ATTACHMENT A

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Xcel Energy Information Request No. 1
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
The hosting capacity map's pop-up box includes a data field for the limiting violation. In some circumstances there is a single violation listed, in other circumstances there are two or more violations listed.
A. Please explain why only one violation is listed in some places, and in other places more than one violation is listed.
B. When more than one violation is listed, why does one violation appear first, and the other after it? Put another way, what is the significance of the order in which violations appear, if any?

Response:
A. The pop-up box references all conductors located within the selected area. The limiting violation data field provides a list of the limiting violations that correspond with one or more values in the hosting capacity data field.
B. The only significance of the order of limiting violations is its correspondence to the hosting capacity data field. For instance, if the hosting capacity data field has 0.03 and 0.46 as values, and the limiting violation lists unintentional islanding and reverse power flow, then one can assume the 0.03 hosting capacity is due to unintentional islanding and the 0.46 capacity is due to reverse power flow. If two hosting capacity values exist with only one limiting violation, it can be assumed that both values are caused by the same violation.

Preparer: Luther Miller
Title: Engineer
Department: Distribution Planning
Telephone: 763-493-1893
Date: December 17, 2019

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Xcel Energy Information Request No. 2
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
A. What version of DRIVE did Xcel use in its 2019 hosting capacity analysis?
B. During what months did Xcel run DRIVE tool to produce its 2019 hosting capacity analysis?
C. What is the most recent version of the DRIVE tool, and when was it released?
D. When is the next version of the DRIVE tool expected to be released?
E. What version of the DRIVE tool does Xcel plan to use in the next iteration of its hosting capacity analysis?

Response:

A. We used the most current version of DRIVE that was available at the time we initiated our 2019 hosting capacity analysis, which was DRIVE version 2.0.
B. we utilized the DRIVE tool in July-early October 2019.
C. Version 2.1.1 is the most recent version of DRIVE and it was released in September 2019.
D. Our understanding is that the next version of DRIVE will be released around September 2020.
E. We plan on using DRIVE version 2.1.1 in our 2020 Hosting Capacity analysis.

Preparer: Chris Punt
Title: Manager, Distributed Energy
Department: Distribution Electric Engineering
Telephone: 763-493-1849
Date: December 17, 2019

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Xcel Energy Information Request No. 3
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
IREC understands that older versions of DRIVE only provide results at the feeder level, while the most recent version of DRIVE provide results on a sub-feeder, or nodal level.[1]
A. Did Xcel's 2019 hosting capacity analysis produced results on a subfeeder or nodal level? If not, why not?
B. If yes, are those sub-feeder or nodal level results available to customers? If the analysis produced sub-feeder or nodal results and those results not available to customers, why not?
C. Does Xcel plan to provide results to customers on a sub-feeder or nodal level in the next iteration of its hosting capacity analysis?

Response:
We clarify for purposes of this response that our understanding of the question is that sub-feeder means a section of the feeder that is less than the full feeder. We also clarify that the DRIVE tool has always had the functionality to provide results at a sub-feeder level.

A. Yes, the 2019 Hosting Capacity analysis provided results on a sub-feeder and nodal level.
B. Sub-feeder results are available in our online hosting capacity map. Due to security and customer privacy concerns as expressed in our filing, we do not show the results down to the nodal level. We do however show sub-feeder level results that vary at different points on a given feeder. Please refer to our November 1, 2019 filing, pages 17-22 for more detailed discussion on customer privacy and system security considerations.

[1] *See* Xcel Energy 2019 Hosting Capacity Analysis Report, Attachment A, at 6 (Nov. 1, 2019) (all citations to Attachment A use the page numbering located in the upper right hand corner).

C. We plan to continue to provide sub-feeder results in our 2020 hosting capacity map consistent with our objectives to appropriately maintain grid and customer security and customer privacy and confidentiality.

Preparer:	Chris Punt
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Xcel Energy Information Request No. 4
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
Xcel plans to use a "Feeder Summary Report" feature to show "results only for metrics selected" in the next iteration of its hosting capacity analysis.[1] Will using this feature change the amount of data that is provided to customers? If so, please explain how it will change the data that is provided to customers.

Response:
The Feeder Summary Report feature simply provides a more efficient way to compile the tabular portion of results. Our use of this feature will not change the amount or type of data provided in our 2020 Hosting Capacity analysis.

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[1] *Id*., Attachment A at 7.

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Xcel Energy Information Request No. 5
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
Xcel did not rebuild a model of every feeder in its system "in an effort to reduce building time for feeders that did not have any significant changes to them. [Xcel] focused on feeders that had experienced large configuration, load or generation changes."[1]
A. What was the threshold used to determine if a feeder had a significant load configuration change to necessitate rebuilding?
B. What was the threshold used to determine if a feeder had a significant load change to necessitate rebuilding?
C. What was the threshold used to determine if a feeder had a significant generation change to necessitate rebuilding?
D. Is there a month or week of the year when changes in load configuration, load, and/or generation occur at a higher rate than at other times? If so, please quantify.

