

1. *STRATEGISTS'S COST ANALYSIS OF SOLAR PORTFOLIOS 1 AND 2*

a. *Modeling Review*

The Department used Strategist to review Xcel's modeling efforts regarding the Company's Solar Request For Proposals (Solar RFP). The general process followed by the Department when reviewing Strategist modeling is as follows:

1. obtain from the utility a base case file and the commands necessary to re-create the various scenarios explored by the Company;
2. re-run the utility's base case file to make sure the outputs match and that the Department is working with the correct file;
3. review the utility's base case inputs and outputs for reasonableness;
4. create a new base case, which includes any changes deemed necessary to the utility's base case;
5. run scenarios of interest on the new base case (if necessary) to explore various risks and alternative futures;
6. assess the results of the scenarios and establish (if necessary) a new preferred case;
and
7. run scenarios of interest on the new preferred case to test the robustness of the preferred case.

Below the Department discusses the results of this analytical process as applied to Xcel's modeling of the Solar RFP.

The Department obtained from Xcel the Company's reference case along with the commands necessary to re-create the scenarios explored by the Company. See Xcel's responses to Department Information Request Nos. 1 to 4 for this information.

After obtaining Xcel's Strategist files, the Department re-ran the file necessary to re-create the Strategist scenarios examined by Xcel in the Petition. The Department's outputs matched the outputs in the file provided by Xcel. This demonstrates that the inputs provided by Xcel were the inputs that created the Company's modeling outputs. Since the results matched, the Department had obtained the proper files from Xcel and modeling could proceed.

Next the Department reviewed the inputs and outputs of Xcel's base case. The Department's initial analysis compared selected inputs used by the Department in the Department's most recent modeling of Xcel's system¹ with the inputs used by Xcel in preparing the Petition. The goal was to determine if certain inputs changed significantly. If the inputs did not change significantly, the Department could rely upon prior review of the model inputs rather than attempting a thorough review at this time.

The Department started by comparing the forecasts of system energy requirements and system peak demand. The comparison indicated that system peak demand did not change significantly for the summer months (June, July, and August) for 2015-2050, but substantial decreases in the

¹ See the October 18, 2013 Rebuttal Testimony of Dr. Steve Rakow in Docket No. E002/CN-12-1240. Specifically, the Department used Scenario 59, which was the last base case that did not add any of the proposals being evaluated in that docket. Instead capacity deficits are filled with generic units.

shoulder (March, April, May, September, October, November) and winter (December, January, February) months:

- Summer months: a range of +2.3% to -3.6 with an average change of -0.4 percent;
- Shoulder months: -1.5% to -17.5 with an average change of -9.3 percent; and
- Winter months: -9.4% to -16.6% with an average change of -13.0 percent.

The results for the comparison of the energy forecast were as follows:

- Summer months: a range of -1.4% to -10.3 with an average change of -5.2 percent;
- Shoulder months: +0.3% to -10.3 with an average change of -5.0 percent; and
- Winter months: +1.6% to -11.0% with an average change of -6.0 percent.

While the summer peak demand forecast generally did not change significantly, the forecasted demand for off peak months decreased substantially, as did the forecasted energy requirements for all months. Since solar resources are used to address energy needs in addition to peak demand requirements, the Department determined that the changes in Xcel's forecast inputs necessitated the use of Xcel's new model. In summary, the Department concludes that the Xcel's 2014 Strategist database is substantially different from the most recent database used by the Department and it is necessary to use Xcel's updated Strategist database.

The Department notes that Xcel's 2014 Strategist database has a locked-in expansion plan.² To determine if Xcel locked in the least cost expansion plan the Department re-ran Xcel's newest Strategist database with CT and CC expansion units (solar and wind expansion units not

² Generally the expansion plan requires the addition of peaking units (CTs) in the initial years (2014 to 2026). In the middle years (2027 to 2034) a mixture of CTs, intermediate units (CCs), and wind units are added and in the last years (2035 to 2053) both CTs and CCs are added.

available) as options rather than as required additions. The result was that the addition of several peaking units was advanced and the addition of one CC unit was deferred. While the first difference between the two files occurred in 2024, most of the changes were after 2033. The Department then repeated the process but with the solar units forced into the expansion plan. The result this time was that the expansion plan from Strategist matched the 2014 plan forced by Xcel. Thus, Xcel's analysis forced in the expansion plan that was least cost under base case conditions assuming the solar portfolio was added.

Regarding the locked-in expansion plan, in this case the Department is not attempting to determine the least cost expansion plan. Instead, the Department is attempting to determine which alternative best complements the resource plan-determined expansion plan. Therefore, a locked-in expansion plan that is compliant with the most recent Commission-approved resource plan would be appropriate.

In this case, the most recent Commission order regarding an Xcel resource plan was issued March 5, 2013 in Docket No. E002/RP-10-825.³ This order stated that:

the Commission notes that it is approving Xcel's plan for planning purposes only ... For purposes of Xcel's competitive bidding docket (Docket No. E002/CN-12-1240), the Commission finds it appropriate to solicit proposals for *an additional* 150 MW in 2017, increasing *up to* 500 MW by 2019.

