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February 2, 2018

XCEL ENERGY'S 2017 DISTRIBUTION SYSTEM / HOSTING CAPACITY STUDY **Docket E002/M-17-777**

FRESH ENERGY'S COMMENTS ON XCEL'S 2017 HOSTING CAPACITY REPORT AND SUGGESTIONS FOR MODIFICATION OF FUTURE REPORTS

Fresh Energy appreciates the opportunity to provide these comments pursuant to the November 15, 2017 Notice of Comment Period on Xcel Energy's 2017 Hosting Capacity Report with tabular data and accompanying map. We appreciate the effort Xcel has made to improve upon their 2016 report and urge the Company and the Commission to continue to invest in this worthwhile effort.

I. POLICY CONSIDERATIONS

As the Company, Commission and stakeholders continue to evaluate the DRIVE tool and hosting capacity methodology, it is important that the trajectory of the hosting capacity analysis exercise be clearly understood, and we urge the Commission to provide direction. From Fresh Energy's perspective, there are two key long-term objectives that Xcel's report questions:

1. **Xcel's hosting capacity analysis should aim to streamline the interconnection process by providing a starting point for applications *and* replacing engineering screens and/or streamlining study analysis.**

To reach this objective the DRIVE tool must continue to improve, Xcel must demonstrate accuracy of the results, and there must be a clear internal plan for integration of the tool. in response to the Commission's information request asking how hosting capacity can be used to inform or improve the interconnection process, Xcel provided the chart below illustrating their view of the hosting capacity analysis as a tool for developers, separated from the application review steps, and with the lowest level of information/accuracy.[1]

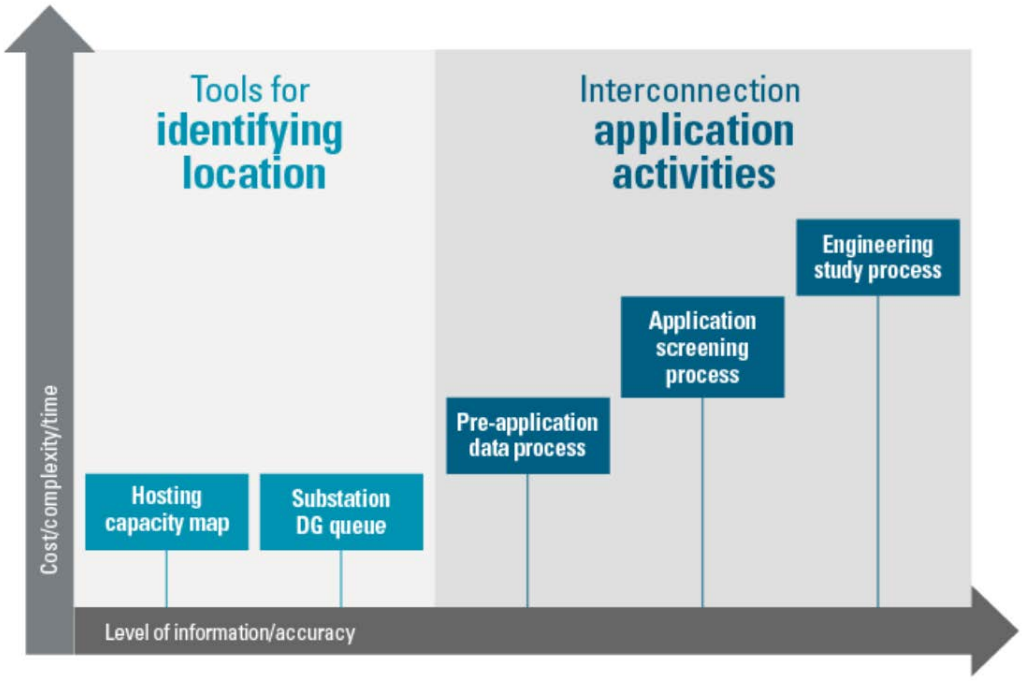

Figure 1. Xcel chart titled "Steps Toward Interconnection"

Additionally, Xcel's report says that it is "still exploring how to best meet the range of interconnection needs" and also says that, "it is possible that an additional tool may be best suited if a future objective were to streamline detailed study analysis."[2] This implies that

[1]https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={E0352361-0000-CFD1-8972-BFE21DCB0864}&documentTitle=20181-139202-09

[2] 2017 Hosting Capacity Report, p. 9

DRIVE may be insufficient to meet this long-term objective, in which case we recommend identifying other options as soon as possible.

2. Xcel's hosting capacity analysis should aim to inform distribution planning and enable the utility to take proactive measures to expand hosting capacity to support continued development of DER.