Response:
A. There was no numerical threshold to determine a significant load configuration change. We identified all feeders that experienced reconfigurations caused by capacity deficiencies or other related projects.
B. The threshold to determine a significant load change was 500 kW of known new load.
C. The threshold to determine a significant generation change was any feeder that had a new solar garden added to it.
D. We are unaware of a pattern that a certain month or week of a year would have a higher rate of changes in load configuration, load, or generation. The Company schedules this type of work based on system needs, customer needs, and resource availability.

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[1] *Id.*, Attachment A, at 9.

Preparer: Chris Punt
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Date: December 17, 2019

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Xcel Energy Information Request No. 6
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
Please provide a table that includes all the items provided to customers in a pre-application report. In that table, please include columns indicating A) if that information is available on Xcel's hosting capacity map, B) if that information is available in Attachment B to Xcel's Hosting Capacity Analysis Report (results in tabular format), C) if not available on the map and/or spreadsheet, why Xcel is not providing that information to customers in the map and/or spreadsheet.

Response:

Pre-Application Data Element	A) Information Available on Hosting Capacity Map	B) Information Available in Tabular Format	C) Notes
Substation Name	Yes	Yes	N/A
Transformer Name	No	No	No Limitation
Transformer Rating	No	No	Privacy/Security Concerns
Transformer Peak	No	No	Privacy/Security Concerns
Transformer DML	Yes	Yes	N/A
Transformer Absolute Min	No	No	No Limitation
LTC or Regulator	No	No	No Limitation
TR Existing Gen	Yes	Yes	N/A
TR Queued Gen	Yes	Yes	N/A
TR Gen Capacity	No	No	Significant technology requirement. Equation would need to be implemented within the map or prior to map creation
Distance from PCC to sub	No	No	Significant technology requirement. Query function would need to be built into Hosting Capacity Map
Feeder Name	Yes	Yes	N/A
Feeder Rating	No	No	Privacy/Security Concerns

Pre-Application Data Element	A) Information Available on Hosting Capacity Map	B) Information Available in Tabular Format	C) Notes
Feeder Peak	No	No	Privacy/Security Concerns
Feeder DML	Yes	Yes	N/A
Feeder Absolute Min	No	No	No Limitation
Feeder Voltage	Yes	No	N/A
Feeder Existing Gen	Yes	Yes	N/A
Feeder Queued Gen	Yes	Yes	N/A
Feeder Gen Capacity	No	No	Significant technology requirement. Equation would need to be implemented within the map or prior to map creation
Nominal Voltage at PCC	Yes	No	N/A
Network or Radial	No	No	No Limitation
# of Phases	Yes	No	N/A
Distance to 3 phase circuit	No	No	Significant technology requirement. Query function would need to be built into Hosting Capacity Map
Devices in line between site and sub	No	No	Security concerns and significant technology requirement. Query function would need to be built into Hosting Capacity Map.
Conductor between site and sub	No	No	Security concerns and significant technology requirement. Query function would need to be built into Hosting Capacity Map

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Preparer: Luther Miller
Title: Engineer
Department: Distribution Planning
Telephone: 763-493-1893
Date: December 17, 2019

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Xcel Energy Information Request No. 7
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochi Zakai
Date Received: December 4, 2019

Question:
Xcel estimates that the cost of its hosting capacity analysis is $300,000, including 1,600 engineer hours at a cost per engineer hour of $100.[1]
A. Please provide any workpapers used to develop this estimate. Please provide any workpapers in native format, with all cells unlocked, no cells hidden, and with all formula intact.
B. Did Xcel use different classifications of employees (including but not limited to intern, junior engineer, senior engineer, supervisor, ect.) to perform the hosting capacity analysis? If so, please provide the cost of each employee classification per hour, and number of hours allocated to each employee classification.
C.i. Is any of the itemized cost of $50,000 to conduct the separate EPRI analysis of 95 feeders with no hosting capacity included in the $300,000 total cost?
C.ii. Is the separately itemized cost of $50,000 to conduct the separate EPRI analysis of 95 feeders with no hosting capacity a product acquisition cost?
C.iii. If Xcel performs an analysis of feeders with no hosting capacity using the EPRI tool in the next iteration of its hosting capacity analysis, will it need to pay EPRI again? If so, how much?
D.i. Did Xcel pay any incremental fees to Synergi to use its software's hosting capacity tool?
D.ii. Is any part of the $250,000 cost to acquire the DRIVE tool included in the $300,000 total cost?
D.iii. Does Xcel pay an additional or annual amount to acquire updates to the most recent version of the DRIVE tool? If so, how much does it cost and at what frequency must Xcel pay?
D.iv. Is any part of the $30,000 cost to participate in the DRIVE User Group included in the $300,000 total cost?

[1] *Id.*, Attachment A at 45-46.

Response:

A. See Attachment A. We note that the total 1,600 distribution engineering hours include an estimated 200 hours of engineering time prior to June 2019. We had originally indicated that these 200 hours were not included in the total estimate.

