MINNESOTA
PUBLIC UTILITIES COMMISSION

Staff Briefing Papers

Meeting Date	June 11, 2020	Agenda Item 4**
Company	Northern States Power Company d/b/a Xcel Energy	
Docket No.	**E-002/M-19-685**	
	In the Matter of the Xcel Energy 2019 Hosting Capacity Report Under Minn. Stat. §216B.2425; Subd. 8	
Issues	1. Should the Commission accept or take some other action on Xcel Energy's 2019 Hosting Capacity Analysis Report?	
Staff	Michelle Rosier Michelle.Rosier@state.mn.us 651-201-2212 Susan Mackenzie Susan.Mackenzie@state.mn.us 651-201-2241	

✓ **Relevant Documents**	**Date**
Xcel Energy, 2019 Hosting Capacity Report Filing and Att. B	Nov. 1, 2019
Department of Commerce – Division of Energy Resources, Initial	Dec. 30, 2019
Fresh Energy, Initial	Dec. 30, 2019
Interstate Renewable Energy Council Inc., Initial and Att. A-C	Dec. 30, 2019
Xcel Energy, Reply	Jan. 17, 2020
Department of Commerce – Division of Energy Resources, Reply	Jan. 17, 2020
Interstate Renewable Energy Council Inc., Reply	Jan. 17, 2020
City of Minneapolis, Comments	Jan. 27, 2020
Xcel Energy, Supplemental Reply	Jan. 27, 2020

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

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

✓ **Relevant Documents**	**Date**
Department of Commerce-Division of Energy Resources, Supplemental Reply	Jan. 27, 2020
Interstate Renewable Energy Council Inc., Supplemental Reply	Jan. 27, 2020
Fresh Energy, Supplemental Reply	Jan. 27, 2020

Contents

I. Statement of the Issues

Should the Commission accept or take some other action on Xcel Energy's 2019 Hosting Capacity Analysis Report?

II. Overview

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 impacting power quality or reliability under existing control configurations and without requiring infrastructure upgrades."[1] Xcel Energy has worked with EPRI since 2015 in the development of the Distribution Resource Integration and Value Estimation (DRIVE) tool used for the Company's hosting capacity analysis which identifies minimum and maximum hosting capacity for feeders.

Minn. Stat. §216B.2425, subd. 8, directs a public utility that is subject to the statute and operating under a multi-year rate plan (currently applies only to Xcel Energy) to "… 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… ."

Under the statute, the study must be conducted biennially (odd-numbered years) and included in the utility's biennial transmission projects report – Xcel Energy has agreed to conduct the study annually and files the Hosting Capacity Analysis (HCA) Report separately. Xcel has filed an HCA Report annually since 2016.[2]

Commission action on Xcel Energy's HCA Report is not required. Given stakeholder interest and the iterative nature of the HCA to-date, the Commission historically has accepted the HCA Report filings upon review and provided additional guidance as warranted. Similar to the past reviews, stakeholders raise a number of recommendations for the Commission and Xcel Energy to consider ranging from frequency of updates to the level and type of data used in the HCA and publicly provided. There are 11 contested items with 31 decision options in this docket as outlined in **Section V. Parties' Comments and VII. Decision Options.** Most of the decision options address Xcel's next HCA Report filing, but others focus on additional information via a compliance filing for the 2019 HCA filing.

At the Commission's May 29, 2020 Agenda Meeting related to the Company's Integrated Distribution Plan[3], there was a discussion about the use of the HCA as replacing the MN DIP Fast Track or Initial Review Screens. Parties, including the Company, agree this is a future use.

---

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

[2] 2016 HCA Report (E002/M-15-962), 2017 HCA Report (E002/M-17-777), 2018 HCA Report (E002/M-18-684), and 2019 HCA Report (E002/M-19-685)

[3] Docket No. E002/M-19-666

The issue or disagreement was how to address the issues you will see outlined in these briefing papers and over what timeframe.

III. Background

On August 15, 2019, the Commission issued its Order Accepting Study [2018 HCA Report] and Setting Further Requirements in Docket No. E002/M-18-684 (2019 HCA Order).

On November 1, 2019, Xcel Energy filed the 2019 Hosting Capacity Report (2019 HCA Report).[4] The 2019 HCA Report identifies a publicly available website displaying Xcel Energy's hosting capacity map[5] and a spreadsheet of HCA for 1,050 feeders in the Company's Minnesota service territory.[6] This is the first time the Company has provided peak load data for substation transformers and feeders. The Company treats this information as Protected Data. As such, Xcel Energy provides a public and trade secret version of the spreadsheet and omits the data on the web-based map.[7]

On December 30, 2019, the Department of Commerce – Division of Energy Resources (Department), Interstate Renewable Energy Council Inc. (IREC), and Fresh Energy filed initial comments.

On January 17, 2020, Xcel Energy, the Department, and IREC filed reply comments.

On January 27, 2020, Xcel Energy, the Department, IREC, and Fresh Energy[8] filed supplemental comments. The City of Minneapolis also filed comments.

IV. Summary of the 2019 HCA Report

Xcel Energy asserts the 2019 HCA Report addresses and acts on the Commission's 2019 HCA Order; further, the Company "believes the 2019 HCA is a meaningful tool to assist in identifying available locations and constraints for DER interconnection as well as for identifying necessary upgrades to support continued DER development."[9] The Company provides a compliance matrix itemizing the Order points and corresponding location in the HCA Report filing where each requirement is addressed.[10] Over the four annual iterations of Xcel Energy's hosting capacity analysis, the Company argues: "Our methodology, data collection, presentation of

[4] Xcel Energy, 2019 HCA Report filing includes Att. A – 2019 HCA Report; Att. B – 2019 HCA Results spreadsheet; Att. C – Compliance Matrix, Att. D – Stakeholder Workgroup Presentation; Att. E – Stakeholder Survey Questionnaire; Att. F – Joint [Utilities'] Petition to the California PUC [on security/privacy concerns with public maps]
[5] https://www.xcelenergy.com/working_with_us/how_to_interconnect/hosting_capacity_map
[6] Xcel Energy, HCA filing, Att. B
[7] Xcel Energy, HCA filing, p. 22
[8] Fresh Energy Supplemental was logged in e-dockets on January 28, 2020.
[9] Xcel Energy, 2019 HCA Report filing, p. 48
[10] *Id.*, Att. C, pp. 1-4

results, and the DRIVE tool have evolved each year, improving the quality and usefulness of the HCA Report."[11]

HCA Use Cases or Purpose

Xcel Energy maintains the HCA is one of several tools available to customers and developers to determine the viability of a potential DER site. Other tools include: the public DER queue, a pre-application report; review of a DER interconnection application; and, if needed, the detailed cost estimate for system upgrades provided at the time of the interconnection agreement.[12]

The Company's HCA continues to focus only on generation sources; rather than include load characteristics from storage that the Company recognizes could reduce thermal and voltage impacts, effectively increasing hosting capacity if sited and coordinated properly.[13] Further, the Company recognizes DRIVE allows for other types of load hosting analysis (e.g. electric vehicle charging stations or beneficial electrification), but argues that such analysis is better suited for the integrated distribution plan (IDP) rather than this HCA.

2019 HCA Results

Xcel cautions that the HCA is a "snapshot in time" (in this report, August 2019), and hosting capacity is a range of values for individual feeders that depends on a number of variables not necessarily captured in the HCA. These include mitigations (increasing hosting capacity) and cumulative effects on substations or the transmission system (decreasing hosting capacity). Results display in a publicly available heat map[14] and by feeder in a spreadsheet.[15]

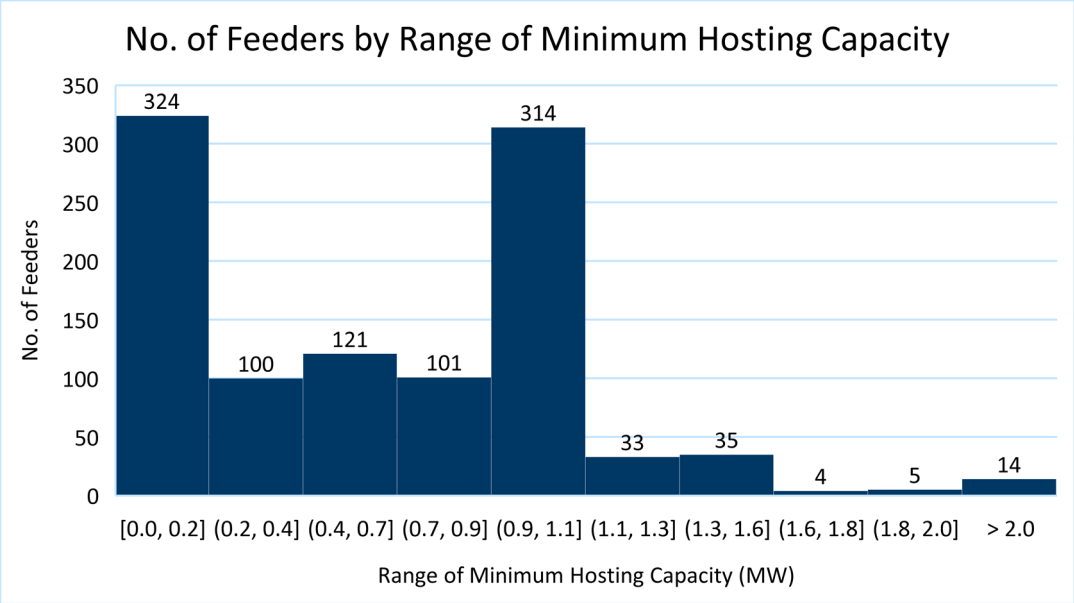
The 2019 HCA found 129 feeders have zero maximum hosting capacity – up from the 95 feeders in the 2018 HCA. Xcel notes 97 of these feeders have at least 1 MW of existing DER installed.

Staff Analysis

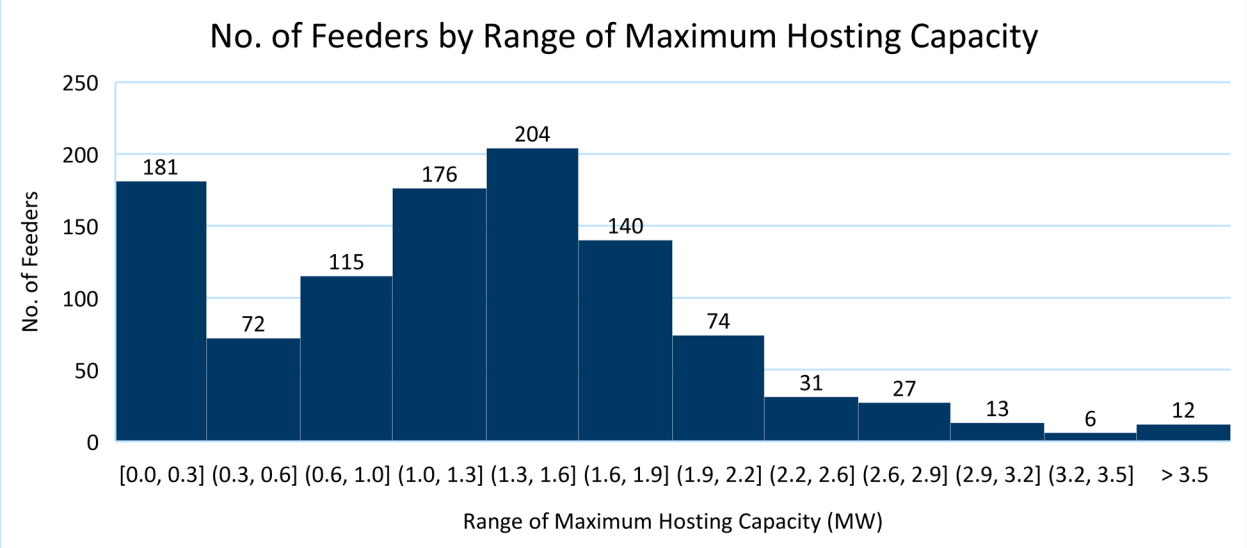
Staff provides charts of the number of feeders within a MW range for both minimum and maximum hosting capacity; however, note a feeder's hosting capacity may be limited by the substation transformer's hosting capacity limit.

Minimum Hosting Capacity: The maximum amount of DER that can be accommodated anywhere on the feeder. Most often at the end of the feeder.

[11] *Id.* , p. 2
[12] *Id*., pp. 8-9
[13] *Id*., p. 6
[14] https://www.xcelenergy.com/working_with_us/how_to_interconnect/hosting_capacity_map_disclaimer
[15] Xcel HCA filing, Att. B



Maximum Hosting Capacity: The maximum amount of DER that can be accommodated at a single point on the feeder. Most often closer to the substation.



Staff offers additional analysis of the changes in feeders' minimum and maximum hosting capacity between the 2018 and 2019 HCA Reports in **VI. Staff Analysis**.

EPRI DRIVE and 2019 HCA

Xcel Energy continues to use the EPRI DRIVE Large Centralized methodology. The Company notes over 86% of the installed MW of DER on Xcel's distribution system are Community Solar Gardens (CSG), typically 1 MW (625 MW total); whereas, smaller-scale DER account for 14% or

100 MW installed.[16] The Large Centralized methodology looks at installing increments of 100 kW on 3-phase sections of feeders; thus, a result of no hosting capacity may be able to accommodate small DER (< 100 kW) without upgrades.[17]

To complete the HCA, Xcel Energy creates 1,050 feeder models in the Company's load flow program (Synergi) using information from the Geographic Information System (GIS), supplemented with 2019 load forecast and historic actual customer demand and energy data. These models are subject to a series of clean-up scripts to address errors (e.g. specifying head-end voltage, utility equipment settings, etc.) Then, each feeder model is allocated load based on demand and customer energy use data and abnormalities are checked for with a load flow analysis. Once the feeder models are finalized, DRIVE is used to perform the hosting capacity analysis. The methodology, DRIVE tool features, and data components are unchanged in the 2019 and 2018 HCA with the exception of the following[18]:

- Use of actual Daytime Minimum Load (DML) data for ~ 25% of total feeders - prioritizing feeders with high levels of existing DER - for the DRIVE HCA. Xcel continued to update feeder DML data and 100% of feeders have DML included in the heat map and spreadsheet.
- Use of actual Power Factors for feeders rather than assuming 99% lagging.
- Rebuilt about 1/3 of the 1,050 feeders to capture large configuration, load or generation changes. This process is one of the most resource-intensive parts of the HCA.
- Utilized DRIVE's Unintentional Islanding threshold[19]
- Provided additional data in results presentation of the heat map and spreadsheet; including: DML for feeder; DML for substation transformer; existing DER installed and queued on substation transformer; existing DER installed and queued on feeder. The heat map also includes a pop-up display of this data; as well as, feeder name, substation name, available hosting capacity, limiting factors, feeder voltage level, line phasing (single/three-phase), line type (overhead/underground), field voltage regulator location and substation location.
- Examined mitigation options to increase hosting capacity for feeders with none identified in 2018 HCA Report.
- Conducted a case study on a feeder varying locations and levels of generation and load.
- Evaluated the accuracy of 2018 HCA results to Synergi results and actual interconnection studies performed for 15 feeders.

