in its public-facing hosting capacity map.

   B. In spreadsheet format, Xcel shall provide hosting capacity data by substation and feeder, with appropriate disclaimers about the data's accuracy, precision, and timeliness. The data shall include, when available, peak load, daytime minimum load, installed generation capacity, and queued generation capacity

   C. Xcel shall provide the same information in its public-facing hosting capacity map, except to the extent that publicly disclosing this data would violate specific data privacy requirements or pose a significant security risk to Xcel's system or its customers. If Xcel withholds any information on this basis, Xcel shall provide the Commission with a full description and specific basis for withholding the information, including any Trade Secret claims.

   D. Xcel shall make the tracking and updating of actual feeder daytime minimum load a priority in 2019, and include those values in its 2019 hosting capacity analysis.

3. Regarding the 95 feeders that Xcel identifies has having no hosting capacity, Xcel shall –

   A. Complete an individual analysis of the feeders and available options for increasing their hosting capacity.

   B. Provide the following information for each feeder:

      1) The frequency at which the constraints to individual feeders occur.

      2) The full range of mitigation options for an individual feeder, including DER capabilities, a range of potential costs for each of the mitigation options available, and a range of total costs.

3) The amount of additional hosting capacity that could be obtained by implementing the identified mitigation options on a technical and economic basis (that is, the technical potential of the mitigation options and the economic potential of the mitigation options).

4) Cost-effective mitigation options that might improve the economic viability of DERs, and the size of the financial benefit these options might provide.

4. Xcel shall provide at least one example, using the DRIVE tool to the extent practicable, exploring a feeder's hosting capacity with different locations and levels of generation and load.

5. Xcel shall provide a complete analysis of the DRIVE tool, including the following:

A. A report on the evolving capabilities of the DRIVE tool and whether it is capable of incorporating the technologies included in the broadened definition of DERs, including a discussion of how Xcel's hosting capacity analysis can be used to assist state energy policy goals related to beneficial electrification.

B. A comparison of other methodologies and interconnection study results on a selection of representative feeders, including a discussion of the tools and analyses used by other utilities in other jurisdictions—in particular, Pepco Holdings and other Exelon Corporation utilities.

6. Xcel shall collaborate with stakeholders in evaluating the costs and benefits associated with a hosting capacity analysis able to achieve the following objectives:

A. remaining an early indicator of possible locations for interconnection;

B. replacing or augmenting initial review screens and/or supplemental review in the interconnection process; and/or

C. automating interconnection studies.

7. In its 2019 Report, Xcel shall include—in addition to the requirements set forth above—the following:

A. Updates on the appropriateness of the methodological choice of the hosting capacity analysis, a discussion of Xcel's ability to obtain more detailed secondary voltage equipment data, and the types of DERs being interconnected in future reports.

B. All costs related to the hosting capacity exercise, including the time of Xcel's engineering staff and any efforts Xcel is making to reduce the costs over time.

C. Information on the number of pre-application capacity screens conducted in the previous year, the amount collected for each, and the total amount collected to conduct the pre-application screens, in the previous year.

8. In future hosting capacity reports, Xcel shall do the following:

   A. Re-evaluate Xcel's choice to focus its hosting capacity analysis on large centralized DERs rather than smaller ones.

   B. Discuss Xcel's ability to obtain more detailed data on secondary voltage equipment, and the types of DERs being interconnected to Xcel's system.

   C. Continue to consider and address relevant requests from parties.

   D. Continue to consider and address the requirements from the 2017 Order, 2018 Order, and the current order.

9. This order shall become effective immediately.

BY ORDER OF THE COMMISSION

Daniel P. Wolf
Executive Secretary

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