B. Yes. Distribution Engineers and Engineering Interns were involved in performing the hosting capacity analysis, under the supervision of Engineering management. The total of 1,600 hours does not include management time, which we have estimated at 10 percent of the total engineering time. We note that there are additional resources involved with producing the map, publishing the map and tabular results on our website, preparing the regulatory filing, conducting the stakeholder meeting, and updating to the latest version of DRIVE, which are not fully included in the 1,600 total hours estimate. Table 1 below provides a summary of the information requested.

Table 1: Estimated Hosting Capacity Analysis Engineering Resource Costs

Resource Type	Hours	Average Loaded Cost/Hour
		[PROTECTED DATA BEGINS
Junior Intern	656	
Senior Intern	318	
Engineer	241	
Principal Engineer	389	
Engineering Manager	160	
		PROTECTED DATA ENDS]

We believe that the $160,000 total cost we estimated is reasonable considering the other costs that were not included.

Ci. Yes, the $50,000 to analyze feeders with no hosting capacity is included in the total $300,000 cost.

Cii. No, the $50,000 is not a product acquisition cost; it is a onetime cost for EPRI to perform the analysis.

Ciii. At this time we do not plan on conducting another analysis on feeders with no hosting capacity. We believe a lot was learned from the first analysis and we view it as a larger learning effort. A second analysis would be largely redundant, and would involve incremental charges based on the extent of the work required.

Di. No, we did not pay any incremental fees to Synergi to use the hosting capacity tool. Synergi's hosting capacity tool is part of our existing licensing agreement. But as noted in our report (page 21 of Attachment A), the Synergi tool was less robust than DRIVE. It limited the maximum hosting capacity due to an

arbitrary 50% "reverse limit" and only considered four criteria thresholds in the analysis as opposed to the eight we utilized in DRIVE.

D ii. Yes. We have used DRIVE for four years, so we included one-fourth of the $250,000 DRIVE acquisition cost in our 2019 total cost estimate.

D iii. Every three years we pay $30,000 to be a part of the DRIVE User Group. This allows the Company to gain the most recent version updates and also the opportunity to collaborate with other utilities on refinements of the tool.

D iv. Yes, one-third of the $30,000 is included in the 2019 total cost (split over 3 years).

The pay ranges and salary structure information is designated as Trade Secret information as defined by Minn. Stat. § 13.37, subd. 1(b). This information has not been publicly released because it could put the Company at a disadvantage in the marketplace when competing for employees. It derives independent economic value from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use. Additionally, we believe we have a duty to our employees to protect their private information. Because of the nature of this data and the ability to associate this data with individuals, the Company considers this as private data on individuals under Minn. Stat. § 13.02, subd. 12, and is private data under Minn. Stat. § 13.37, subd. 2.

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Date: December 23, 2019

Date	Day	Eng A	Eng B	Eng C	Eng D	Eng E	Eng F	Eng G	Total Hrs Worked
Totals		182	136	211	203	242	389	241	1604
Estimated time prior to June 13							200		
6/13/2019	Thursday	0	0	8	8	0	1	3	
6/14/2019	Friday	0	8	8	8	0	2	3	
6/15/2019	Saturday	0	6	0	0	0	0	0	
6/16/2019	Sunday	0	0	0	0	0	0	0	
6/17/2019	Monday	0	6	8	8	0	1	3	
6/18/2019	Tuesday	0	0	8	8	0	0	0	
6/19/2019	Wednesday	0	4	6	4	0	1	0	
6/20/2019	Thursday	0	0	2	0	0	2	3	
6/21/2019	Friday	0	3	5	3	0	2	0	
6/22/2019	Saturday	0	0	0	0	0	0	0	
6/23/2019	Sunday	0	0	0	0	0	0	0	
6/24/2019	Monday	3	8	4	3	7	2	4	
6/25/2019	Tuesday	0	0	0	0	3	1	0	
6/26/2019	Wednesday	0	4	1	0	0	0	0	
6/27/2019	Thursday	0	0	0	0	1.5	0	2	
6/28/2019	Friday	0	8	1	2	1.5	1	2	
6/29/2019	Saturday	0	0	0	0	0	0	0	
6/30/2019	Sunday	0	0	0	0	0	0	0	
7/1/2019	Monday	0	8	0	0	8	2	3	
7/2/2019	Tuesday	0	0	0	0	8	2	3	
7/3/2019	Wednesday	0	4	6	8	8	0	0	
7/4/2019	Thursday	0	0	0	0	0	0	0	
7/5/2019	Friday	0	8	8	0	8	0	0	
7/6/2019	Saturday	0	0	0	0	0	0	0	
7/7/2019	Sunday	0	0	0	0	0	0	0	
7/8/2019	Monday	6	3	8	8	8	0	4	
7/9/2019	Tuesday	6	0	8	8	8	0	4	
7/10/2019	Wednesday	8	3	8	8	8	0	4	
7/11/2019	Thursday	4	0	8	8	8	0	0	
7/12/2019	Friday	8	6	6	6	8	0	4	
7/13/2019	Saturday	0	0	0	0	0	0	0	
7/14/2019	Sunday	0	0	0	0	0	0	0	
7/15/2019	Monday	8	8	8	8	8	1	6	
7/16/2019	Tuesday	8	0	8	8	0	3	6	
7/17/2019	Wednesday	0	3	0	0	0	4	4	
7/18/2019	Thursday	8	0	8	8	8	1	4	
7/19/2019	Friday	3	8	8	5	8	1	4	
7/20/2019	Saturday	0	0	0	0	0	0	0	
7/21/2019	Sunday	0	0	0	0	0	0	0	
7/22/2019	Monday	0	7	0	2	2	2	2	
7/23/2019	Tuesday	0	0	0	4	0	6	4	
7/24/2019	Wednesday	0	4	8	4	4	1	2	
7/25/2019	Thursday	3	0	8	3	3	2	2	
7/26/2019	Friday	8	7	8	7	8	3	0	