In contrast, Xcel's Strategist database used for this proceeding does not add a new generating unit until 2020 and the addition of 500 MW of new generating units is not reached until 2024. Given the significant differences (in the forecast as discussed previously and the supply-side expansion plan)

³ Note that the Commission issued an Order February 27, 2014 in Docket No. E002/RP-13-368. However, this order accepted a Commission-ordered study and set filing requirements and did not address Xcel's resource needs.

between Xcel's most recent data and the Commission-approved resource plan, the Department concluded that it would be reasonable to leave the expansion units as options in this analysis rather than locking-in the expansion plan from the last resource plan. The only exception was that the Department retained Xcel's locked in wind units⁴ and added optional wind units in the initial years of the resource plan.

Next the Department determined the packages of units to be analyzed in this proceeding. Xcel's Petition at page 2 states:

There are two alternative solar generation portfolios that can be crafted to meet the 150-200 MW range of needed utility-scale solar generation: (1) should the Commission decide to move forward with the Geronimo solar project, a 187 MW portfolio could consist of the *Marshall Solar* and *MN Solar I* PPAs, and the Geronimo solar project; (2) a 187 MW portfolio could consist of only the *Marshall Solar*, *MN Solar I* and *North Star Solar* PPAs.

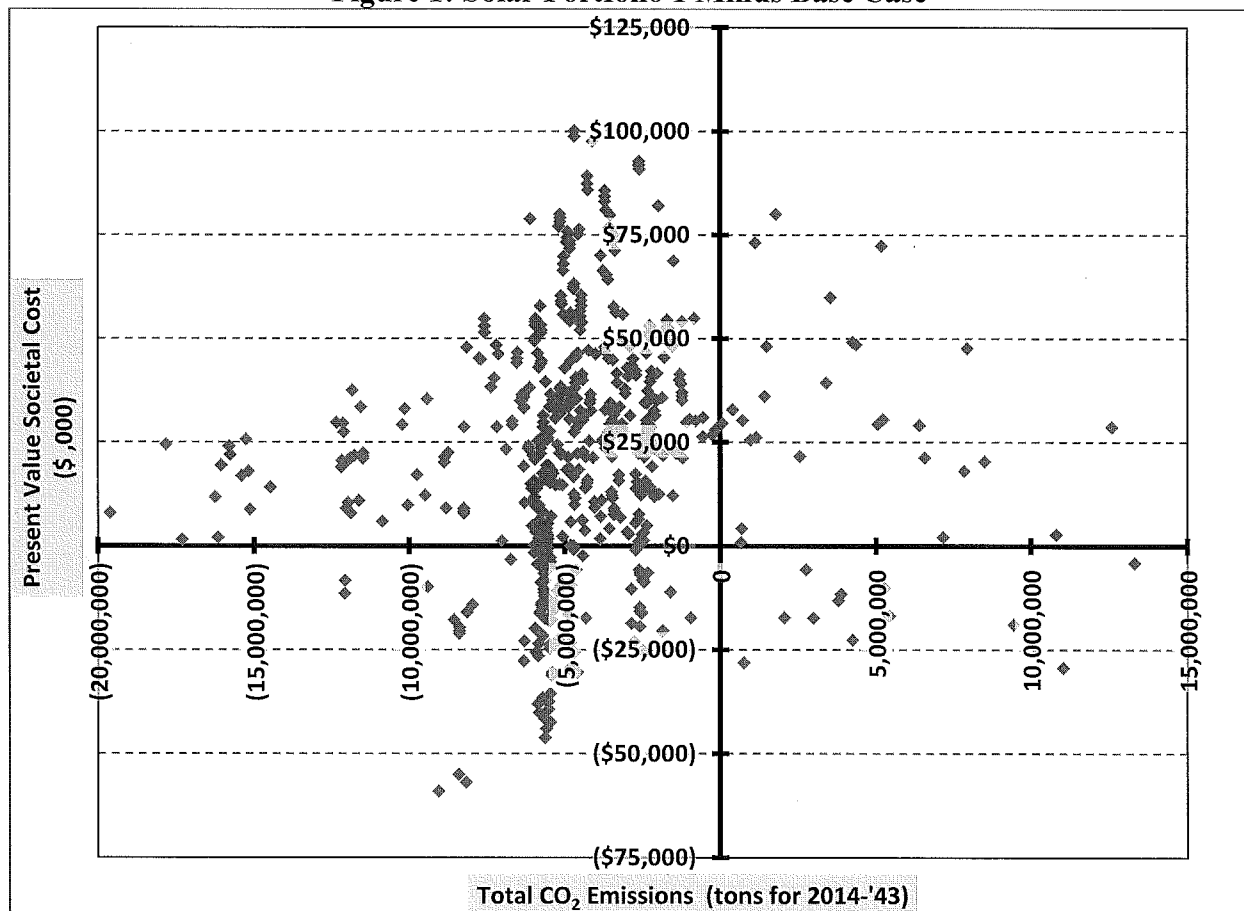
Therefore the Department created a base case with no solar units added and then separately forced two solar portfolios into the base case. Solar Portfolio 1 consisting of the Marshall Solar PPA, MN Solar I PPA, and the Geronimo solar project and Solar Portfolio 2 consisting of the Marshall Solar PPA, MN Solar I PPA, and the North Star Solar PPA. The Department ran Strategist with all possible combinations of three contingencies (high, middle and low) on natural gas fuel prices, wind unit prices, coal fuel prices, forecast, and expansion unit capital costs along with four variations (high, middle, low and none) on CO₂ costs.