<u>Accuracy: DRIVE Compared to Synergi and Interconnection Studies</u>

[16] *Id.*, p. 3
[17] *Id.*, p. 8
[18] *Id.,* pp. 4-6
[19] *Id*., Att. A, p. 26

Xcel Energy compared the 2018 HCA results from DRIVE on a subset of 15 feeders to 1) the Company's Synergi distribution load flow model[20]; and 2) actual interconnection application studies for CSG. Xcel selected feeders based on where interconnection studies were performed between September 2018 and February 2019.

DRIVE and Synergi results are consistent.[21] For the Synergi comparison, the Company used the same assumptions as included in DRIVE for the four criteria thresholds available – compared to the eight thresholds used in the DRIVE analysis. Xcel Energy only presents the minimum hosting capacity values because a "reverse limit" threshold of 50% of the feeder arbitrarily limits the Synergi results for maximum hosting capacity. In contrast, DRIVE uses "reverse power flow," which limits hosting capacity based on load. Xcel concludes the results "add validity to both methods and should provide further confidence in the HCA results."

DRIVE and actual interconnection study results are much less consistent.[22] Eight of the feeders had interconnection study results outside the identified HCA minimum and maximum hosting capacity. The table below summarizes Xcel's rationale for the inconsistencies:

# of feeders	Xcel's rationale for inconsistency
3	Minimum load values that differed by more than 1 MW which should be corrected in the 2019 HCA with the inclusion of actual DML data. The 2018 HCA used a 20% of peak assumption for minimum load; whereas, the interconnection studies used actual data when available.
3	Different power factor values for the DER generation installed which will continue to be a challenge because the HCA uses an assumption. The 2018 HCA assumed 98% leading; whereas, the actual interconnection studies identified using a power factor of 95% leading accommodated the added DER generation without requiring system upgrades.
1	Incorrect data for the power factor of existing DER (98% actual vs. 100%)
1	Did not capture a system upgrade of nearly a mile of single-phase line to three-phase which added substantial length and impedance to the feeder

Seven of the 15 feeders had interconnection study results within the minimum and maximum hosting capacity range identified by DRIVE. Data integrity improved for the 2019 HCA; however, it will continue to play a role in HCA accuracy.[23] Xcel Energy concludes that a HCA cannot reach the same level of accuracy and detail as interconnection studies.[24]

Security and Privacy Concerns

Xcel Energy redacts 115 of 1,050 feeders on the public heat map. The Company continues to blur the lines in the heat map, and marks the peak load data for substation transformers and

[20] Staff notes this approach is sometimes referred to as an iterative Integration Capacity Analysis.
[21] *Id*., Att. A, Table 4, p. 19
[22] *Id.,* Att. A, Table 5, p. 21
[23] *Id.*, Att. A, p. 22
[24] *Id*., Att. A, p. 23

feeders as Protected Non-Public on the spreadsheet. The Company applies the same criteria used in the 2018 HCA: presence of critical infrastructure, and the Company's 15/15 aggregation standard - fewer than 15 customers, or 15% of peak load served to one customer. The feeders where the 15/15 aggregation standard (15/15 or 15/15 standard) applies are included in the spreadsheet; however, the critical infrastructure and 15/15 feeders are not identified on the spreadsheet. With the new requirement by the Commission to include peak load data, the Company identifies a "Catch-22" dilemma for the 15/15 feeders: providing the data publicly would violate its Protected treatment, yet marking it as Protected under the 15/15 standard discloses which feeders the Company treats as having sensitive private information. As a result, Xcel Energy provides all peak demand data as Protected Non-Public Data, and will not provide it to the parties even under a non-disclosure agreement.[25]

Mitigation Analysis: 94 Feeders with No Hosting Capacity in 2018

The 2019 HCA Report describes potential mitigations for the most common constraints to a feeder's hosting capacity, and summarizes key takeaways from the National Renewable Energy Laboratory on the costs and methods to increase the hosting capacity. Xcel Energy argues these findings align with the Company's approach and reiterates the need for a detailed interconnection study for a specific, proposed DER on a specific feeder.[26]

Xcel Energy worked with EPRI to complete additional analyses of 94 feeders with zero hosting capacity identified in the 2018 HCA Report.[27] EPRI developed a new mitigation tool allowing streamlined analysis of a large number of feeders attempting to automate mitigation comparisons using predetermined mitigation settings to suggest potential solutions. Xcel is the first utility to use the tool with this analysis. The mitigation analysis focused on improving the hosting capacity by 1 MW at the midpoint between the substation and the end of the feeder during 2 hours (minimum and peak load).[28] The analysis also examined solutions for the primary overvoltage and thermal violations as follows:

Mitigation	General Cost Estimate
Adjust existing DER fixed power factor	No cost
Adjust future DER fixed power factor	No cost
Use Volt-Var in future DER	No cost
Use Volt-Watt in future DER	$10 per kW curtailed
Adjust existing regulators' settings	$5,000
Add a new regulator	$75,000
Reconductoring	$250,000 per mile

Additional mitigation options for the remaining violations:

[25] *Id*., Att. A, p. 29
[26] *Id*., Att. A, Table 6, pp. 30-31
[27] *Id*., Att. A, pp. 31-39
[28] Xcel Energy explains limiting to minimum and peak load addresses not having hourly forecasted load data (8760), DRIVE tool limitations, and computing time. Similarly, choosing the midpoint was a practical decision to avoid comparing thousands of feeder points and mitigation options.

Mitigation	General Cost Estimate
Updated Protection settings	$7,500
New Recloser mid-feeder	$50,000
Voltage Supervisory Reclosing at the feeder breaker	$120,000

Xcel Energy's analysis selected the least-cost mitigation that achieved at least 1 MW of hosting capacity, and for the remaining feeders the most hosting capacity (<1 MW) regardless of cost. As a result, 82% (77 of 94 feeders) saw an increase in hosting capacity. "The total cost for mitigating all violations on these feeders ranged from $75,000 to over $3.3 million per feeder and totaled nearly $50 million for all 77 feeders. However, the majority of feeders (53) could be successfully mitigated with comprehensive solutions that cost under $300,000."[29] Xcel Energy summarizes the results:

> For the most part, these mitigation solutions align with the Company's practice in how we conduct interconnection studies. We search for the least cost option, which usually involves power factor correction and sometimes reduction down to 0.95. If issues still exist, we move on to more expensive solutions, such as reconductoring. We note that the smart inverter functions [Volt-Var and Volt-Watt]– which we currently do not employ – showed additional benefit in a small number of cases and we may be able to use these functions in the future. The option to add a regulator also showed some potential in some cases, but we do not plan to utilize this option in the future because regulator installation has some other adverse impacts.

Sensitivity Analysis: Varying Bus Voltage and DER Power Factor

Xcel Energy refers to the 2018 HCA Report[30] and notes that duplicating this sensitivity analysis for the 2019 HCA Report would be redundant and would not yield any additional conclusions.

Case Study: Varying Load and Generation Conditions

Xcel selected a case study of a primarily rural feeder with small areas of town/urban loading looking at 20 scenarios varying increments of load and new DER installations at different locations on a representative feeder for a CSG installation. For each scenario, Xcel Energy created a Synergi model and then performed analysis with the DRIVE software. The results show that more hosting capacity is available closer to the substation and as more load is added to a feeder.[31]

2019 HCA Costs

[29] *Id*., Att. A, p. 38
[30] Summarized in Staff Briefing Papers (e-filed on May 23, 2019), Docket No. E002/M-18-684, pp. 6-7; Xcel 2018 HCA Report, pp. 23-26
[31] *Id.*, Att. A, pp. 40-42

Xcel Energy estimates the total cost for the 2019 HCA and Report was over $300,000. The Company highlights an estimated $160,000 in engineering staff time (1,600 hours) between June – October 2019 to complete the 2019 HCA. The Company claims more frequent updates "would cost slightly less than this, but still be substantial" because of the need to rebuild feeder models and update system data for each HCA update. The mitigation analysis with EPRI cost an additional $50,000. In addition, Xcel notes the Company has incurred $280,000 in additional costs to acquire the DRIVE software and participate in the EPRI DRIVE User Group through May 2020.[32]

Pre-Application Data Requests

In 2018, Xcel Energy received 288 pre-application data requests (known as Capacity Screens in the CSG program) and collected $72,000 in fees. The Company notes one of the most common requests from stakeholders is the integration of the pre-application data reports with the HCA, but cautions significant costs and barriers would need to be addressed. Xcel Energy provides a useful table of pre-application data points and how the information is attained, security/privacy concerns, and the frequency of information updates.[33] The Company notes that integrating the pre-application data with the HCA would require: 1) website integration whether on the map or separate; 2) staff time for data collection and validation, and 3) web-query programs for GIS and Salesforce which do not exist today. Further, Xcel Energy notes inclusion of pre-application data has limited value, may require a fee or subscription service to cover significant costs, and may lead to locking the currently public HCA maps and spreadsheets behind a paywall for fees and security/privacy concerns.[34]

V. Parties' Comments[35]

A. Use Case or Purpose of the HCA

Xcel Energy suggests the Commission may wish to clarify the HCA purpose. The Company argues the comparisons to New York and California may not be appropriate, noting that unlike Minnesota, those states are "actively developing and advancing alternative regulatory frameworks and competitive DER markets and do not necessarily align with the current Minnesota regulatory framework or statewide interconnection process."[36] Further, Xcel Energy reiterates the Company's view that the HCA Report "is intended to provide insight as to potential feeder capacity, and is only *one tool among several* necessary to accommodate and integrate DER without causing adverse impacts on the distribution system."[37]

---

[32] *Id*., Att. A, pp. 42-43
[33] *Id*., Att. A, pp. 45-46
[34] Id., Att. A, pp. 43-47
[35] City of Minneapolis Comments were a list of recommendations that the City supports. Given Minneapolis's 10% local generation goal, the City endorsed a robust distribution grid to support the public infrastructure, which is owned and operated by Xcel Energy. The City viewed the HCA as a tool to identify opportunities to integrate solar so that its $750 million three-year distribution system budget can improve hosting capacity and support electrification meeting state and local climate goals. Staff further summarizes these comments by indicating the City's support of the specific decision options in **VII. Decision Options**
[36] Xcel Supplemental, p. 1
[37] Xcel Reply, p. 2

Interconnection: HCA and Pre-Application Report Data

The Department and IREC conclude that Xcel's discussion of integrating the pre-application report and the HCA is inadequate and insufficient.[38] The Department argues that to comply with the 2019 HCA Order (Order Point #6), Xcel needs to develop a specific plan (including cost estimates and timelines for implementation) to integrate the pre-application report and the HCA. This plan should identify pathways that would enable Xcel to maintain free and public access to the HCA.[39]

The Department also notes that while the Company generally discusses current challenges, it offers no basis for evaluating the process by which the HCA could achieve the objectives identified in the 2019 HCA Order. These include evaluating the costs and benefit of a HCA able to replace or augment initial review screens and/or supplemental review in the interconnection process, as well as, a HCA able to automate interconnection studies.[40] The Department highlights that according to Xcel's survey, stakeholders rank combining the pre-application and the HCA report as the most important functionality change.[41]

Xcel indicates that despite clear benefits from integrating pre-application data with the hosting capacity map, there are some significant costs and barriers. Xcel's Table 9 lists the information that is currently provided in its MN DIP pre-application report, and the effort and challenges that would be involved to provide that information in the hosting capacity map. However, the Department finds the information in Table 9 to be of limited value. As applied to Order Point #6, the general categorization of the MN DIP pre-application information in the table does not respond to whether the HCA and pre-application report can or should be integrated. As an example, the Department highlights that no specific cost information is provided.[42]

With the addition of the pop up data displays to the HCA map in 2019, Xcel Energy notes that more than half of the items provided in a pre-application data report can be viewed directly or derived from the map. The Company asserts the remaining items are either impractical to provide on a broad basis in the HCA or present security and privacy concerns.[43] IREC acknowledges Xcel provided significantly more distribution system data in its online map with the 2019 HCA Report.[44] Although this made the map more useful, IREC argues that Xcel should publish all pre-application report data unless Xcel can articulate a reason for not doing so.[45] IREC also dismisses Xcel's argument that the HCA and pre-application report cannot be combined because the Company collects a fee for the pre-application report. IREC argues that

[38] Department Initial, p. 10; IREC Supplemental, pp. 5-7
[39] Department Supplemental, pp. 3-4
[40] Department Supplemental, p. 4
[41] Department Supplemental, p. 10
[42] Department Supplemental, p. 5
[43] Xcel Energy provides an outline of security and privacy concerns by data type at Xcel 2019 HCA Report, Att. A, Table 9, pp. 45-46 and IREC Initial, Att. A, IREC IR No. 6 response.
[44] IREC Supplemental, pp. 5-7
[45] IREC Initial, pp. 34-35

customers should not pay to access data that Xcel has available and can easily upload to a public map.

However, Xcel Energy maintains that the HCA and pre-application reports are not duplicative: "HCA should provide a generalized analysis of all locations [on a feeder], while the pre-application report is for a specific project at a specific [location and] point in time."[46] IREC finds Xcel's argument erroneous.[47] IREC argues Xcel should provide as much basic distribution system data as possible instead of arguing against combining the HCA and pre-application report.