Date	Day	Eng A	Eng B	Eng C	Eng D	Eng E	Eng F	Eng G	Total Hrs Worked
7/27/2019	Saturday	0	0	0	0	0	0	0	
7/28/2019	Sunday	0	0	0	0	0	0	0	
7/29/2019	Monday	8	8	8	8	8	0	6	
7/30/2019	Tuesday	8	0	8	7	7	4	6	
7/31/2019	Wednesday	7	4	6	8	8	1	2	
8/1/2019	Thursday	8	0	4	6	6	0	6	
8/2/2019	Friday	4	8	8	0	0	0	6	
8/3/2019	Saturday	0	0	0	0	0	0	0	
8/4/2019	Sunday	0	0	0	0	0	0	0	
8/5/2019	Monday	8	0	0	8	8	1	0	
8/6/2019	Tuesday	8	0	0	8	8	2	0	
8/7/2019	Wednesday	8	0	0	3	4	2	2	
8/8/2019	Thursday	4	0	0	8	8	0	2	
8/9/2019	Friday	0	0	0	8	8	0	6	
8/10/2019	Saturday	0	0	0	0	0	0	0	
8/11/2019	Sunday	0	0	0	0	0	0	0	
8/12/2019	Monday	6	0	0	0	7	1	6	
8/13/2019	Tuesday	7	0	0	0	7	4	6	
8/14/2019	Wednesday	8	0	0	0	8	4	4	
8/15/2019	Thursday	8	0	0	0	8	3	4	
8/16/2019	Friday	2	0	2	0	2	1	4	
8/17/2019	Saturday	0	0	0	0	0	0	0	
8/18/2019	Sunday	0	0	0	0	0	0	0	
8/19/2019	Monday	8	0	4	0	6	1	4	
8/20/2019	Tuesday	7	0	4	0	5	1	4	
8/21/2019	Wednesday	0	0	4	0	3	2	3	
8/22/2019	Thursday	0	0	4	0	5	1	2	
8/23/2019	Friday	0	0	0	0	0	2	2	
8/24/2019	Saturday	0	0	0	0	0	0	0	
8/25/2019	Sunday	0	0	0	0	0	0	0	
8/26/2019	Monday	0	0	0	0	0	2	1	
8/27/2019	Tuesday	0	0	0	0	0	0	1	
8/28/2019	Wednesday	0	0	0	0	0	1	1	
8/29/2019	Thursday	0	0	0	0	0	6	2	
8/30/2019	Friday	0	0	0	0	0	4	0	
8/31/2019	Saturday	0	0	0	0	0	0	0	
9/1/2019	Sunday	0	0	0	0	0	0	0	
9/2/2019	Monday	0	0	0	0	0	0	0	
9/3/2019	Tuesday	0	0	0	0	0	1	3	
9/4/2019	Wednesday	0	0	0	0	0	5	3	
9/5/2019	Thursday	0	0	0	0	0	2	0	
9/6/2019	Friday	0	0	0	0	0	6	6	
9/7/2019	Saturday	0	0	0	0	0	0	0	
9/8/2019	Sunday	0	0	0	0	0	0	0	
9/9/2019	Monday	0	0	0	0	0	4	2	
9/10/2019	Tuesday	0	0	0	0	0	4	2	