As with interconnection, reaching this objective will require further improvements to the DRIVE tool, accurate results, and a clear plan for integration into the distribution planning process. In response to the Commission's information request regarding how the hosting capacity analysis can be used to inform the planning process, Xcel states the following:

> At this time, we view our hosting capacity analysis as tool for external parties to understand potential areas in which to connect DER. We believe whether the Company uses the hosting capacity view of its system into its planning processes may raise a policy question – whether the Company should undertake system upgrades or changes in order to expand hosting capacity to accommodate greater levels of DER, where capacity may be more limited at present.[3]

Fresh Energy's interpretation of § 216B.2425, subd 8 is that it supports proactive measures by providing direction to "conduct a distribution study to […] identify necessary distribution upgrades to support the continued development of distribution generation resources." Therefore, tangible steps toward integration of these disjointed efforts should be taken to identify upgrades or other opportunities to expand hosting capacity where new DER adoption is limited by lack of sufficient supporting infrastructure.

[3] Response to Staff Information Request No. 10, p. 1-2

II. RECOMMENDATIONS FOR FUTURE REPORTS

A. More robust analysis to demonstrate accuracy of the DRIVE methodology.

We cannot overstate the importance of accuracy in a hosting capacity analysis. For the tool to be useful and this effort worthwhile, the results must be valid and trusted. This requires, especially in early iterations of the report and methodology, much more robust and careful analysis. To highlight a small example, there are three circuits (ESW082, NOF073, OSS072,) that have zero minimum hosting capacity, but non-zero maximum hosting capacity – a result that seems impossible

The August 1, 2017 Commission Order required Xcel to provide analysis of the accuracy of the hosting capacity results "determined through any interconnection studies or other reasonable metric."[4] The section dedicated to accuracy in Xcel's 2017 report lacks the rigor that is merited when vetting a new tool and working toward enhancements in earnest. Xcel chose to use interconnection study results to evaluate accuracy despite concluding that interconnections studies were "extremely difficult to effectively compare" and providing seven bulleted reasons why this comparison was limited.[5] Upon concluding that this method would result in a very limited sample size of only 15 feeders, we would expect Xcel to then cast a wider net.

Further, the report provides very limited information to support Xcel's conclusion that the DRIVE methodology produces sufficiently accurate results. In considering the six technical screens that were compared to the 2016 hosting capacity results, for example, Xcel provides the following information:

> Three of the six screens fell below the minimum hosting capacity mark, while two of the others were slightly above the maximum. One of six was approved for over 700 kW greater than what the maximum hosting capacity

[4] https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={10EB9E5D-0000-C013-ABB5-F4FA1C04D825}&documentTitle=20178-134418-01

[5] 2017 Hosting Capacity Report, p. 18

> value indicated. That is the only one that stands out, but still proves the hosting capacity method to be slightly conservative but reliable.[6]

First, "slightly above the maximum" is an insufficient level of detail when reporting on accuracy. Second, the result is that 3 out of 6 feeders were able to accommodate a value greater than the maximum hosting capacity value indicated which is a poor result. Third, the 700 kW discrepancy, which is significant, lacks explanation as to how the methodology may have yielded this result and how Xcel plans to use this discovery to improve the tool and increase confidence in future iterations of the report.

It is our recommendation that a much more complete accuracy analysis be required, with sufficient data and transparent results with the goal of tracking continued improvement.

B. Further steps should be taken to make the heat map more useful and information more easily accessible.

We appreciate that Xcel has taken initial steps to publish its hosting capacity results using a heat map, but the heat maps in their current form are not particularly useful. For example, there is no linkage between the map and the tabular data, no way to tell from the map which circuit or substation serves a particular area, and no way to identify the hosting capacity limiting factor at each feeder location.

Further, as Fresh Energy explained in our April 20, 2017 comments on Xcel's 2016 hosting capacity analysis in Docket No. E002/M-15-962, customers and DER providers benefit from knowing not only the available hosting capacity at each location, but also the limiting factor(s), allowing them to better understand necessary mitigation and any associated interconnection costs.

We recommend that the next iteration of Xcel's hosting capacity analysis and maps:

- Include "pop-up" windows to provide HC details, including limiting factors, for each node or line section. Figure 2 below shows a screenshot of some of the easily-

[6] *Id.,* p. 19

accessible information on Southern California Edison's map, as an example.

- In addition to the color-coded maps, provide the HCA results in downloadable files, allowing customers and developers to perform analysis of the HCA results and to more easily identify DER opportunities and constraints.
- Provide downloadable feeder load profiles during peak and minimum load days to help customers and developers better understand circuit characteristics and associated DER opportunities and constraints.