IREC claims that Xcel Energy demonstrates that additional basic distribution system data can be provided without any technology upgrades, customer privacy concerns, or security issues.[48] For example, the Company states there is no limitation to publishing Transformer Name, Transformer Absolute Min, Load Tap Changer (LTC) or Regulator, Feeder Absolute Min, and Network or Radial. Therefore, IREC concludes that the Commission should require Xcel to immediately publish this basic system data on its map and in its tabular spreadsheet to provide value to customers.[49] (**Decision Option 3 or 8.f**)

The Department recognizes that the current HCA cannot substitute for the MN DIP pre-application process. However, these tools should inform one another, given their shared purpose to provide information on the DER hosting capacity of Xcel Energy's distribution system by substation or feeder. Because the current HCA is conducted in isolation from the MN DIP pre-application process, it provides little value for those using the pre-application process, resulting in a loss of potential process efficiencies and cost savings. These losses should be quantified to enable stakeholders and the Commission to assess the benefits of integrating the HCA and the MN DIP pre-application process. The Department requests that Xcel comply with the Commission's 2019 HCA Order (specifically, Order Point #6) by examining opportunities for process efficiencies between the MN DIP pre-application and screening processes and the HCA.[50] (**Decision Option 2**) To the extent the Commission agrees with the Department, Xcel Energy offers to provide an analysis examining fully integrating pre-application data into the HCA in conjunction with the 2020 HCA Report filing.[51]

Fresh Energy did not take a position on whether the HCA should be integrated with (or replace) the MN DIP pre-application data request, but believes that other changes should be made first. Making these changes would increase the usefulness of the HCA and be less resource-intensive. However, Fresh Energy is interested in the Company's evaluation of what would be required to integrate the pre-application data report and the HCA. Fresh Energy strongly opposes the idea of a fee for access to the HCA map and tabular report. Fresh Energy notes that the HCA has

[46] Xcel Reply, pp. 27-28
[47] IREC Supplemental, p. 6. IREC notes that the HCA is an analysis of thousands of specific locations, with nodes on each feeder. Xcel performs the HCA analysis at each node. Thus, IREC maintains that the HCA is the opposite of a generalized analysis.
[48] IREC Initial, Attachment A, Xcel Energy Response to IREC IR No. 6
[49] IREC Initial, pp. 34-35; IREC Supplemental, pp. 5-7
[50] Department Supplemental, pp. 5-6
[51] Xcel Supplemental, p. 2

always been intended as a free public resource, which should not be put behind a paywall unless a useful but simplified free version is available.[52]

Distribution Planning: Beneficial Electrification and Electric Vehicles

IREC argues that the HCA could provide customers more value and support the state's energy goals by including both load and generation analysis. IREC agrees with Fresh Energy that new DER load, including energy storage and electric vehicles, and heating electrification are necessary to meet Minnesota's energy goals.[53] IREC suggests that Xcel be required to provide an HCA that can be used to identify how much new DER load a feeder, or sections of a feeder, can feasibly accommodate without additional study, upgrades, or cost. (**Decision Option 25**)

Fresh Energy continues to believe load-hosting capacity is important to inform Minnesota's de-carbonization and beneficial electrification policy objectives. Beneficial electrification is a key policy priority for Fresh Energy and for other clean energy advocates.[54] Fresh Energy notes that the Minnesota Pollution Control Agency's recently initiated the Clean Cars Minnesota rulemaking to accelerate electrification of the transportation sector, and the 2018 Minnesota Energy Efficiency Potential Study, both highlighted the importance of efficient electric space heating for maximizing efficiency opportunities and meeting Minnesota's climate goals.

Fresh Energy disagrees with Xcel that the focus of the HCA is generation capacities rather than load capabilities. The Commission's 2019 HCA Order (Order Point #5A) directs Xcel to provide: "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."[55]

Fresh Energy argues that the DRIVE tool can model load characteristics of DERs (battery storage and electric vehicles) and that it is important to begin incorporating load DERs into the HCA now. This will allow policy makers and stakeholders to plan for the high-electrification future and promote understanding of the relationship between hosting capacity and increases in load or changes in load profile.[56]

Xcel Energy maintains that the Integrated Distribution Plan, not the HCA, is the appropriate place to address load characteristics of DER. The Company argues the load analysis and maps proposed by some parties have minimal benefit and would compromise grid security and customer privacy and security.[57] However, Xcel Energy is open to further discussion about performing a beneficial electrification study, outside the HCA, if the Commission sees it as useful for achieving state energy policy goals.[58]

[52] Fresh Energy Supplemental, p. 4
[53] IREC Supplemental, pp. 12-13
[54] Fresh Energy Initial, pp. 2-3
[55] Fresh Energy Supplemental, p. 6
[56] Fresh Energy Initial, p. 3
[57] Xcel Supplemental, p. 2
[58] Xcel Reply, p. 15

Fresh Energy is willing to discuss options outside of the HCA report to obtain the information requested for informing distribution system planning (such as EV charging locations and electrification programs). Fresh Energy encourages Xcel Energy to engage other stakeholders, particularly EV charging providers, in discussions about information on load hosting capacity and the format and cadence of this information. Fresh Energy recommends that in the 2020 HCA, Xcel Energy provide a discussion of how the hosting capacity analysis can be used to assist state energy policy goals related to beneficial electrification; including detail on how a load hosting analysis would be done, an estimate of the resources that would be required, and the specific information it could provide.[59] (**Decision Option 4**)

The Department defers to the Commission on whether Xcel's very brief and limited explanation of how the DRIVE tool can assist state energy policy goals related to beneficial electrification is sufficient to meet the intent in the 2019 HCA Order (Order Point #5A).

The Department notes that Xcel provided a summary of the changes that EPRI made to the DRIVE tool between the time the 2018 HCA was published and the time the 2019 HCA was completed, using some but not all of the new DRIVE enhancements. Xcel also provided a list of further changes to the DRIVE tool that EPRI announced will be available for the 2020 HCA. The Department also notes that Xcel explained how DERs were incorporated into the 2019 HCA. Xcel only incorporated DER that acts as generation, arguing that load hosting capacity analysis is more traditionally part of distribution planning.

While the Department agrees with Xcel that traditional distribution planning should be the vehicle to anticipate the impacts and potential for beneficial electrification, it also notes that the Commission may have been contemplating the potential for HCAs to inform broader policy discussions.[60]

B. HCA Methodology and Tools

EPRI DRIVE and Synergi Comparison

The Commission's 2019 HCA Order required Xcel to provide a complete analysis of the DRIVE tool, including 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."[61] The Department interprets this Commission direction to require Xcel to analyze representative feeders using other methodologies and interconnection study tools, including those used by other utilities in other jurisdictions, and to compare those results to the results of Xcel's DRIVE tool used in the HCA.[62]

[59] Fresh Energy Supplemental, p. 6
[60] Department Initial, pp. 17-20
[61] 2019 Order, Docket No. E002/M-18-684, Order Point #5B, p. 15
[62] Department Initial, p. 18

In initial comments, the Department asked Xcel to explain what capabilities Synergi has and to discuss the appropriateness of comparing Synergi to the DRIVE tool in order to satisfy the requirements of the 2019 HCA Order (Order Point #5B). In reply, Xcel explained that there are three commercially available tools that can be used to conduct HCAs and only two are available to the Company (DRIVE and Synergi). Xcel also noted that the results of its comparison of the DRIVE results to Synergi were aligned with San Diego Gas & Electric's (SDG&E's) findings. The Department concludes that Xcel's approach complying with the requirement to compare EPRI Drive and Synergi (Order Point #5B) is reasonable. However, the Department asks that the Company file additional information on the capabilities of Synergi to conduct an HCA, noting that Synergi is available to the Company at little or no cost.

The Department also argues that Xcel should more directly compare the results of DRIVE to Synergi, which is also capable of conducting an HCA. The Department proposes that the Commission ask Xcel to analyze and compare the hosting capacity of a selection of representative feeders using both the DRIVE tool and Synergi.[63] (**Decision Option 6**) Xcel sees limited value in the Department's recommendation to repeat the comparison of DRIVE to Synergi in the 2020 HCA.

Xcel Energy maintains DRIVE is better than Synergi for HCA because it was specifically designed to conduct a HCA. DRIVE analysis is more granular, and its software is updated and improved annually based on user feedback and input. Xcel Energy highlights DRIVE's 13 limiting criteria violation thresholds (the Company uses eight in the HCA Reports) compared to Synergi's four criteria threshold. Synergi lacks the following thresholds: additional element fault current, breaker relay reduction of reach, reverse power flow, and unintentional islanding. DRIVE users have access to annual and quarterly training and input sessions compared to the annual general user meeting for Synergi.[64]

Fresh Energy and the Department note continued questions over the use of DRIVE versus other methodologies such as Synergi for the HCA. Fresh Energy asked Xcel for a stakeholder demonstration of the DRIVE and Synergi models to ensure stakeholder have a sufficient understanding of the models' functionality, structure, assumptions, inputs, outputs, and interactions with other models or data sets. Xcel is willing to provide such a demonstration and scheduled a stakeholder meeting on March 23, 2020 for this purpose.[65]

Order Point #7A asks Xcel to provide "Updates on the appropriateness of the methodological choice of the hosting capacity analysis, a discussion of ability to obtain more detailed secondary voltage equipment data, and the types of DERs being interconnected in future reports." Fresh Energy wants to learn more about the new DRIVE methodology, which combines the large centralized and small distributed methods, and requests Xcel provide stakeholders with

[63] Department Supplemental, p. 13
[64] Xcel Supplemental, p. 4
[65] Fresh Energy Supplemental, p. 5. Note: Due to COVID-19, this stakeholder meeting was postponed. As of May 1, 2020, Xcel Energy's plan was to reschedule this event for early June. See Ex Parte Communication Report (May 4, 2020), Docket No. E002/M-19-666. Staff confirms these meetings were rescheduled for June 2 and June 16 via email from the Company.

more information about the combined methodologies and an opportunity to provide feedback before the Company decides whether or not to use the combined method for the 2020 HCA.[66]

Fresh Energy appreciates the Company's discussion of its ability to obtain secondary system data and its plans to use advanced metering infrastructure. Xcel is proposing to deploy this information as part of the AGIS initiative, to help to collect this data "in the near future." It would be helpful to know whether the combined DRIVE method discussed above requires secondary system data, which data points AMI is capable of collecting, whether ADMS and other software are currently set up to manage this data, and what the Company's timeline is for gathering the data via AMI.[67]

The Department, Fresh Energy and Xcel Energy support the Company providing an update on the evolving capabilities of DRIVE and Synergi, together with a discussion of substantive HCA advancements or shifts observed in the industry; as well as, which tool is most capable of providing an accurate and reliable HCA in the 2020 HCA.[68] (**Decision Option 7**)

C. Commission Guidance on the 2020 Hosting Capacity Analysis Report

Frequency of update

The Department, Fresh Energy, and IREC maintain that updates of Xcel Energy's HCA more often than annually would provide more value, in the form of accuracy and relevance, to developers and customers. Xcel Energy agrees; however, the Company argues that the associated resource investment must be commensurate with public policy drivers and consistent with cost causation principles.[69]

IREC and Fresh Energy note Xcel Energy's current HCA occurs once a year during June through October with results released in November. As a result, IREC argues the results are "inaccurate, outdated, and unreliable" when released because feeder configurations, load data, and DER penetrations may already have changed. Between the 2018 and 2019 HCA, Xcel Energy updated distribution system data, including collecting daytime minimum load, and rebuilt approximately a third of the feeder models used in the annual HCA with an estimated cost of $160,000 (1,600 hours of engineering time).[70]

Xcel Energy highlights key factors affecting the Company's ability and the costs of performing more frequent HCA updates: 1) full or partial (targeted) update; 2) criteria to determine partial

[66] Fresh Energy Initial, pp. 3-4
[67] Fresh Energy Initial, pp. 3-4
[68] Department Supplemental, p. 7; Fresh Energy Supplemental, p. 5
[69] Xcel Energy Reply, p. 10
[70] The Company reported $300,000 in costs for the 2019 HCA; however, IREC challenges some of the costs included. See IREC Initial pp. 10-12.

updates – both when and what to update; and 3) desired update frequency.[71] IREC recommends that on a monthly basis, beginning with the 2020 HCA, Xcel should: (1) identify feeders where significant changes in load, configuration, or generation occurred, (2) update or rebuild the model of those feeders, and (3) publish time-stamped, updated HCA data and results for these feeders.[72] (**Decision Option 8a-f**)

IREC maintains increased frequency may not result in significantly increased engineering labor time or costs. IREC suggests targeted updates, focused on where changes are occurring on the distribution system, may actually reduce the overall cost of more frequent HCA reports because there will be no reason to perform all the updates at the same time of year. Updating feeder models and performing the HCA on those feeders as changes occur spreads Xcel Energy's work over the course of the year; rather than, concentrated in a specific month or season. IREC identifies a secondary benefit of keeping Xcel's distribution system models current.[73]

Xcel Energy notes the Company's current process and resources are insufficient to conduct multiple full or partial HCA throughout the year. The Company relies on summer interns to complete portions of the annual HCA, and the Xcel staff in GIS and Distribution System Planning have other priority assignments throughout the year that limits availability.[74]

The Department highlights the developer and/or stakeholder feedback included in Xcel's 2019 HCA filing, noting that the second most requested feature of the HCA is monthly updates. Based on this feedback, the Department finds that the 2019 HCA is not sufficient to provide a starting point for interconnection applications.[75] The Department and Xcel Energy[76] agree to include a proposal in the Company's 2020 HCA for monthly, quarterly, and semi-annual updates, with the costs associated with each frequency, and whether and how any additional costs can be imposed on those who obtain a benefit from more frequent updates (**Decision Option 10.**)

Fresh Energy believes waiting for the 2020 HCA (typically HCA reports are filed in November) is unnecessary, and recommends a compliance filing by April 30, 2020 **(Decision Option 9)**.[77] The filing should evaluate the feasibility, resource requirements, and estimated costs of partial (targeted) updates to the HCA for updates at least: 1) monthly, 2) quarterly, and 3) made pursuant to different possible criteria. Fresh Energy recommends Xcel Energy consult with stakeholders about which criteria to include in the third option.

Granularity of data (e.g. geographic area, feeder, or line segment)

[71] Xcel Energy Reply, p. 9
[72] IREC Initial, pp. 7-8
[73] *Id*., pp. 8-9. IREC notes that between the 2017 and 2018 HCA, only one-third of Xcel's feeders underwent a significant changes.
[74] Xcel Reply, p. 10
[75] Department Initial, pp. 25-26
[76] Xcel Supplemental, p. 2
[77] Given COVID-19, staff adjusts the decision option to [insert a date] for Commission flexibility.