Date	Day	Eng A	Eng B	Eng C	Eng D	Eng E	Eng F	Eng G	Total Hrs Worked
9/11/2019	Wednesday	0	0	0	0	0	4	2	
9/12/2019	Thursday	0	0	0	0	0	0	0	
9/13/2019	Friday	0	0	0	0	0	1	0	
9/14/2019	Saturday	0	0	0	0	0	0	0	
9/15/2019	Sunday	0	0	0	0	0	0	0	
9/16/2019	Monday	0	0	0	0	0	1	0	
9/17/2019	Tuesday	0	0	0	0	0	1	0	
9/18/2019	Wednesday	0	0	0	0	0	4	2	
9/19/2019	Thursday	0	0	0	0	0	3	0	
9/20/2019	Friday	0	0	0	0	0	3	0	
9/21/2019	Saturday	0	0	0	0	0	0	0	
9/22/2019	Sunday	0	0	0	0	0	0	0	
9/23/2019	Monday	0	0	0	0	0	2	2	
9/24/2019	Tuesday	0	0	0	0	0	2	2	
9/25/2019	Wednesday	0	0	0	0	0	0	0	
9/26/2019	Thursday	0	0	0	0	0	1	5	
9/27/2019	Friday	0	0	0	0	0	1	5	
9/28/2019	Saturday	0	0	0	0	0	0	0	
9/29/2019	Sunday	0	0	0	0	0	0	0	
9/30/2019	Monday	0	0	0	0	0	1	1	
10/1/2019	Tuesday	0	0	0	0	0	0	0	
10/2/2019	Wednesday	0	0	0	0	0	1	0	
10/3/2019	Thursday	0	0	0	0	0	8	4	
10/4/2019	Friday	0	0	0	0	0	2	0	
10/5/2019	Saturday	0	0	0	0	0	0	0	
10/6/2019	Sunday	0	0	0	0	0	0	0	
10/7/2019	Monday	0	0	0	0	0	6	4	
10/8/2019	Tuesday	0	0	0	0	0	3	4	
10/9/2019	Wednesday	0	0	0	0	0	4	2	
10/10/2019	Thursday	0	0	0	0	0	6	6	
10/11/2019	Friday	0	0	0	0	0	0	2	
10/12/2019	Saturday	0	0	0	0	0	0	0	
10/13/2019	Sunday	0	0	0	0	0	0	0	
10/14/2019	Monday	0	0	0	0	0	1	2	
10/15/2019	Tuesday	0	0	0	0	0	0	2	
10/16/2019	Wednesday	0	0	0	0	0	0	0	
10/17/2019	Thursday	0	0	0	0	0	3	0	
10/18/2019	Friday	0	0	0	0	0	2	0	
10/19/2019	Saturday	0	0	0	0	0	0	0	
10/20/2019	Sunday	0	0	0	0	0	0	0	
10/21/2019	Monday	0	0	0	0	0	0	4	
10/22/2019	Tuesday	0	0	0	0	0	2	4	
10/23/2019	Wednesday	0	0	0	0	0	4	2	
10/24/2019	Thursday	0	0	0	0	0	3	2	
10/25/2019	Friday	0	0	0	0	0	7	4	
10/26/2019	Saturday	0	0	0	0	0	0	0	

Date	Day	Eng A	Eng B	Eng C	Eng D	Eng E	Eng F	Eng G	Total Hrs Worked
10/27/2019	Sunday	0	0	0	0	0	0	0	
10/28/2019	Monday	0	0	0	0	0	2	2	
10/29/2019	Tuesday	0	0	0	0	0	3	2	
10/30/2019	Wednesday	0	0	0	0	0	1	2	
10/31/2019	Thursday	0	0	0	0	0	1	2	

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Xcel Energy Information Request No. 8
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
A. What is the average number of employee hours that it takes to run a hosting capacity analysis for a single feeder?
B. What is the range of employee hours that it takes to run a hosting capacity analysis for a single feeder?

Response:
A. Per feeder, the average amount of employee hours that is required to run a hosting capacity analysis is roughly 2 hours for a single feeder. This includes model creation, cleanup, and DRIVE analysis.
B. A single feeder may require a range of 0.5 to 4 hours to complete the analysis. Time variation is largely dependent on model size, availability/accuracy of GIS data, and amount of existing solar on the feeder.

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Date: December 17, 2019

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Xcel Energy Information Request No. 9
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
A. Why does Table 5[1] show that the maximum hosting capacity from all interconnection studies is 1 MW?
B. Is it possible that one of the feeders listed in Table 5 can host more than 1 MW of new distributed generation?

Response:
A. Table 5 shows a 1 MW maximum hosting capacity value for the interconnection studies because each study was conducted for a community solar garden, and the size of applications in the community solar garden program is limited to 1 MW. Interconnection studies are only performed up to the requested generation capacity.
B. Yes, it is possible that a feeder listed in Table 5 can host more than 1 MW of distributed generation. Interconnection studies focus on how to interconnect the requested project at the given size at the given location, and do not analyze hosting capacity for all locations on the feeder for different levels of DER.

Preparer: Chris Punt
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Department: Distribution Electric Engineering
Telephone: 763-493-1849
Date: December 17, 2019

[1] *Id.*, Attachment A at 24.

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Xcel Energy Information Request No. 10
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
A. Did Xcel track the computational intensity of performing a hosting capacity analysis using DRIVE and Synergi?
B. If so, please provide a table that quantifies the computational intensity of performing a hosting capacity analysis on each feeder listed in Table 4.[1] If not, please explain why not.
C. Did Xcel track the time its employees spent performing the hosting capacity analysis in DRIVE and Synergi for each feeder listed in Table 4?[2]
D. If so, please provide a table that quantifies the time employees spent performing the hosting capacity analysis on each feeder listed in Table 4.7 Please subdivide this data by classification of employee (intern, junior engineer, senior engineer, ect.). If not, please explain why not.