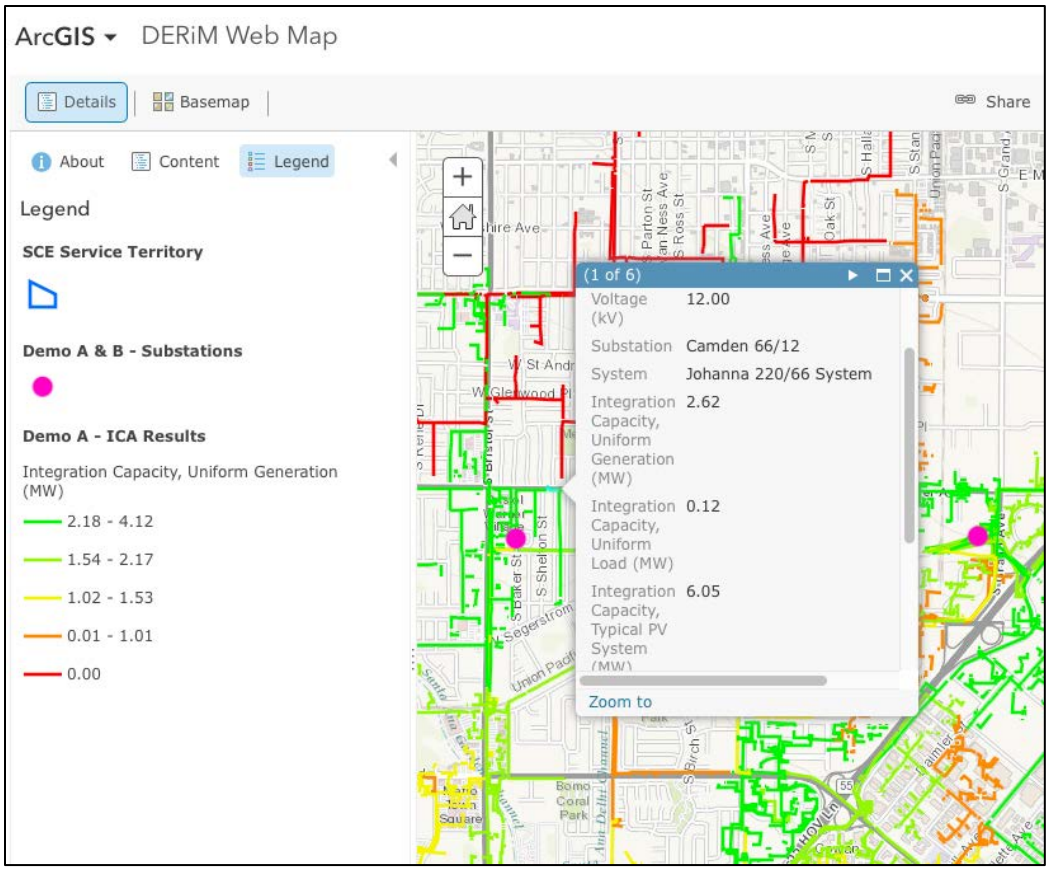

Figure 2. Southern California Edison's Integration Capacity Analysis (ICA) Results

C. Sensitivity analyses should be performed to show the impact of varying assumptions.

758 feeders (72% of the total) have "Primary Over-Voltage" as the minimum hosting capacity limiting factor. Fresh Energy is concerned that several of Xcel's assumptions are

overly conservative and may be resulting in an understatement of true available minimum hosting capacity. Specifically:

- The use of the Large Centralized methodology in DRIVE
- A substation bus voltage of 104% of nominal, which Xcel acknowledges "is intended to provide a realistic worst-case scenario in order to catch potential overvoltage impacts".[7]
- 0.98 leading power factor for all new installations. Xcel acknowledges "This can have a fairly large effect, especially when trying to compare a hosting capacity value of unity to one that is 0.95, for instance".[8]
- Use of the same conductor spacing for each voltage class, which impacts the impedance and over-voltage calculations.

It would be a valuable exercise to conduct sensitivity analyses showing the impact of varying these assumptions on the hosting capacity results. In other words, how much additional minimum hosting capacity is available if Xcel:

- Uses the Large Distributed DRIVE methodology?
- Assumes a bus voltage of 102% of nominal instead of 104%?
- Assumes a 0.95 leading power factor for all new DER instead of 0.98?
- Uses actual conductor spacing for each voltage class?

D. Close attention should be paid to minimum hosting capacity results of zero, and additional explanation provided.

The tabular hosting capacity results reveal a surprising number of feeders with no available hosting capacity. Specifically, 177 feeders (17% of the total) have zero minimum hosting capacity. It appears that the smallest increment of hosting capacity in the analysis is 10 kW, which would imply that 177 of Xcel's feeders cannot accommodate even one

[7] 2017 Hosting Capacity Report, p. 14
[8] *Id.*, p. 18

additional 10 kW residential rooftop solar system at any location on the circuit. This, if accurate, is startlingly limited.