IREC and Fresh Energy explain that DRIVE provides line segment and nodal (also known as sub-feeder level) results in tabular format. However, Xcel only publishes a summary spreadsheet at the feeder level that does not identify where on a particular feeder the capacity is located. The Department, IREC and Fresh Energy claim without this more detailed information, the results in the spreadsheet are less valuable. While Xcel provides line segment results in the pop ups on the heat map, the map cannot be used to specifically identify the location of the line segment for which results are provided. In addition, a customer cannot identify which line segment the HCA data corresponds to because the pop-up box does not identify the line section with a unique name or number. Fresh Energy highlights that Xcel Energy does not illustrate nodal level results citing security and privacy concerns.[78] Further, the Company reiterates the HCA is a high level and free first step in the interconnection process. Nodal information in the spreadsheet or the heat map could provide a false sense of precision when an actual interconnection study is needed to determine if a DER can be accommodated at a specific location.

IREC argues that publishing the location of distribution system lines is important because it will allow customers to identify the line segment to which they interconnect. Xcel's map shows broad blocks of color instead of publishing actual locations on distribution lines, impairing developers' ability to use the map to determine precise locations and relevant information. IREC comments that other major utility HCA maps in the country provide the actual locations of the lines.[79]

Xcel's tabular spreadsheet provides a range of the hosting capacity of an entire feeder and customers are unable to use the map to identify the specific location of the line segment for which the results are provided. IREC argues the range shown in the spreadsheet (between the maximum and minimum hosting capacity on the feeder) is so large that it renders the results useless.[80] To improve precision and allow users to identify specific locations on a feeder, IREC and Fresh Energy recommends that Xcel provide, in both the downloadable spreadsheet and in the HCA map's pop-up boxes, a unique name or number for each line segment (**Decision Option 11 and 13**). It should then publish the location of the lines on the HCA map so that customers can identify the location to which that HCA data corresponds. (**Decision Option 12)** IREC also recommends that criteria violation values be provided for each line segment in a downloadable spreadsheet to allow customers and developers to make informed decisions about DER systems.[81] (**Decision Option 17**)

---

[78] Fresh Energy Initial, pp. 4-5

[79] IREC Initial, p. 29, Fn 64. See Southern California Edison's map at https://ltmdrpep.sce.com/drpep/; NYSEG and RG&E map at https://iusamsda.maps.arcgis.com/apps/webappviewer/index.html?id=2f29c88b9ab34a1ea25e07ac59b6ec56; National Grid's (MA) map at https://ngrid.apps.esri.com/NGSysDataPortal/MA/index.html; PEPCO's entire service territory map at http://pepco.maps.arcgis.com/apps/webappviewer/index.html?id=5c02592c8e0541b188eef9cbd8a2c9c0

[80] IREC Initial, pp. 16-17. IREC notes that over 25 percent of Xcel's feeders include a range of 1 MW or larger. For example, feeder HSN312 includes a hosting capacity range of 0 MW to 3.25 MW. These results indicate that the feeder could potentially host a large 3 MW system, or could fail to host a small net metering system of 10 kW. This range is so wide that it dilutes, if not renders useless, the value of HCA results on that feeder.

[81] IREC Supplemental, pp. 7-8 and IREC Initial, pp. 16-17

Xcel Energy defends displaying a range of minimum and maximum hosting capacity per feeder in the spreadsheet rather than the line segment (or sub-feeder)-level information available in the 2019 heat map pop up boxes[82]:

> While [the range] may not specifically point out *where* on a particular feeder the capacity is, these values make it easier to compare results year-over-year, and are good proxies for a feeder's ability to host more DER overall..

Further, the Company explains that providing a spreadsheet with thousands of feeders and thousands of nodes per feeder would be cumbersome for users and complicate the tabular results. However, Fresh Energy finds it reasonable to expect the tabular report to correspond to the HCA map, and to publish information already being produced by DRIVE. For this reason, Fresh Energy recommends that Xcel move toward making, at a minimum, sub-feeder level results available to stakeholders who may find this information useful.[83]

Xcel Energy's survey results show respondents rank more granular display of lines on the heat map twice as highly as nodal data on the heat map, but below both monthly HCA updates and integrating the HCA with the pre-application reports.[84]

Daytime Minimum Load Data

Emphasizing the priority on actual daytime minimum load data for the 2019 HCA, Fresh Energy notes the Company incorporated this data for only 25% of the feeders for the 2019 DRIVE HCA – relying on the 20% assumption used in past years for the majority feeders. Fresh Energy recommends that in future HCA reports, Xcel include the precise number of feeders with actual and estimated daytime minimum load data and note the feeders with estimated daytime minimum load on the tabular spreadsheet to inform developers' use of the report. (**Decision Option 14)**. Further, Fresh Energy recommends that Xcel provide a description of its plans for adding SCADA to additional feeders, particularly rural feeders where SCADA would help secure actual daytime minimum load data for areas with significant CSG penetration.[85] (**Decision Option 15.)**

The Department notes that Xcel explained that given limited time for the 2019 DRIVE analysis the Company prioritized actual daytime minimum load value data for 25% of feeders that have a significant amount of existing interconnected DERs. During the rest of the HCA process, Xcel was able to establish actual daytime minimum load values for all feeders. This data is included in the public-facing hosting capacity map and spreadsheet.[86] The Department concludes that

[82] Xcel Reply, p. 12
[83] Fresh Energy Supplemental, pp. 2-3
[84] Xcel Energy HCA Report filing, p. 16
[85] Fresh Energy Supplemental, p. 3. Staff note: Xcel Energy describes plans to install SCADA at 3-5 substations each year. Most, but not all, substations' SCADA include feeder load monitoring (FLM). (Xcel Energy, 2019 IDP, pp. 40, 210 (Nov. 1, 2019), Docket No. E002/M-19-666.)
[86] Department Initial, pp. 13-14

Xcel complied with the August 15, 2019 Order requirement (Order Point #2D) to track and update actual feeder daytime minimum load and include those values in the 2019 HCA report.

IREC proposes that Xcel move from annual data to publish HCA results using monthly data for peak, daytime minimum, and absolute minimum load to be more useful for customers designing systems to avoid seasonal constraints on Xcel's system.[87] (**Decision Option 16**). For example, if a line section could support a 2 MW PV system for 11 months of the year, but only a 1 MW system in the remaining month, a customer could build a 2 MW system and agree to limit its output to 1 MW during the one month that the constraint exists. In this way, the customer can build the system at the size desired while avoiding the need for upgrades to Xcel's distribution system with a seasonal output limit.

To-date, Xcel Energy's HCA uses peak and daytime minimum load data. IREC notes that publishing HCA results using monthly absolute minimum load will provide more useful data for customers seeking to design systems based on generation types other than solar (PV). Similar to how a customer can design a PV-only system to avoid seasonal constraints using results with daytime minimum load, a customer can design a system using other generation types (like solar+storage) to avoid seasonal constraints using results with absolute minimum load.

Xcel Energy opposes IREC's recommendations because of limited benefit and overwhelming effort to perform such an analysis. Currently, Xcel Energy performs the HCA at annual peak loading and DML for 3,000 nodes per feeder, increasing DER in 100 kW steps until a criteria threshold violation occurs - which the Company estimates is approximately 60,000 calculations per feeder. If Xcel Energy were to complete monthly HCA using the three data points (peak, DML, and minimum), the estimated number of calculations would increase to approximately 1,080,000 per feeder.[88] The Company understands additional analysis of absolute minimum load could provide additional value for non-solar DER; however, does not see DER interconnection requests of this type warranting this effort in the near-term or foreseeable future.[89]

As a long-term goal, IREC recommends Xcel move toward providing hourly HCA results using the 24-hour load profile for each month's peak day and minimum day.[90] Xcel Energy describes this method as a 576 analysis (24 hour load profile x 12 months x 2 (peak load day and minimum load day)) and estimates that this would result in nearly 17.3 million calculations per feeder. IREC takes issue with Xcel Energy's estimated calculations:[91]

[87] IREC Initial, pp. 15-16
[88] Ex Parte Communication Report (March 3, 2020), Docket No. E002/M-19-685. Xcel describes three types of load data used in HCA: annual (currently used), hourly (8760), and a hybrid 24-hour load curve in a monthly peak and minimum day (576). IREC is proposing a monthly peak, DML, and absolute minimum now, and the hybrid 576 analysis in the longer-term.
[89] Xcel Reply, pp. 10-11. Note: correction in number of calculations required for IREC's proposal in the ex parte communication.
[90] IREC Initial, p. 15
[91] Ex Parte Communication Report (March 4, 2020), Docket No. E002/M-19-685.

EPRI claims that DRIVE is faster than the iterative methodology because it uses an "intelligent increment" algorithm to vary the amount of the increments. For example, when evaluating 1,500 kW of hosting capacity, DRIVE may perform 5 analyses at varying increments instead of 15 analyses at 100 kW increments. In any case, the specific number of calculations are not relevant to the engineers performing the analysis because the calculations are performed automatically in the background by HCA software.

Criteria Violation Values

IREC argues that Xcel Energy includes an insufficient number of the criteria violations necessary to give customers the likely system constraints information at the proposed point of interconnection. IREC argues that Xcel should both include more information on various criteria valuations, and report more than the most limiting of these.[92] Although the 2019 HCA uses eight criteria violations, Xcel publishes only the single most limiting one (the "primary limiting factor"). Therefore, Xcel's 2019 HCA results do not allow customers to see limiting factors beyond the violation for the minimum hosting capacity, or to understand the available capacity before reaching the next limiting factor. IREC argues that providing all the criteria violations values rather than only the primary limiting factor will provide customers with more precise information upon which to determine whether DERs would impact the grid or require upgrades.[93] Fresh Energy and the Department generally agree.

IREC argues that in order to take advantage of the flexibility and capabilities of DER technologies and to allow customers to develop projects well-suited to their location, Xcel needs to publish values for each of the HCA criteria. IREC recommends that Xcel publish the criteria violations and corresponding potential hosting capacity available for each HCA model run and location.[94] (**Decision Option 17**) In Initial Comments, IREC describes how customers could use other criteria violations currently not provided by Xcel to design DER projects and avoid costly upgrades. Allowing customers to see the quantity of DERs that can be supported without violating each criteria would allow customers to understand whether the violation can be addressed through DER system design, and the type of distribution system upgrades, that may be required in order to interconnect.[95]

Xcel Energy is willing to examine this suggestion and provide an update in the 2020 HCA, but cautions it is not straightforward (**Decision Option 18**). The mitigation used to resolve the first violation may affect the second violation. For instance, if power factor is chosen to resolve a Primary-Over-Voltage condition, the Thermal for Discharging DER limit could become more restrictive; whereas, reconductoring could result in a less restrictive thermal limiting condition. Again, the Company argues more granularity may not be useful and could be misleading.

---

[92] IREC Initial, pp. 13-14

[93] IREC Supplemental, p. 7 and IREC Initial, p. 12

[94] IREC Initial, pp. 12-17. The criteria violations that Xcel used in 2019 analysis are: Primary Over-Voltage, Primary Voltage Deviation, Regulator Voltage Deviation, Thermal for Discharging DER, Additional Element Fault Current, Breaker Relay Reduction of Reach, Reverse Power Flow, and Unintentional Islanding.

[95] IREC Initial, pp. 12-14. IREC provides an example that illustrates how additional technical hosting capacity results for a line segment will give customers information that allows them to design systems that avoid interconnection studies and costly system upgrades.

Fresh Energy agrees that it is reasonable to expect the HCA report to include all relevant data that DRIVE is already providing and that the information on the HCA criteria and violation thresholds is very useful to developers. Fresh Energy suggests Xcel Energy's concerns could be addressed with a disclaimer on the HCA map and report noting that hosting capacity is likely to change depending on mitigations performed.[96]

The Department supports IREC's recommendation that Xcel be required to publish the hosting capacity values for each of the criteria violations but acknowledges, as Xcel explained, that the additional information provided may not be as useful as the other parties hope. The Department agrees with IREC and Fresh Energy that those who use the HCA are likely to be sophisticated and knowledgeable about the implications of this information. For example, a developer will understand that implementing a mitigation option such as a power factor correction is likely to affect the thermal discharging DER value. The Department also agrees with Fresh Energy that Xcel could provide caveats or further explanation accompanying information which might be confusing. Therefore, the Department supports the provision of this additional information, and recommends that the Commission require Xcel to provide more granular information regarding HCA criteria values. The Department defers to Xcel on how best to present the information in a meaningful way.[97] (**Decision Option 17)**.

Mitigation Analysis

Xcel Energy notes the mitigation analysis conducted with EPRI's help was complex, novel, and resource intense – and one of the first attempts in the industry at automating a mitigation assessment for hosting capacity. The analysis would not have been possible without EPRI's "cutting-edge advancements" in automating mitigation assessment for hosting capacity by streamlining analysis of a large number of feeders. The mitigation analysis took approximately 400 hours of EPRI time to provide results for only the most cost-effective solution at one location for each feeder. The Company states that to consider all potential solutions exponentially increases complexity and time, and was not feasible to meet the filing deadline.

The Department notes that while Xcel Energy's analysis did not indicate the specific mitigation options at each individual feeder, it provides a reasonable basis for assessing what mitigation options are available on its feeders and the cost to implement them. The Department states that at this time providing information that is more detailed appears unreasonable and cost prohibitive.[98] Therefore, the Department concludes that Xcel Energy sufficiently complied with the requirement in the 2018 HCA Order to more fully analyze the 95 feeders identified as having zero hosting capacity.

Fresh Energy is concerned that the number of zero capacity feeders has increased. Xcel's 2019 HCA shows 129 feeders with zero hosting capacity at both minimum and maximum[99], which is

[96] Fresh Energy Supplemental, p. 3
[97] Department Supplemental, pp. 11-12
[98] Department Reply, p. 6
[99] Staff notes Fresh Energy identified 130 feeders; however, staff confirms 129 feeders with zero (less than 100

38% more than last year. Fresh Energy also notes that in the 2019 HCA, the limiting factor for the vast majority (84%) of these feeders is reverse power flow. For the 2018 HCA, Fresh Energy speculated that this might be due to the use of estimated daytime minimum load inputs. Fresh Energy believes that this years' DRIVE results continue to show the same pattern due to the continued use of estimated daytime minimum load inputs for 75% of the feeders.[100]

To help stakeholders understand whether zero HCA feeders are more likely to have estimated than actual daytime minimum load, Fresh Energy recommends that the Xcel Energy specify which feeder HCA results use actual versus estimated data in the 2020 HCA report. (**Decision Option 14**)

Fresh Energy also commented that it is supportive of the Company's efforts to increase efficiency in the HCA process, but that stakeholders should have a better understanding of the EPRI Mitigation Assessment Tool's accuracy, including error ranges for its outputs. Fresh Energy also asked whether EPRI or the Company had compared the tool's results to individual engineering studies at a comparable feeder location.