Response:
A. No, we did not track computational time for performing the 2019 Hosting Capacity analysis.
B. Our focus was on the analysis and comparison of the results, not on the computational intensity of each tool or each run.
C. No, we did not track employee time per tool or per feeder.
D. Our focus was on the analysis and comparison of the results, not on the employee time per tool or per feeder.

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Telephone: 763-493-1849
Date: December 17, 2019

[1] *Id.*, Attachment A at 19.
[2] *Id.*

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Xcel Energy Information Request No. 11
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
A. Is the load analysis that Xcel provided[1] useful for identifying if a feeder, or sections of a feeder, can accommodate the interconnection of "new sources of DER load—load which could include energy storage and electric vehicles,"[2] without additional upgrades or cost?
B. Is DRIVE able to perform the analysis described in 10.A?
C. Is Synergi able to perform the analysis described in 10.A?

Response:
A. No, the analysis looked at how hosting capacity was affected when load was changed. It was not a load analysis.
B. Assuming the question means 11 A., yes, DRIVE can perform load analysis for new sources of DER load without additional upgrades or cost.
C. Assuming the question means 11 A., yes, Synergi can perform load analysis for new sources of DER load without additional upgrades or cost.

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Date: December 17, 2019

[1] *Id.*, Attachment A at 43-45.
[2] Minn. Pub. Util. Comm., Order Accepting Study and Setting Further Requirements, Dkt. No. E002/M-18-684, at 3 (Aug. 15, 2019); *see id.* at 12.

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Xcel Energy Information Request No. 12
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
It appears that Xcel performs the hosting capacity analysis over the summer, but does not publish the updated data until Nov. 1.
A. Does Xcel complete its analysis of all feeders in the same week? If not, over how many weeks does Xcel complete its analysis?
B. Are there any technological limitations that prevent Xcel from publishing updated tabular data for a feeder within one week of completing the analysis on that feeder?
C. Are there any technological limitations that prevent Xcel from updating its map data for a feeder within one week of completing the analysis on that feeder?

Response:
A. The timing of our hosting capacity analysis is specified by the Minnesota Public Utilities Commission, and is currently due each November 1. The due date for the report drives the timeframe for our analysis. As noted in other responses, we begin our analysis in mid-June/early July and generally conclude it in late September / early October (roughly 16 weeks). The feeder analysis is completed on a continuous basis throughout this timeframe.
B. While no technological limitations exist that would prevent incremental tabular updates within a week of completing the analysis, in general, updating tabular data on a feeder by feeder basis would be very inefficient. It is a much more efficient process to complete the analysis and update the tabular results in larger batches.
C. Yes, there are technological and efficiency limitations associated with incremental updates to the hosting capacity map. First, all analysis data must be compiled in a manner that is easily readable for the Geospatial Information System (GIS), which we note we have improved over time. Next, the analysis results must be overlaid onto the ArcGIS mapping software, which is a process that takes several days of GIS mapping work. Lastly, the map must be tested and any errors or glitches within the mapping software must be fixed. Updating the hosting capacity map on

a feeder by feeder basis would be extremely inefficient, increase the cost, and detract GIS resources from other important work they do to help serve our customers with reliable utility service.

Preparer: Luther Miller
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Date: December 17, 2019

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Xcel Energy Information Request No. 13
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
What efforts is Xcel making to reduce the cost performing a hosting capacity analysis over time?

Response:
We are always looking for ways to make our work more efficient. Specific to our hosting capacity analysis, we are streamlining the process in ways such as, selectively updating models only of feeders that have experienced significant changes over the previous year and planning to implement DRIVE's new Feeder Summary Report feature to expedite internal processes. We are also monitoring other methods and tools for conducting the hosting capacity analysis. We note that a significant proportion of the costs associated with the hosting capacity analysis are engineering time required to perform the analysis. We have found that while these costs can be somewhat mitigated by providing extensive foundational training, with the increasing complexity and level of detail provided with the hosting capacity map, it is unlikely that this portion of the costs will decrease.

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Xcel Energy Information Request No. 14
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
Does Xcel commit to using actual daytime minimum load for all feeders for the next iteration of its hosting capacity analysis?

Response:
We plan to continue to use actual daytime minimum load in our 2020 hosting capacity analysis for all feeders where SCADA information is available and provides reliable data.

Preparer: Luther Miller
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Date: December 17, 2019

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Xcel Energy Information Request No. 15
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
Does Xcel commit to continue using actual power factors where possible in the next iteration of its hosting capacity analysis?

Response:
Xcel Energy plans to continue to use actual power factor data in the 2020 hosting capacity analysis for all feeders where SCADA information is available and provides reliable data. Otherwise, the feeder power factor must be estimated.