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

Questions for Xcel:

- Are community solar projects the explanation for the "zero" results?
- Presumably some of the projects will result in upgrades to the distribution system. Once complete will more hosting capacity become available?
- What about the nine substations with zero minimum hosting capacity but no solar gardens in the queue? Why is the hosting capacity so limited in these locations?

As Xcel reaches higher penetration of DER, determining where circuits are truly "saturated" – meaning without room for even one rooftop PV systems – will become increasingly important to avoid wrongly discouraging DER growth and to correctly inform Xcel's distribution planning. We recommend that the Commission request Xcel to evaluate the accuracy of the "zero" outcomes, provide an explanation of how and where planned DG facilities are contributing factors, and provide guidance for developers on how best to approach potential projects in areas of "zero" capacity.

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

E. The DRIVE tool and modeling should be utilized to provide developers with a minimum and maximum capacity and limiting factors as part of their "Capacity Screen" results.

At the request of a developer, and for the price of $250, Xcel performs what they are calling a "capacity screen" of a specific location being considered for DER development.[10] And while the results of the screen include information that is useful to the developer such as feeder voltage, minimum daytime load and location of regulators and reclosers, the capacity screen does not actually provide developers with a hosting capacity number. It is our recommendation that Xcel use the DRIVE tool to provide developers with the most updated minimum and maximum hosting capacity, and both min and max limiting factors as part of the capacity screen review.

F. Xcel's conclusions and assumptions should be supported through transparent data and much more thorough explanation.

In the January 11, 2018 information requests compiled by Commission staff, Pacific Gas & Electric's Integration Capacity Analysis filing is provided as an example of a detailed and thorough report.[11] Xcel's report is 24 pages (excluding the spreadsheet) compared to PG&E's 268 pages of detail and explanation. Further, Xcel's 2017 report did not noticeably improve from the 2016 report. Simply said, Xcel has not provided enough information to illustrate that the analysis is complete and correct.

As an example, consider Xcel's decision to use 20 percent of peak demand to calculate minimum daytime load. This is a critical assumption, since 975 feeders (93% of the total) have either "Primary Over-Voltage" or "Thermal for Gen" as the minimum hosting capacity limiting factor. According to Xcel's response to Staff's January 11, 2018 Information Request No. 1, both of these conditions typically occur during times of

[10] https://www.xcelenergy.com/working_with_us/renewable_developer_resource_center/solar_rewards_community_developer_resources

[11] https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={C0E3E560-0000-C91E-BC06-9148F73B3399}&documentTitle=20181-138789-01

daytime minimum load when PV output is high. Xcel explains in its Hosting Capacity Report:

> We use 20 percent of peak demand for calculating daytime minimum load for feeders that do not have SCADA enabled, or other methods of determining the actual daytime minimum load. We initially relied on this value as a result of a National Renewable Energy Laboratory (NREL) paper.[12] Since that time, we have compared it to nearly 150 feeders where we have SCADA data on our system and where interconnection requests have been submitted, concluding that it is representative of our system.[13]

The NREL paper Xcel cites states that "By the time PV systems are producing a substantial amount of power, loads are well above their nightly lows on most feeders. Therefore, it makes sense to consider minimum daytime load as a technical screening criterion. For example, a screen may set a threshold at minimum daytime load, where daytime is defined as the period between 10:00 a.m. and 2:00 p.m." The data in Figure 5 of the paper show that 90% of the 500 sample feeders have daytime minimum load greater than 20% of peak demand.

Xcel's assumption that daytime minimum loads are 20% of peak demand is important, as the hosting capacity of an unknown number of feeders is limited by factors influenced by this assumption. The assumption is also surprising considering NREL found 90% of their sample feeders to have a higher daytime minimum load than 20% of peak.

Questions for Xcel:

- What percent of feeders are SCADA enabled or provide some other method of determining actual daytime minimum load and what percent are you using an estimated 20% of peak?

[12] "Updating Interconnection Screens for PV System Integration." See http://www.nrel.gov/docs/fy12osti/54063.pdf
[13] 2017 Hosting Capacity Report, p. 13

- What did the comparison data of those 150 feeders look like? How many were over 20% and by how much? How many were under and by how much?
- How does the data support the conclusion that 20% is representative of all Xcel feeders?

Lastly, one final request for clarification from Xcel also related to the over-voltage limiting factor:

- In response to Staff's Information Request No. 1, Xcel states, "Voltage regulation is not examined in this (primary over-voltage) analysis"[14]. Please explain what this means, why voltage regulation is not included in the over-voltage analysis, and how much additional minimum hosting capacity would be available if it were.

III. CONCLUSION

Again, thank you to Xcel for their ongoing efforts. We appreciate the opportunity to comment and look forward to continuing to support this exciting work.

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[14] Response to Staff Information Request No. 1, p. 5