Fresh Energy believes the Company has provided an analysis of most traditional mitigations, but encourages the Company to expand the list of potential mitigations to include the addition of load DERs – especially those that increase minimum daytime load, shift peak load, and be managed to provide grid support services. Such additions have the potential to increase hosting capacity and may result in lower costs than the Tier 2 or Tier 3 mitigations Xcel identified.[101]

Xcel Energy is open to requesting EPRI add load DER in their Mitigation Assessment Tools as a potential mitigation alternative, and will report on that discussion in the 2020 HCA (**Decision Option 20)**. For the results to be valid, the Company finds it necessary to analyze to what extent the load aligns with the location, timing and characteristics of the DER generation.[102]

The Department agrees with Xcel that without relevant and usable information about load operational characteristics, load analysis would be theoretical, not provide broad benefits, and better placed within the distribution planning/study process. However, the Department agrees with Fresh Energy that Xcel should include load DERs in its analysis of mitigation options. The Department notes that Xcel plans to request that EPRI add load DER into their Mitigation Assessment Tool as a potential mitigation alternative, and is committed to reporting the results of its discussion with EPRI in the 2020 HCA.

The Department concludes that simply reporting the results of these discussions would delay improvements to the 2020 HCA resulting from incorporating load DER as a mitigation alternative improvement. Therefore, it recommends that if load DER cannot be added to EPRI's Mitigation Assessment Tool in time to be included in the 2020 HCA, Xcel should be required to

kW) minimum and maximum hosting capacity in Xcel Energy 2019 HCA Report, Att. B (spreadsheet of feeders.)

[100] Fresh Energy Initial, p. 2; Fresh Energy Supplemental, pp. 4-5

[101] Fresh Energy Supplemental, p. 2

[102] Xcel Energy Reply, p. 15

conduct an illustrative technical and economic analysis of how a load DER can affect hosting capacity.[103] (**Decision Option 21**).

The Department is interested in the applicability of the mitigation analysis conducted by the Company in partnership with EPRI in the interconnection process, and specifically the extent to which the mitigation analysis can be relied upon in the interconnection process for a specific project. Therefore, the Department recommends that the Commission require Xcel to perform mitigation analyses in future HCAs that provide information on (**Decision Option 19**): [104]

> (1) frequency at which constraints to individual feeders occur;
> (2) mitigation options available for those constraints and a discussion of whether distributed energy resources can also serve as a mitigation option;
> (3) amount of additional hosting capacity that can be obtained by implementing the identified mitigation option;
> (4) cost of each mitigation option; and
> (5) whether the mitigation analysis performed by Xcel can be relied upon to interconnect specific and actual distributed energy resource project proposals.

Xcel Energy explains that comparing the mitigation assessment with actual interconnection studies would need to be for the exact same location on the feeder; therefore, any error ranges in a comparison would be subjective without sound data for multiple locations.[105]

Accuracy and Sensitivity Analyses

Accuracy Analysis

Xcel Energy compared the interconnection studies conducted for CSG to the range of minimum and maximum hosting capacity values produced in DRIVE. This comparison indicates that "seven of the 15 feeders analyzed had interconnection study results that were between the minimum and maximum DRIVE hosting capacities or within 100 kW, which [it] consider[s] to be a positive correlation" and that "eight feeders had interconnection study results that fell outside of the minimum and maximum DRIVE hosting capacities." The Company provided a number of reasons why there were discrepancies between the DRIVE tool and actual interconnection studies, concluding that an HCA is presently only capable of providing a high-level overview of the potential for DER interconnection, and is not reliable for more than a first step of the interconnection process.[106] Based on this, the Department finds that the Company satisfied the requirement of the 2019 HCA Order requiring Xcel to compare the DRIVE tool to interconnection study results.[107]

IREC supports the 2019 HCA's accuracy check, but maintains that further data validation efforts are needed once frequency and granularity issues are addressed. IREC suggests that the

[103] Department Supplemental, pp. 12-13
[104] Department Supplemental, p. 6
[105] Xcel Reply, pp. 5-6
[106] Department Initial, pp. 19-20
[107] Department Initial, p. 20

Commission work with stakeholders and Xcel to ensure a more robust, representative and thorough accuracy assessment.

IREC raises the concern that although the comparison of results with Synergi is positive, the comparison with actual interconnection studies is not. Less than half of the feeders in the 2018 HCA accuracy check had valid results.[108] IREC notes these inaccuracies may have less to do with the model itself, and more to do with how infrequently the model is updated and the lack of granularity in its results. Therefore, IREC believes that the best way to increase the accuracy of Xcel's HCA is to perform monthly updates and provide more granular results. (**Decision Options 8a-f, 11-13**) IREC recommends implementing these recommendations, then engaging in a data validation effort.[109] To begin, IREC recommends that Xcel develop a written data validation plan, accept written feedback from stakeholders, and then implement a plan that incorporates stakeholder feedback.[110] (**Decision Option 24**).

Sensitivity Analysis

The Department comments that Order Point #7C of the 2019 HCA Order has the operational effect of requiring Xcel to conduct a sensitivity analysis of the 2019 HCA. It explains that in the 2018 HCA, Xcel conducted a sensitivity analysis for the bus voltage and DER power factor on multiple feeders. However, the Company did not perform a sensitivity analysis for the 2019 HCA. The Department agrees with Xcel that performing a sensitivity analysis on these two variables would have been redundant and would not have yielded additional results. The Department also agrees with Xcel that translating the theoretical gains in hosting capacity (demonstrated by the Company's bus voltage sensitivity analysis in the 2018 HCA) into actual gains of hosting capacity would likely result in several negative unintended outcomes for customers. As a result, the Department concludes it is not a suitable to perform this sensitivity analysis at this time.[111]

As part of Reply Comments, the Department asked Xcel to discuss whether performing a sensitivity analysis on any other variables in the HCA might be valuable and potentially lead to increased hosting capacity. The Company suggests that adjusting the increments of added generation may provide more granular value, but suggests resources are better focused on substantive advancements such as increasing the frequency of analysis.[112] After reviewing Xcel's response, the Department concludes that performing sensitivity analysis on additional factors would not be useful.[113]

Load Analysis

[108] IREC Initial, p. 35. Fn. 80
[109] IREC Initial, pp. 35-37
[110] IREC Supplemental, p. 4. IREC notes that a national best practice for validating HCA results has yet to be developed, but that many states are evaluating possible approaches. IREC expects a data validation plan to use automated flags to identify results that may be inaccurate, including a certain number of random manual checks to ensure accuracy before publication, and a system to check that hosting capacity results of zero are accurate.
[111] Department Initial, p. 26-27
[112] Xcel Reply, p. 17; Xcel Supplemental, p. 5
[113] Department Supplemental, p. 8

IREC argues that HCA load analysis can support the review and approval of long-term integrated distribution plans and investments by helping to cost-effectively integrate DERs to the benefit of all ratepayers. It claims that both software tools that Xcel uses for its HCA - DRIVE and Synergi - can perform load analysis.[114] Although the Commission in the 2019 HCA Order indicated that load analysis would be useful[115], IREC argues Xcel did not meet the goals endorsed by the Commission in the Order.

Xcel's analysis models incremental increases in load, then adds incremental, additional DER generation at various locations on a representative feeder. According to IREC, what customers need is an analysis that identifies how much new DER load (electric vehicle chargers or energy storage) a feeder or sections of a feeder can accommodate without additional study or cost. (**Decision Option 25).** Currently, a time-intensive study is required before a customer will know if a particular site will trigger costly upgrades.[116]

IREC understands that such an analysis would not require any additional updates to feeder models, which is the most time-intensive part of the HCA. Instead, performing HCA for new DER load only requires taking the feeder models that are already in the DRIVE tool, providing appropriate load data, and requesting the results. Xcel claims that performing this analysis will be onerous because it uses different load data. However, IREC argues that using different load data is not onerous; it is the same process and uses the same software tools as the HCA.[117]

Fresh Energy describes two types of load DER modeling under discussion: (1) modeling hosting capacity, as currently done, with the addition of load characteristics of DERs installed at the time of modeling, and (2) modeling hosting capacity under various scenarios of DER deployment, including both generation and load DERs. The first may not be critical until deployment levels warrant it, but the second appears important for informing integrated distribution planning and identifying comprehensive mitigations for areas of limited hosting capacity.

Xcel Energy finds little to no benefit in adding load-based DER to the HCA. The Company reiterates that adding load to allow for more hosting capacity is at most a one-to-one effect on the system, and could be less depending on the load characteristics. Xcel Energy identifies one exception: circumstances where the added load is consuming reactive power (VARs) which aids in reducing localized voltage – similar to adjusting the power factor on a DER. The Company cautions that drawing additional VARs beyond current limits is not advised, because VARs have to be generated somewhere – a cost borne by customers, not generators.[118]

Xcel Energy notes the worst case scenarios for generation and load hosting capacity differs - for generation hosting, it is light loading times with high voltage; whereas, for loading, it is heavy

[114] IREC Initial, pp. 29-30
[115] 2019 HCA Order, p. 12
[116] IREC Supplemental, p. 12. For example, IREC notes that a local business chain seeking to locate electric vehicle chargers at its various locations could review the available load capacity at all its stores and install chargers only in locations least likely to trigger costly upgrades to Xcel's system.
[117] IREC Supplemental, pp. 12-13
[118] Xcel Reply, pp. 13-14

loading with low voltage. The Company agrees hosting capacity and other system planning will increasingly integrate; however, does not see the HCA as the place where that integration should occur.

Xcel Energy highlights better load forecasting using the proposed investment in an Advanced Planning Tool (APT) [119] will improve the HCA. However, the Company does not support using the APT's DER scenario analysis in the HCA because it would result in significant additional hours of work using today's HCA tools and capabilities. The Company is hopeful that as tools mature, these types of analyses will be more efficient and system-wide.[120]

D. Privacy and Security Considerations

In the 2019 HCA Order (Order Points #2B and #2C), the Commission requires Xcel to provide additional information in the public-facing hosting capacity map. This information includes, where available: peak load, daytime minimum load, installed generation and queued generation capacity. Further, the Commission recognizes a "tension between the need to provide information to support the continued development of DER, and the need to protect customer privacy and system security," and "qualif[ies] Xcel's duty to provide information if it would violate a specific privacy requirement or pose a significant risk to Xcel's system or its customers." In such event, the Commission places the burden of explaining the reasons for withholding information on Xcel requiring a "full description and specific basis for withholding that information, including any claim that the information is Trade Secret."[121]

In the 2019 HCA Report, Xcel Energy claims peak load data for both feeders and substation transformers is Protected Not Public data under the Minnesota Data Practices Act for security reasons, and suggests stakeholders did not identify this data as necessary for useful HCA information. The Company further maintains some feeders' data is protected as Critical Energy Infrastructure Information (CEII) or under the Company's 15/15 standard.[122]

In response to Fresh Energy's question about whether Minnesota's legal framework differs from other states' where this information is public[123], Xcel Energy asserts it is. The Company suggests other leading HCA states have legislative and regulatory frameworks driving transformation of the utility and DER market that may lead states to have different positions on whether the public interest outweighs security and privacy risks.[124] The Company highlights California and New York as "working to transform each state's power supply, part of which is to facilitate the entry of third party DER providers into the market through an alternative regulatory structure." Xcel Energy concludes Minnesota does not have a similar legislative or

[119] Xcel Energy, 2019 Integrated Distribution Plan and Advanced Grid Intelligence and Security Certification Request (Nov 1, 2019), Docket No. E002/M-19-666, pp. 11-12. Xcel describes the tool as enabling more efficient planning, enhanced load forecasting capabilities, and better integration with other planning effort, and estimates the tool will be available in 2022 and cost $4 million in upfront costs for NSP-MN.
[120] Xcel Reply, pp. 17-18
[121] 2019 HCA Order, p. 11, and Order Point #2C
[122] See page 7 of these briefing papers for more details.
[123] Fresh Energy Initial, p. 6
[124] Xcel Reply, p. 2

regulatory framework driving this transformation, and even if it did, privacy and security considerations for HCA maps and information require a fresh look – and are pending Commission action in California.[125]

IREC finds the redaction and withholding practices of Xcel to be inconsistent with the Commission's 2019 HCA Order and unsupported in the record.[126] IREC maintains that the Commission's Order requires Xcel to fully describe and explain the specific basis and reasons for withholding data in this docket.[127] IREC provides five arguments critical of Xcel's reasoning and explanations for data redaction and withholding.[128]

First, IREC argues that Xcel's use of the 15/15 standard is incorrectly applied to redacted data unrelated to a customer's energy use, including all HCA data from the applicable feeders. IREC notes that California utilities publish some or all of the data redacted by Xcel.[129] IREC concludes that if the 15/15 standard is used to redact customer information, it should allow Xcel only to redact peak load and daytime minimum load and to publish all other HCA data on its map.[130] (**Decision Option 26**) Xcel Energy argues customers' grid connection information, not just energy usage, warrant cautionary treatment for customer security and privacy.[131]

Second, IREC disagrees with Xcel's contention that peak load data is not useful to developers. IREC argues the usefulness of peak load data is in siting electric vehicle charging stations or new solar projects to avoid system upgrades triggered by peak load restrictions. Fresh Energy notes access to peak load data can help effective DER deployment shave or shift peak load.[132] If Xcel Energy publishes peak load data, IREC maintains, the result would be to avoid negative distribution system impacts and provide benefit for the grid. Therefore, IREC recommends Xcel should publish monthly peak load, as well as monthly absolute and daytime minimum load, for all feeders and substations.[133] (**Decision Option 16**)

Third, IREC maintains that Xcel's assertion of security risks to withhold data is overly broad. IREC argues that Xcel Energy's list of four categories of critical energy infrastructure data posing security risks does not meet FERC's CEII documentation standards[134], nor the required demonstration of significant security risk called for in the Commission's 2019 HCA Order.