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Date: December 17, 2019

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Xcel Energy Information Request No. 16
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
Does Xcel commit to continue displaying all data provided in the pop-up box on its map in the next iteration of its hosting capacity analysis?

Response:
Xcel Energy plans to continue to display all data provided in the 2019 hosting capacity map in the 2020 hosting capacity analysis unless ordered otherwise by the Minnesota Public Utilities Commission.

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Xcel Energy Information Request No. 17
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
DRIVE provides results for single and two-phase nodes.[1]
A. Does Xcel's hosting capacity analysis provide results for single-phase segments of three-phase feeders, feeders that are entirely single-phase, or both?
B. Xcel uses the Large Centralized method and states that that "method only focuses on installations on three-phase lines."[2] Please explain the relevance of the hosting capacity values provided for single and two-phase feeders in light of the focus of the Large Centralized method.

Response:
A. Our 2019 Hosting Capacity Analysis provides results for single, two-phase, and three-phase sections for all feeders.
B. The Large Centralized methodology performs a three-phase calculation to determine available hosting capacity. Single and two-phase lines use the same calculation but the single-phase values are calculated as 1/3 of the three-phase values and two-phase values are calculated as 2/3 of the three-phase values.

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Date: December 17, 2019

[1] Xcel Energy 2019 Hosting Capacity Analysis Report, Attachment A, at 6.
[2] *Id.*, Attachment A, at 12.

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Xcel Energy Information Request No. 18
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
This question only applies if Xcel is performing a hosting capacity analysis on secondary feeders. Xcel "traditionally assumed a three Volt drop across the secondary conductors and transformers to ensure compliance with ANSI C84.1.6 This means that when we model voltages on the primary system, we subtract three additional Volts to better quantify the actual voltage at the customer level."[1]
A. Please provide documentation that shows that a three volt drop over secondary conductors and transformers is an appropriate assumption to use.
B. Please describe and provide an example of how this calculation is performed when the customer is exporting to the grid.
C. Please describe and provide an example of how this calculation is performed when the customer is importing from the grid.

Response:
We do not perform hosting capacity analysis on the secondary portion of our system.

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Date: December 17, 2019

[1] *Id.*, Attachment A, at 15

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Xcel Energy Information Request No. 19
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
Does Xcel plan to update the quantity of existing and queued distribution generation on a regular basis? If so, at what frequency?

Response:
We note that we file annually on March 1 information in a tabular spreadsheet format on existing and new interconnected DER for the prior calendar year. This information is filed in the Minnesota Public Utilities Commission's Docket No. [year]-10. We also note that we update our DER queue monthly, which is available on our website at https://www.xcelenergy.com/working_with_us/how_to_interconnect.

With respect to our existing and queued DER and our hosting capacity analysis, we would like to update data on the hosting capacity map and tabular results spreadsheet at least once before the 2020 hosting capacity analysis is completed. However, we still need to develop that process and understand how it can efficiently be done before we commit to a specific timeline.

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Xcel Energy Information Request No. 20
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:

A. Please provide a detailed description of the impact of using the "Maximum Tap Regulators in Over/Under-Voltage Analysis" advanced setting?[1]

B. How is the advanced setting different than utilizing a 50% bandwidth threshold for the "Regulator Voltage Deviation"[2] criterion? Please explain the interplay between the two.

C. What is the justification for using the "Maximum Tap Regulators in Over/Under-Voltage Analysis" advanced setting?

Response:

A. When the Maximum Tap Regulators in Over/Under-Voltage Analysis setting is selected, voltage at a regulated bus is adjusted to the edge of the regulated nodes bandwidth. All voltages downstream until another regulation device or the edge of the feeder are adjusted accordingly. This is a valid voltage condition as the regulation device would not operate as long as the regulated bus is still within its bandwidth. For overvoltage, voltages are moved to the top of the bandwidth, which is where this setting has impact.

B. The Regulator Voltage Deviation threshold is the maximum allowable voltage change at a regulated bus. This is used to determine the regulator voltage deviation hosting capacity which may be an indication of excessive regulator tap operations. Using the Maximum Tap Regulators setting is an option that will provide a more worst-case overvoltage or undervoltage hosting capacity. It does not impact regulator voltage deviation hosting capacity.

C. The Maximum Tap Regulators setting could capture additional voltage issues that would have otherwise been missed.

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[1] *Id.*, Attachment A, at 5, 18.
[2] *Id.*, Attachment A, at 19.

Preparer: Chris Punt
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Date: December 17, 2019

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Xcel Energy Information Request No. 21
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
Does the "Unintentional Islanding"[1] criterion limit distributed energy resource generation to 100% of minimum load at a large three-phase protective device?

Response:
Yes, the Unintentional Islanding criterion limits DER generation to 100% of minimum load. We note that this percentage can be adjusted to a different percentage.

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Date: December 17, 2019

[1] *Id.*, Attachment A, at 19.

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Xcel Energy Information Request No. 22
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
Does the "Reverse Power Flow"[1] criterion limit each individual feeder to 100% of minimum load, such that there would never be backfeed into the substation bus?