Fourth, IREC discusses Xcel Energy's references to California utilities' Petition for Modification, in which three large utilities filed in 2018 to continue withholding certain information. Similar to

[125] Xcel Reply, 19-23
[126] IREC Initial, pp.17-29, IREC Reply, pp.3-6, IREC Supplemental, pp.13-16
[127] IREC Supplemental, p. 16
[128] IREC Initial, pp. 18-29
[129] IREC Initial, p. 19, fn. 40
[130] IREC Initial, p. 22
[131] Xcel Energy Reply, pp. 3, 23
[132] Fresh Energy Initial, p. 1
[133] IREC Initial, p. 23
[134] IREC suggests that FERC regulations related to Critical Energy Infrastructure Information (CEII) can serve as a guide to this determination. (IREC Initial, pp. 24-26.) FERC requires a proactive demonstration that the risks to specific pieces of infrastructure be specified and documented. (IREC Initial, p. 25, fn. 51, citing FERC Guidelines for Filing Critical Energy Infrastructure Information.)

Xcel, these utilities declined to provide certain CEII data; however, the California PUC has yet to rule on the Petition and in IREC's view may decline to rule or may even reject it.[135] IREC notes that utilities in California, unlike Xcel, have already published hosting capacity maps online that are updated monthly and contain much more granular information than Xcel's maps, such as exact line locations, load profiles, customer breakdowns by feeder as well as specific downloadable data.[136] IREC summarizes its references to FERC and California standards related to security risks and asks the Commission to hold Xcel to a reasonable standard of proof—not to accept blanket assertions of these security risks.[137]

Fifth, IREC asks the Commission to require Xcel immediately to publish the actual locations of distribution lines on its maps, rather than simply indicating broad blocks of color. This would be consistent with the practices of other utilities nationally and would materially assist developers to determine precise locations for connection. The resulting benefits for the design of DER facilities would improve the performance of the grid as a whole.[138]

The Company argues national cyber and physical security concerns have increased since some state commissions or individual utilities publicly published distribution grid information. The Company highlights (Xcel emphasis):[139]

- Russia has the ability to execute cyber attacks in the United States that generate localized, temporary disruptive effects on critical infrastructure—such as disrupting **an electrical distribution network** for at least a few hours—similar to those demonstrated in Ukraine in 2015 and 2016.
    - **Moscow is mapping our critical infrastructure with the long-term goal of being able to cause substantial damage.**

The Department highlights the Company's observation that existing regulatory, legal and industry frameworks provide little guidance over what data should be withheld.[140] The Department notes that Xcel relied on other state and federal-level guidelines related to consumer privacy and grid security, in particular the 15/15 standard, to preserve the anonymity of customer usage information by marking the data as Trade Secret. In addition, the Department recognizes Xcel's use of Personally Identifiable Information (PII) and Customer Energy Usage Data (CEUD)[141] to make privacy determinations.[142] The Department finds that Xcel's resulting four categories, under which it excluded data from its public-facing housing capacity map, are "a full description and specific basis for withholding information, including

[135] IREC Initial, pp. 27-28
[136] IREC Initial, p. 28, fn. 63, citing Southern California Edison's map at https://ltmdrpep.sce.com/drpep/
[137] IREC Initial, p.28
[138] IREC Initial, pp. 28-29
[139] Xcel Energy Reply, p. 21. Citing, and in full as Att. A to Reply, the President's National Infrastructure Advisory Council December 12, 2019 Report, pp. 5-6 which cites Daniel R. Coats, "Statement for the Record, Worldwide Threat Assessment of the U.S. Intelligence Community," Before the Senate Select Committee on Intelligence, January 29, 2019.
[140] Department Initial, p. 12, fn. 17
[141] See Docket No. E,G-999/CI-12-1344
[142] Department Initial, p. 13

Trade Secret Claims." Thus, the Department concludes Xcel Energy's redaction or withholding of information under these categories complies with the 2019 HCA Order.[143]

IREC states that neither the Department nor Xcel apply any known or demonstrable standard for determining the specific risks of publishing certain data. For example, IREC claims the Company does not explain how revealing peak load data would substantially increase risks to the grid.[144] IREC argues that each customer privacy claim and security risk should be treated specifically, as called for in the Commission's 2019 HCA Order. Finally, IREC argues that Xcel's use of, and the Department's support for, the 15/15 standard to redact data goes beyond the protection of CEUD authorized in the Commission's 2019 Order.[145] IREC recommends the Commission require Xcel to separately evaluate and justify each privacy and security concern, so as to provide "a full description and specific basis for withholding the information" as stated in the 2019 HCA Order at Order Point #2C. (**Decision Option 27**) IREC observes that Xcel's comments do not attempt to refute arguments concerning the scope of the data that should be withheld. It concludes that the burden of showing why data should be withheld lies with Xcel, especially given the Company's knowledge of its own systems and resources.[146]

In summary, IREC claims three recommendations would allow for reasonable information sharing and transparency, without adversely impacting customer privacy and security. First, it proposes that when the 15/15 standard calls for the redaction of customer energy use data (CEUD) at the substation or feeder level to protect customer privacy, Xcel should only redact load data at that individual level, while all other HCA data should be published on Xcel's map, and in a downloadable spreadsheet. (**Decision Option 26**) Second, it proposes that Xcel publish monthly peak load, monthly absolute minimum load, and monthly daytime minimum load, by substation and feeder, unless that data violates the 15/15 standard. (**Decision Option 16**) Third, IREC proposes that before withholding any HCA data for security reasons, Xcel should demonstrate that publishing data for that specific site creates a significant risk that is substantial enough to outweigh the benefits of providing this transparency to facilitate optimal siting of DERs.[147] (**Decision Option 27 and 28**)

Xcel Energy counters that addressing the security and privacy issues raised in this docket requires further dialogue about grid data, grid and customer security, privacy and confidentiality. As such, the Company suggests the discussion should involve all utilities, relevant experts with a role in protecting critical infrastructure, and customers.[148] (**Decision Option 29**)

---

[143] The Department indicates that its final recommendations would be contained in Supplemental comments. The Department's final list of recommendations do not call on the Commission to require Xcel to alter its current redactions or data withholding practices for purposes of confidentiality or privacy. (Department Supplemental, pp. 14-15.)

[144] Staff note: Xcel Energy's claim for not providing the peak load data as public is described at p. 7 of these briefing papers.

[145] IREC Reply, pp 5-6

[146] IREC Supplemental, p. 15

[147] IREC Supplemental, pp. 3-4

[148] Xcel Supplemental, p. 3

E. Stakeholder Engagement

The Department notes that the 2019 HCA Order (Order Point #2A) requires Xcel to work with stakeholders to improve the value of the HCA. Fresh Energy comments that the 2019 HCA is significantly improved and that Xcel has worked to address many of the concerns raised by stakeholders.[149] The HCA is an iterative process involving stakeholders, and to-date includes annual review and direction from the Commission.

Xcel Energy summarizes outreach efforts for the 2019 HCA stakeholder meeting and survey. This includes notification to the HCA docket, 500 individuals receiving interconnection communications, and discussion at a Solar*Rewards Community Implementation Workgroup. The survey received 15 responses.[150] Xcel Energy summarizes the results:[151]

> The results showed that stakeholders would like the future functionality to include the ability to combine the HCA with the pre-application report provided to interconnection applicants, more frequent updates to the Heat Map (monthly or quarterly), the addition of notes fields, more defined lines by color rather than a heat map (like GoogleMaps), pop-up data, additional nodal data and application interface access.

The Department notes that only one of the functionalities identified in the survey led to a material change to the 2019 Report. Specifically, Xcel added on-screen pop-up functionality in the public-facing hosting capacity map, which displays additional data. In determining compliance with the 2019 Order, the Department finds Xcel's stakeholder processes for the 2019 HCA to be reasonable, given time constraints. However, the Department asked Xcel to provide a preliminary plan in reply comments to identify and engage additional stakeholders in the Company's next iteration of the HCA.[152]

The Department, Fresh Energy and IREC agree that well-timed stakeholder feedback is necessary to meet the public-facing intent required of Minn. Stat. §216B.2425, subd. 8, and the Commission's Orders. Although Xcel made a good faith effort to comply with the 2019 Order, and implement feedback after the HCA was completed, the parties concur that stakeholder processes and outreach should occur before or during the inception of the HCA so that it is more responsive to this feedback.[153]

In the 2020 HCA, the Department expects Xcel to engage additional stakeholders during the beginning phases of the report, so that it can be more responsive earlier in the process. Xcel Energy commits to reviewing the top three survey responses for possible inclusion in the 2020 HCA: combining the pre-application and HCA, monthly updates, and a notes field for the HCA map.

---

[149] Fresh Energy Initial, p. 4
[150] Xcel Reply, pp. 23-29 summarizes and responds to survey results. Staff Note: Fresh Energy surveyed 6 CSG developers for the 2018 HCA docket (Docket No. E002/M-18-684) summarized in the docket's May 23, 2019 Briefing Papers at 9, 11.
[151] *Id*. p. 26
[152] Department Initial, pp. 8-10
[153] Department Initial, p. 9; IREC Reply, pp. 6-7

In response to parties' feedback, Xcel Energy proposes the following stakeholder engagement plan:[154]

- Early March: Begin stakeholder outreach and host a stakeholder session on the new DRIVE combined methodology.[155]
- April/May: Second stakeholder session with a focus on: HCA technical assumptions and inputs, HCA spreadsheet and map details (e.g. notes field), and beginning to discuss AMI and other proposed advanced grid investment benefits for HCA.

Overall, the Department supports Xcel's stakeholder engagement plan and finds it improved over the Company's 2019 HCA effort. The Department requests the Company provide a fuller explanation of the results of the stakeholder process in the 2020 HCA. This summary of the process should include an overview of the feedback and suggestions provided by participants. It should also include discussion of whether the Company incorporated this feedback, and if not, why not.[156] (**Decision Option 30**)

IREC supports the Department's expectation that Xcel "engage additional stakeholders during the inception of the next iteration of the HCA" and that it be required to publish an HCA, which is "responsive to the stakeholder processes." IREC does not believe that Xcel's outreach included stakeholders who work on battery storage and electric vehicles. It recommends that Xcel perform a complete HCA, including both load and generation analyses so that customers can help deploy smart DERs that avoid system impacts and provide benefits to the system.[157] Fresh Energy recommends Xcel seek input from a diverse group of stakeholders, including EV charging developers and providers, on[158]:

- The criteria to be used, and data to prioritize, in more-frequent updates to the HCA
- What data to include in a notes field
- The usefulness of feeder line locations
- Use cases for a load hosting capacity analysis and what data points would be most useful

<u>Stakeholder Input on Technical Assumptions</u>

IREC welcomes the opportunity to discuss technical assumptions with Xcel.[159] According to IREC, some of the technical assumptions, limiting criteria, and thresholds upon which Xcel's HCA relies were applied so as to lead to inaccurate results. To ensure that stakeholders have an understanding of how Xcel performs its analysis, and an opportunity to suggest modifications,

[154] Xcel Reply, p. 24
[155] Xcel Energy, Letter (March 13, 2020) and Ex Parte Communication (May 5, 2020) in current docket. Staff confirms two HCA stakeholder meetings were rescheduled for June 2 and June 16 via email from the Company.
[156] Department Supplemental, p. 3
[157] IREC Supplemental, p. 13
[158] Fresh Energy Supplemental, pp. 6-7
[159] IREC Supplemental, p. 11

IREC proposes that the Commission supervise a discussion leading to an Order directing the use of specific assumptions, criteria and thresholds.[160]

IREC recommends that the Commission oversee and facilitate these discussions and set assumptions and thresholds by Order, allowing stakeholders and Xcel to discuss the technical assumptions applied, while providing the Commission with oversight of important choices and technical decisions.[161] These discussions should be Commission-supervised, decision-fixing, and lead to an Order. (**Decision Option 31**)

F. Commission Action on the 2019 Hosting Capacity Analysis Report

Approve or Reject

Xcel Energy requests the Commission accept the 2019 HCA Report. (**Decision Option 1**)

No party suggests rejection. The Department notes that Minn. Stat. § 216B.2425, subd. 8, has a substantive requirement (to conduct a study) and a procedural requirement (to include the study in its report). The Department then says that the 1,050 feeders including the 115 excluded from the "heat map" are "a reasonable and sufficient amount of interconnection points on the Xcel distribution system" and render the 2019 HCA "complete" as far as the substantive requirement of the Statute is concerned."

As mentioned earlier, Fresh Energy requests a compliance filing be required as part of the 2019 HCA (**Decision Option 1.b**)

Staff notes no action on the 2019 HCA Report is required, but the Commission has accepted the past three HCA Report iterations and provided additional guidance by order. The Commission is guided by Minn. Stat. 216B.2425; subd. 8 and past HCA orders.

Past Orders

The Department performed an analysis of the 2017, 2018, and 2019 HCA Orders to determine whether there were Order Points that appeared related. The Department reviews compliance with these Order Points and made specific recommendations on each. The Department interprets the more recent Commission Order (2019 HCA Order) to be superseding. The Department concludes that only two Order Points from the earlier Orders (2017 and 2018) remain operational. These are Order Point #2 of the 2018 Order, and Order Point #7C of the 2018 Order:[162]

> 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

[160] IREC Initial, pp. 30-31
[161] IREC Supplemental, pp. 11-12; IREC Initial, pp. 29-30. See staff summary of IREC's comments on specific technical assumptions in **Attachment A** to staff briefing papers
[162] Department Initial, pp. 22-26; See Table 5, p. 25.

of submittal of the report to the extent practicable. The information should be sufficient to provide developers with a starting point for interconnection applications. (**Decision Option 5**)

7c- The Commission hereby requests that Xcel Energy address stakeholder recommendations in the Company's 2018 Hosting Capacity Report filing; including … conduct a sensitivity analysis. (**Decision Option 22**)

Xcel Energy supports the Department's analysis and requests the Commission carry forward only the specific past Order points that remain relevant for the current Order.

VI. Staff Analysis

Hosting Capacity Analysis

In the past, staff provided an average hosting capacity and total change in minimum and maximum hosting capacity; however, Xcel Energy has cautioned against that interpretation of the HCA Report because individual feeder hosting capacity does not take into account substation hosting capacity limits. Meanwhile, IREC and Fresh Energy argue using a 20% assumption about a feeder's DML could result in conservative hosting capacity. Staff is not able to analyze the impact of actual vs. estimated DML in the 2019 HCA because most feeders in the spreadsheet have actual DML, but at the time of the DRIVE HCA only 25% of the feeders included the actual data. This should be corrected in the 2020 HCA given Xcel Energy was able to complete the DML data for inclusion in this year's spreadsheet after the HCA. Having feeder data identified is helpful to understand the impact of actual DML vs. the 20% of peak assumption on hosting capacity results. Below staff offer a comparison of a feeder's minimum and maximum hosting capacity between 2018 and 2019 (# of feeders) and the percent of those feeders which also saw any increase in DER (Feeders w/ increased DER). The final column reports what percent of total feeders fall into each category (Feeders as % total feeders).

Feeder-level Changes between 2019 and 2018 HCA[163]

	# of feeders	Feeders w/ Increased DER	Feeders as % total feeders[164]
Increased Min Hosting Capacity	213	45%	20%
Increased Max Hosting Capacity	833	56%	79%
Decreased Min Hosting Capacity	666	58%	63%
Decreased Max Hosting Capacity	186	66%	18%
No change in Min Hosting Capacity	167	65%	16%

[163] The percentages for Increased DER denote a change to Xcel's distribution system; whereas, feeder and substation DML are the number of feeders in that row that had DML data provided. Staff cannot tell from the HCA spreadsheet which DML data was added after the DRIVE HCA, and cautions only about 25% of the feeders had actual DML data incorporated when the DRIVE HCA was done for the 2019 HCA Report.

[164] Not all 1050 feeders have min. and max. hosting capacity values in both 2018 and 2019 HCA. 1046 feeders have min hosting capacity values; whereas, 1026 have max. hosting capacity values.

No change in Max Hosting Capacity	7	86%	1%

Xcel Energy made a number of other modifications to the hosting capacity analysis between 2018 and 2019. Staff notes overall 5% of all feeders saw an increase in both minimum and maximum hosting capacity; 1% saw a decrease.

Use Case or Purpose of the HCA

Staff identifies 3 related questions are relevant to a number of the contested issues: 1) what information should be provided publicly and for free?; 2) how often should information be updated and provided and at what level of granularity when not specifically requested (and paid for by the requester)?; and 3) how should costs and privacy or security for providing such information be handled?

IREC argues that if Xcel Energy identifies no cost or privacy or security concerns with information available in a pre-application report, then it should be made publicly available in the HCA map and spreadsheet[165] (**Decision Option 3**). Xcel Energy may disagree if the expectation is that the Company is required to provide more frequent updates or granular display of data than exists in the HCA today. Otherwise, the Company does not appear to disagree, except to question the value of this information when not provided for a specific location at a specific point in time.

For the remaining data, a trade-off emerges: Xcel maintains some of the data released with a paid pre-application report would be too costly or sensitive to provide on the free HCA map or spreadsheet. For example, a pre-application report includes "[r]elevant line section(s) actual or estimated peak load and minimum load data, including daytime minimum load … and absolute minimum load, when available"[166] (staff emphasis). However, the Company states that the peak load data in the HCA is Protected Non-Public and will not be provided even under a NDA. In this case, staff leans toward preserving an interconnection customer's ability to access this information for a specific location even if it requires a fee and application with confidentiality provisions.

All parties seem to agree a version of the HCA should be publicly available and free, so staff cautions against requiring information in the HCA that would lead the Company to successfully assert a paywall is needed to recover costs at this time.

It is in the interest of the utility and the interconnection customer to identify locations with hosting capacity for DER interconnection applications, especially as the number of applications increases. While not a replacement for engineering review of an individual project, such locations are more likely to clear the streamlined Fast Track initial review screens which saves resources for both the DER and the utility. Staff supports the Department's request for Xcel

[165] The information in question: Transformer Name, Transformer Absolute Min, Load Tap Changer (LTC) or Regulator, Feeder Absolute Min, and Network or Radial. See IREC Initial, Att. A, Xcel Response, IREC IR No. 6.
[166] Xcel Energy Rate Book, Section No. 10, Sheet No. 174, MN DIP 1.4.2.8

Energy to continue evaluating costs and benefits of various uses of the HCA (**Decision Option 2**).

The Commission's 2019 HCA Order directed Xcel Energy to report on the evolving capabilities of DRIVE to incorporate a broadened definition of DERs, and whether the HCA could be used to assist with state energy policy goals related to beneficial electrification. Staff highlights that whether to require Xcel to use the HCA for siting beneficial electrification (e.g. EV charging stations or heating electrification) to avoid system upgrades (**Decision Option 4**), depends on the statutory requirement that the HCA focuses on distributed generation.[167] Staff notes that distributed generation includes storage (and could include EV-to-grid (VTG)) which has load and generation characteristics. Staff agrees with the parties, including Xcel Energy, that consideration of distribution system hosting capacity of load is important to ensure electrification and does not lead to reliability concerns or expensive system upgrades. Staff supports this issue being further developed in the Company's integrated distribution plans[168] or, if focusing on engaging EV stakeholders, the Transportation Electrification Plan.[169]

HCA Methodology and Tools

Parties are in agreement to continue to address the evolving capabilities of Synergi and DRIVE (**Decision Option 7**). Staff takes no position on the Department's request for a comparison of Synergi and DRIVE (**Decision Option 6**), but suggest that this analysis could fit within the scope of the DRIVE demonstration at the rescheduled stakeholder workshop.

Frequency of Update

Parties agree, and Xcel's survey identified as a top priority, that increasing the frequency of HCA data updates from annually to monthly would be more valuable for developers and customers. Parties also agree monthly updates could be streamlined by doing partial rather than full updates of the HCA by focusing on feeders with "significant changes." The criteria for when a change is "significant" and the cost for Xcel Energy to monitor and update the feeder data (and if needed, rebuild feeder models to run the DRIVE analysis) is not fully developed in the record. The cost consideration is exacerbated by the Company's current reliance on an influx of summer interns to do an unclear amount of this work in the current annual updates to the HCA.

IREC recommends the Commission require Xcel Energy to begin monthly updates of the HCA with the 2020 HCA (**Decision Option 8a-f**.) The Department and Fresh Energy offer different timeframes for Xcel Energy to develop criteria for partial, more frequent updates moving from annual to semi-annual, quarterly or monthly before the Commission requires implementation. Staff takes no position, but notes the Department proposal would mean more frequent updates will not occur before the 2020 HCA (and realistically, not before Commission action in first or second quarter of 2021 (**Decision Option 10**)). Alternatively, the Commission may wish to clarify how a compliance filing will be treated if filed outside the annual Commission review of a HCA

[167] Minn. Stat. 216B.2425; Subd. 8. Distribution Study for distributed generation.
[168] 2019 IDP is in Docket No. E002/M-19-666
[169] E999/CI-17-879

report (**Decision Option 9**). For instance, the Commission could adopt the IREC proposal to start monthly updates beginning on Nov 2, 2020 with the 2020 HCA (**Decision Option 8**) and treat the Fresh Energy compliance filing as a preview of the associated criteria and costs, or use the compliance filing to make a decision in the 2020 HCA Order.

More frequent updates should have an additional benefit. Today, if an interconnection customer requests and pays for a pre-application report they may not receive more current information than what is provided in the HCA if the Company is not able to pull that data from a desktop nor compiling that data more frequently for another purpose.

Granularity of Data

The Commission may wish to prioritize the frequency of HCA updates or the granularity of HCA helping to balance the trade-offs between usefulness and costs, including Xcel Energy staff resources. In recognition of the unresolved privacy and security considerations and the stakeholder prioritues identified in the survey, frequency of updates seems the obvious near-term priority. Alternatively, the Commission could provide guidance on the privacy and security considerations in this docket. If the Commission wishes to address data granularity, more accurate public map display of the feeder or line segment data provided in the pop up box seems a higher priority based on survey results than providing nodal information at this time.

Minimum Load Data

Staff commends Xcel for reporting actual data for nearly all feeders, and supports notation of which feeders are actual vs. assumed DML in the HCA going forward. This notation is critical to evaluating the effect of actual vs. estimated DML on a feeder's hosting capacity. To that end, it would be beneficial for Xcel to provide such notation for the 2019 HCA data (**Decision Option 1.b(ii)**); as well as for data going forward (**Decision Option 14**.) Staff offers language for the 2019 DML notations as part of the compliance filing, but is open to the data provided with the 2020 HCA. Staff is unclear if Xcel Energy has this data readily available. Parties may wish to address this issue at the Agenda Meeting.

Staff is unconvinced that absolute minimum data is a priority at this time, and sees more long-term value for all DER in more time-varying data on load (such as monthly peak and DML hourly data) (**Decision Option 16**). This may be a topic for further discussion with stakeholders; especially HCA users.

Criteria Violation Values

Providing not only the other limiting factors but the additional hosting capacity potential if the primary violation is mitigated could be very valuable information to a DER customer. This is especially true because some mitigations can be inexpensive. However, Xcel Energy cautions that this information has limited value because it does not consider the cascading impacts of the mitigation for the first violation on the next and so on. Xcel Energy offers to discuss this option further in the 2020 HCA Report (**Decision Option 18**). The Department, Fresh Energy and IREC are in agreement that this information should be provided in any case (**Decision Option**

17). Staff takes no position. This may be an issue for further stakeholder discussion, including HCA users (developers), to make sure there is a shared understanding of what the information provides.

Mitigation Analysis

First, Fresh Energy, the Department and Xcel Energy agree to request EPRI's consideration of adding load as a mitigation option in the mitigation assessment tool. The Department requests Xcel report on progress of this request in the 2020 HCA, but does not provide a decision option. The Commission may wish to confirm that the Company intends to provide such a report.

Second, Fresh Energy suggests a driving factor of the zero capacity feeders is the continued use of estimated DML, and requests the Company report in the 2020 HCA which feeders had actual versus estimated DML in the DRIVE analysis. As mentioned above, staff supports this recommendation and, if practicable, the inclusion of notation of which feeders had actual DML used in the 2019 DRIVE HCA (**Decision Options 14 and 1.b(ii)**).

Finally, the Department recommends continuing the mitigation assessment in the 2020 HCA and amends what was required for the 2019 HCA to include a specific discussion on DER as a mitigation and "whether the mitigation analysis can be relied upon to interconnect specific and actual [DER] project proposals." (**Decision Option 19**.) Xcel Energy recommends not repeating the mitigation analysis for the zero capacity feeders, and notes that unless the interconnection study is at the same exact location the error range when compared with the mitigation analysis will be subjective. Staff defers to the Commission, but suggest limited resources may be better spent on increasing the frequency of updates or granularity of data available for the HCA map and spreadsheet.

Accuracy and Sensitivity Analyses

Data validation has benefit not only for the HCA, but also for the interconnection process and pre-application reports to the extent the Company is updating the data across platforms. (**Decision Option 24**.)

Staff supports the Department and Xcel Energy's conclusions, and recommends no action on **Decision Option 22,** which, if adopted, would carry forward past order's requirement for the Company to conduct a sensitivity analysis. If the Commission wishes to make it clear a sensitivity analysis is not required in the 2020 HCA, staff offers **Decision Option 23**.

Load Analysis

Staff agrees with the overall goal of optimizing distribution system assets by identifying ideal locations for DER, but note how DERs are evaluated by the utility differs. DER encompasses load-only (e.g. EVs, demand response, energy efficiency) and load and generation resources (e.g. storage, solar+storage, EV-to-grid).[170] Load-only resources are not subject to the same

[170] Staff notes it may be true that a controllable EV load and solar would have a similar potential at expanding

interconnection review as DER, which can also deliver electricity to the grid. Instead, load-only resources are addressed in new service requests, possibly in DR or EE program enrollment, and in distribution system planning. Depending on grid impacts, some load at the time of connection is required to invest in distribution upgrades; whereas, other load is perceived to cover distribution costs through their monthly bills (whether demand or energy (consumption) charges.)

The 2019 HCA Order directed Xcel to "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." Xcel did this, but not with a nuanced load shape for the load and generation offered by the DER. Staff is unsure such nuance can be captured at the granularity of data used (annual peak load and DML) in the HCA currently, nor whether that nuance can be incorporated into DRIVE or in future HCA load forecasts developed by Xcel Energy's proposed Advanced Planning Tool, if approved. [171]

IREC recommends the Commission continue to require load analysis in the HCA (**Decision Option 25**). If the Commission determines one of the use cases of the HCA is to support beneficial electrification or electric vehicles as Fresh Energy suggests, the Commission should adopt this recommendation.

Privacy and Security Considerations

The Commission has provided clear guidance on privacy related to customer energy usage data (CEUD) and Personal Identification Information (PII). For instance, the Commission defined CEUD as "data collected from the utility customer meters that reflects the quantity, quality, or timing of customers' natural gas or electric usage or electricity production" and required utilities to have customer consent and otherwise apply an aggregation policy to release the data.[172] The Commission has an open docket on a petition to further open access to customer energy usage data.[173] The Commission has not issued an Order directly addressing a utilities' aggregation policy despite references in a number of dockets; such as, Xcel Energy's 15/15 standard. Nor has the Commission issued an Order on the definition of critical energy infrastructure information beyond referencing the FERC regulation in the Minnesota DER Interconnection Process (MN DIP 5.9). As mentioned, in the 2018 HCA Report review and in party comments in this docket, there is more clarity on customer privacy and critical energy infrastructure than distribution grid information or as Xcel describes a customer's grid connection information.

Staff will not repeat parties' arguments but recognize the tension between information and privacy and security identified by the Commission in the 2019 HCA Order remains. The Commission has flexibility in whether and how to address this issue. IREC prefers the

hosting capacity of a feeder.

[171] Docket No. E002/M-19-666

[172] MN PUC, ORDER GOVERNING DISCLOSURE OF CUSTOMER ENERGY USE DATA TO THIRD PARTIES, REQUIRING FILING OF PRIVACY POLICIES AND COST DATA, AND SOLICITING COMMENT (January 17, 2019), Docket No. E,G-999/CI-12-1344, Ordering Points 1 & 2.