Response:
Yes, the Reverse Power Flow criterion limits each individual feeder to 100% of minimum load and it is used as an indicator for potential protective issues.

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[1] *Id.*, Attachment A, at 19.

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Xcel Energy Information Request No. 23
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
A. For the purpose of "Additional Element Fault Current" and "Breaker Relay Reduction of Reach"[1] criteria, does Xcel assume that the new distributed energy resource is an inverter-based system?
B. How is fault current from both existing and new distributed energy resources calculated in order to evaluate "Additional Element Fault Current" and "Breaker Relay Reduction of Reach" criteria?

Response:
A. Yes, we assume that new DER is an inverter-based system for purposes of Additional Element Fault Current and Breaker Relay Reduction of Reach criteria.
B. Existing and new DER are summed together for the Breaker Relay Reduction of Reach threshold since all (existing and future) DER will be contributing together. Only the upstream existing DER is summed with the future DER when calculating the Additional Element Fault Current hosting capacity at a particular location. This is because existing DER downstream from the examined location will go directly into the fault and not increase current through the device.

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Telephone: 763-493-1849
Date: December 17, 2019

[1] *Id.*, Attachment A, at 19.

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Xcel Energy Information Request No. 24
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:

A. Are the as-operated field settings for voltage regulators or load tap changers (LTCs) incorporated into the model?
B. Can DRIVE account for line drop compensation techniques?
C. If so, why is head-end voltage set to 1.04pu for any distributed energy resource scenario?[1]

Response:

A. The models that are used to perform the hosting capacity analysis are models of the distribution system, and do not include any substation equipment such as substation LTCs or regulators. To include substation equipment would require additional manual modeling and increase the time and cost needed to complete the hosting capacity analysis. The distribution field regulators and settings are modeled based on a combination of our standard regulator settings and the best available information.

B. While line drop compensation techniques are included in the baseline analysis, the current calculation performed by DRIVE is based on the voltage profile results obtained when the feeder model is run in Synergi. DRIVE does not rerun a full load flow analysis to determine changes to LTCs or regulators and any line drop compensation they may have.

However, as noted in our filing (pages 6-7 of Attachment A), the next version of DRIVE will have the ability to allow regulators to operate based on the controls, including line drop compensation, with the addition of DER. As indicated, we are considering this modification for our 2020 hosting capacity analysis.

C. At present, the DRIVE tool calculation does not include active modeling of voltage regulating equipment. Since these devices are not actively modeled in the

[1] *Id.*, Attachment A, at 16.

analysis, there is very little benefit to include them in the model when compared to the cost required to manually model them. Instead, the 1.04 pu send out voltage is used because it is our standard bus voltage set point at the substation.

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Date:	December 17, 2019

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Xcel Energy Information Request No. 25
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
A. How is the flicker calculation[1] performed?
B. For the flicker calculation, what assumptions about distributed energy resource connections, disconnections, or power levels are used?

Response:
A. We did not use DRIVE tool's Flicker Calculation threshold in our current hosting capacity analysis. This threshold is based on IEEE 1453-2015, Recommended Practice for the Analysis of Fluctuating Installations on Power Systems.
B. DER connections, disconnections, and power levels are user-defined variables. As IEEE1453 states, the flicker analysis is conducted on a single system basis, and therefore existing DER does not impact the flicker analysis.

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Date: December 17, 2019

[1] *Id.*, Attachment A, at 7.

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Xcel Energy Information Request No. 26
Docket No.: E002/M-19-685
Response To: Interstate Renewable Energy Council
Requestor: Yochanan Zakai
Date Received: December 4, 2019

Question:
A. How is the Primary Voltage Deviation[1] calculation performed?
B. For the Primary Voltage Deviation calculation, what assumptions about distributed energy resource connections, disconnections, or power levels are used that would result in primary voltage deviations?
C. What is the justification for these assumptions (*i.e.*, how do they reflect actual DER operations)?

Response:
A. The Primary Voltage Deviation calculation is done by looking at the instantaneous change in voltage at a given location with all voltage regulation devices locked in their current position for a given reduction in aggregate DER output.
B. We assumed a 100% loss of full aggregate DER on the feeder. Voltage deviation due to the aggregate loss of generation is limited to 5% at any location on the feeder. Aggregate voltage deviation exceeding 5% will limit hosting capacity.
C. These limits are based on IEEE 1453-2015 and were developed with the input from an IEEE 1453 Technical Stakeholder Group convened by Xcel Energy in early 2017. Xcel Energy filed a white paper titled "Applying IEEE 1453-2015 for Determining the Voltage Deviation Limits for Medium Voltage Distribution Connected Photovoltaics for Step-Changes in Voltage and Ongoing Voltage Deviations due to the Passing of Clouds" on April 26, 2017 in Docket No. E002/M-13-867.

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Date: December 17, 2019

[1] Xcel Energy 2019 Hosting Capacity Analysis Report, Attachment A, at 19 (using numbering in the upper right corner).