[173] Docket No. E,G-999/M-19-505

Commission provide direction in this docket (**Decision Option 26-28**); whereas, Xcel Energy suggests any guidance should be developed with other utilities and industry experts (**Decision Option 29**.)

Stakeholder Engagement

Staff appreciates the parties working together to identify an earlier stakeholder schedule to inform the 2020 HCA (**Decision Option 30**). For the 2020 HCA, it will be difficult given staffing resources for the Commission to lead a discussion on the technical assumptions as proposed by IREC (**Decision Option 31.a-f**). It may be more realistic/appropriate for Commission staff to observe or for parties to file a report on the outcome of that discussion. Parties seem to agree there is value in more detailed discussion.

Past Orders

Staff defers to the Commission on whether or not to identify which past ordering points should be explicitly carried forward in the 2020 HCA Order to maintain the Commission's direction:

> In future hosting capacity reports, Xcel shall do the following … [c]ontinue to consider and address the requirements from the 2017 Order, 2018 Order, and the current order.[174]

Past orders remain in effect unless superseded. The Department highlights two 2018 Order Points which carry forward: starting point for interconnections and sensitivity analysis. Staff offers the Commission **Decision Options 5 and 22.a** to include these without referencing past orders.

Staff notes that the 2019 HCA Order also directs Xcel in future HCA Reports to address: 1) the appropriateness of using the DRIVE Large, Centralized methodology; 2) the Company's ability to obtain more detailed information on secondary voltage equipment and DERs interconnected, and 3) conduct a sensitivity analysis.[175] No decision options was offered by parties on the first two, and without Commission action these requirements would be retained for the 2020 HCA. It may be easier for the Commission to bring forward with this docket's order the items to be retained. (**Decision Option 22.b-d**.)

VII. Decision Options

1) Accept the 2018 Hosting Capacity Analysis Report filed by Northern States Power Company d/b/a Xcel Energy. (*Xcel Energy*)

[174] MN PUC, 2019 HCA Order, Ordering Point #8.d.
[175] 2019 HCA Order, Order Point #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."

a) Find the filing satisfies requirements of the Commission's Order Accepting Study and Setting Further Requirements (August 15, 2019) in Docket No. E002/M-18-684 [2019 HCA Order]. (*Xcel Energy*)

OR

b) Require a compliance filing within 30 days of the Commission's Order including:
   i) a tabular report containing the sub-feeder results displayed on the 2019 hosting capacity map. This report shall be available in the docket, on the hosting capacity webpage, and/or by email request. (*Fresh Energy*)
   ii) Include notation of which feeders had actual DML data incorporated in the 2019 DRIVE HCA (*Staff*)

AND/OR

c) Find improved and additional information is necessary in future reports to satisfy the requirements in Minn. Stat. 216B.2425; Subd.8. (*IREC, Fresh Energy*)

HCA Use Cases

2) Xcel shall collaborate with stakeholders in evaluating the costs and benefits associated with a hosting capacity analysis able to achieve the following objectives: (*Department*)
   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; further,
   d) Direct Xcel to continue working with stakeholders to identify opportunities to integrate the HCA and the MN DIP pre-application and screening processes in future iterations of the HCA.

3) Direct Xcel to include on the HCA map and in downloadable spreadsheet format the following data: Transformer Name, Transformer Absolute Min, Load Tap Changer (LTC) or Regulator, Feeder Absolute Min, and Network or Radial. (*IREC*) **[D.O. 8.f requires same monthly]**

4) Direct Xcel in the 2020 HCA, to provide a discussion of how Xcel's hosting capacity analysis can be used to assist state energy policy goals related to beneficial electrification including detail on how a load hosting analysis would be done, an estimate of the resources that would be required, and the specific information the Company could provide. (Fresh Energy)

5) Xcel's 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. (*2018 HCA Order, Order Point #2*)

HCA Methodology and Tools

6) Direct Xcel to analyze and compare the hosting capacity of a selection of representative feeders using both the DRIVE tool and Synergi. (Department)

7) Direct Xcel to provide an update on the evolving capabilities of Synergi in future HCAs and a discussion of which tool is more capable of providing an accurate and reliable HCA in the 2020 HCA Report. (Department)

Frequency of HCA Updates

8) Require monthly updates and publication of hosting capacity analysis and available distribution system data beginning with the 2020 HCA Report. (*IREC, Minneapolis)*
   a) For feeders where significant changes in load, configuration, or generation has occurred, update or rebuild those feeder models and publish updated HCA data and results.
   b) Publish the criteria violation values for each HCA model run and location.
   c) Publish HCA results using peak load for each month of the year, daytime minimum load in each month of the year and absolute minimum load in each month of the year.
   d) Include a unique name or number for each line segment in the map's pop-up boxes.
   e) Show the actual locations of distribution system lines instead of broad blocks of color on the HCA map.
   f) Include on the HCA map and in downloadable spreadsheet format the following data: Transformer Name, Transformer Absolute Minimum, Load Tap Changer (LTC) or Regulator, Feeder Absolute Minimum, and Network or Radial.

OR

9) Evaluate the feasibility, resource requirements, and estimated costs of partial (targeted) updates to the HCA and file a compliance filing by [*INSERT DATE*]. This analysis should evaluate the feasibility, resource requirements, and costs for (1) monthly and (2) quarterly updates, and updates made pursuant to different possible criteria. Xcel shall consult with stakeholders about which criteria should be prioritized in more frequent updates and which to examine in this compliance filing. (*Fresh Energy)*

OR

10) Provide options for monthly, quarterly and semi-annual HCA updates, including cost estimates, with the 2020 HCA Report filing (*Department*, *Xcel Energy)*

Granularity of HCA

11) Direct Xcel to include a unique name or number for each line segment in the maps' pop-up boxes. (*IREC*) [**D.O. 8.d requires same monthly**]

12) Direct Xcel to show the actual locations of distribution system lines instead of broad blocks of color on the HCA map. (*IREC*) [**D.O. 8.e requires same monthly**]

13) Direct Xcel, starting in November 2020, to make available a tabular report containing the sub-feeder results displayed on the 2020 hosting capacity map. This report shall be available in the docket, on the hosting capacity webpage, and/or by email request. (*Fresh Energy, IREC, Minneapolis*)

Granularity of Load Data

14) Direct Xcel to include in future HCA reports the precise number of feeders with actual and estimated Daytime Minimum Load data and note the feeders with estimated Daytime Minimum Load on the tabular spreadsheet to inform developers' use of the report. (*Fresh Energy)*

15) Direct Xcel, in future HCA reports, to provide a description of plans for adding SCADA to additional feeders, particularly rural feeders where SCADA would help secure actual Daytime Minimum Load data for areas with significant community solar garden penetration. (*Fresh Energy)*

16) Require Xcel to publish HCA results using peak load for each month of the year, daytime minimum load in each month of the year, and absolute minimum load in each month of the year unless that data violates the 15/15 standard. (*IREC)*

Criteria Threshold Violations

17) Direct Xcel to publish the criteria violation and corresponding hosting capacity values for each HCA model run and location in the 2020 HCA tabular report and map with appropriate caveats. (*IREC, Fresh Energy, Department, Minneapolis*)

18) Examine publishing the additional criteria violation information and provide an update in the 2020 HCA Report (*Xcel Energy*)

Mitigation Analysis

19) Direct Xcel to perform mitigation analyses [*of feeders with zero hosting capacity analysis*] in future HCAs that provide information related to: (1) the frequency at which constraints to individual feeders occur; (2) the mitigation options available for those constraints and a discussion of whether distributed energy resources can also serve as a mitigation option; (3) the amount of additional hosting capacity that can be obtained by implementing the identified mitigation option; (4) the cost of each mitigation option; and (5) whether the mitigation analysis performed by Xcel can be relied upon to interconnect specific and actual distributed energy resource project proposals. (*Department with [Staff clarification], Minneapolis*)

20) Direct Xcel to request that EPRI add load DER into EPRI's Mitigation Assessment tool. If such a feature can be added in time to conduct such analysis for the 2020 HCA, Xcel should do so. If it cannot be added in time, or added at all, Xcel should provide the results of its discussion with EPRI. (*Department*)

21) If load DER cannot be incorporated into EPRI's Mitigation Assessment tool in time to be included in Xcel's 2020 HCA, direct Xcel to conduct an illustrative technical and economic analysis of the effect that a load DER can have on hosting capacity as an alternative to traditional mitigation options. (*Department*)

Sensitivity and Accuracy Analysis

22) The Commission requests that Xcel Energy address stakeholder recommendations in the Company's 2020 Hosting Capacity Report filing; including:

[*No action maintains these options based on the cited Orders]*

a) Conduct a sensitivity analysis. (*2018 HCA Order, Order Point #7c*)
b) Re-evaluate Xcel's choice to focus its hosting capacity analysis on large centralized DERs rather than smaller ones. (*2019 HCA Order, Order Point #8a)*
c) Discuss Xcel's ability to obtain more detailed data on secondary voltage equipment, and the types of DERs being interconnected to Xcel's system. (*2019 HCA Order, Order Point #8b)*
d) Continue to consider and address relevant requests from parties. (*2019 HCA Order, Order Point #8c)*

23) The Commission does not require a sensitivity analysis for the 2020 HCA (*Staff clarification option*, *Department, Xcel Energy*)

24) Direct Xcel to develop a written data validation plan for HCA results, accept written feedback from stakeholders on a draft of the written plan, and then include the final plan in the next HCA report. (*IREC*)

Load Analysis

25) Direct Xcel to provide an HCA that is useful for identifying how much new DER load a feeder, or sections of a feeder, can feasibly accommodate without additional study, upgrades, or cost. (*IREC*)

Data and Privacy/Security

26) Find that when the 15/15 standard calls for the redaction of customer energy use data (CEUD) at the substation or feeder level to protect customer privacy, it is only appropriate to redact load data at that individual level. All other HCA data should be published on Xcel's map, and in a downloadable spreadsheet. (*IREC*)

27) Require Xcel to separately evaluate and justify each privacy and security concern, so as to provide a full description and specific basis for withholding the information. (*IREC*)

28) Direct that before withholding any HCA data for security reasons, Xcel must demonstrate that publishing data for a specific site creates a significant risk that is substantial enough to outweigh the benefits of providing this transparency to facilitate optimal siting of distributed energy resources (DERs). (*IREC*)

29) Refer discussion of grid data, and grid and customer security, privacy, and confidentiality to a Commission discussion involving all utilities, relevant experts with a role in protecting critical infrastructure, and customers. (*Xcel Energy*)

Stakeholder Engagement

30) Direct Xcel to implement its 2020 stakeholder engagement plan as outlined in the Company's January 17, 2020 Reply Comments. Direct Xcel to provide the results of the stakeholder process, including an overview of the feedback and suggestions provided by stakeholders, whether the feedback and suggestions are included in the 2020 HCA, and an explanation for any feedback and suggestions received but not included in the 2020 HCA Report. (*Department, Minneapolis*)

31) Direct Commission staff to oversee and facilitate a discussion with Xcel and stakeholders of the technical assumptions, limiting criteria, and thresholds used in Xcel's HCA. Find that after this discussion is completed, the Commission will issue an order setting the thresholds and assumptions for Xcel to use in its HCA. The discussion should address: (*IREC, Minneapolis*)

    a. Thresholds for what constitutes a significant change in configuration, load, or generation to warrant rebuilding a feeder model,
    b. Use of the Maximum Tap Regulators in Over/Under-Voltage Analysis setting,
    c. Analysis assumptions for Primary Voltage Deviation
    d. Other voltage analysis issues identified in IREC's opening comments
    e. Limitations on Unintentional Islanding, and
    f. Other topics identified by stakeholders for review.

32) Direct Xcel Energy to file the 2020 HCA Report on November 2, 2020. (*Staff. Clarifies annual HCA Report filing in even-numbered year.*)

Attachment A: Summary of IREC Comments on Technical Assumptions

(**Decision Option 31.a-f**)

A. Thresholds for Feeder Model Rebuid

IREC notes that Xcel Energy developed thresholds for rebuilding a feeder model based on what constitutes a significant change in configuration, load, or generation. The Company used a 500 kW threshold for changes in load. IREC finds this high for a single feeder because smaller changes in load are likely to impact reverse power flow. Xcel also considered the placement of a new solar garden as the threshold for new generation, but IREC notes that most solar garden projects have a capacity around 1 MW, which is a high threshold for a single feeder. For both of these thresholds, IREC proposes that Xcel instead use the smallest increment that is feasible, such as 100 kW, in the Company's next HCA in order to produce more accurate results.[176]

B. Max Tap Regulators

IREC is also concerned that Xcel Energy's analysis assumption that distribution equipment is operated at the high end of voltage ranges and allowing for zero tap changes, leaves little headroom for DERs to reduce load or reverse power flow on a feeder without causing overvoltage violations. If the HCA is to be used as a tool to understand how operations might be altered to accommodate higher levels of DER, then a supervised discussion, of the actual voltage regulation techniques used by the Company in the field and whether these techniques are effectively modeled for the HCA, would be useful.[177]

C. Primary Voltage Deviation

IREC notes that Xcel Energy's Primary Voltage Deviation analysis assumes that all DERs on a circuit cease generation simultaneously. IREC questions this assumption, noting that IEEE has released new standards that address similar step voltage changes for DER. IREC proposes that the Commission and stakeholders review and consider how conservative this assumption should be in order to maintain power quality limits during normal operation. After further discussion, the Commission could consider issuing a decision addressing the appropriate method.[178]

D. Voltage Analysis Issue

IREC argues that Xcel Energy's analysis of feeder voltage unnecessarily restricts the hosting capacity results, and suggests that the Commission supervise a discussion on voltage issue assumptions. According to IREC, the Company has configured the analysis so that voltages

[176] IREC Initial, p. 31
[177] IREC Initial, p. 32
[178] IREC Initial, pp. 32-33

outside a certain range never occur, which is more strict than required by the American National Standards Institute (ANSI).[179]

E. Unintentional Islanding

IREC comments that the Unintentional Islanding criterion in the HCA appears to limit reverse power flow through any large three phase protective device, further limiting the HCA values. Unintentional Islanding appears to be the limiting factor for hosting capacity on about 12% of Xcel Energy's feeders listed in the 2019 HCA. IREC suggests further review of the applicability of this criterion to inverter-based systems with anti-islanding protection is warranted.[180]

[179] IREC Initial, pp. 31-32
[180] IREC Initial, pp. 33-34