The impact of adding Solar Portfolio 1 to the base case is shown in Figure 1 below. Figure 1 shows that Solar Portfolio 1 generally increases system costs but reduces overall CO₂ emissions. In terms of energy production, for every MWh from coal that the Solar Portfolio 1 displaced, on

⁴ Presumably needed for compliance with Minnesota's renewable energy standard.

average, about 4.5 MWh of natural gas were displaced. The cost impacts range from an increase of \$100.2 million present value of societal costs (PVSC) measured over 30 years, 2014 to 2043 to a decrease of \$59.1 million PVSC with the average impact being a cost increase \$28.8 million PVSC. The impact on CO₂ emissions ranges from an increase of 13.3 million tons (again over 30 years, 2014 to 2043) to a decrease of 19.6 million tons with the average impact being a decrease of 4.6 million tons.

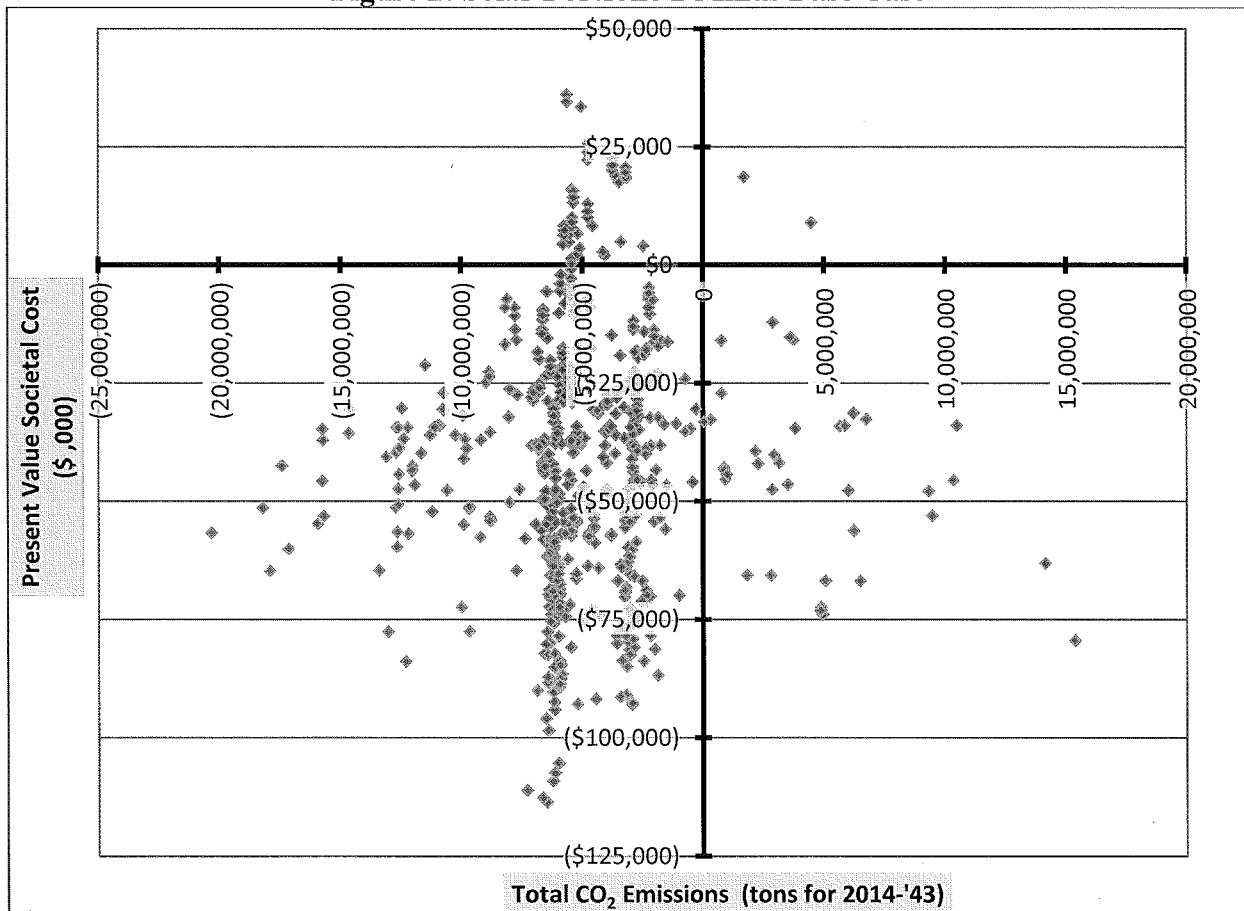
Figure 1: Solar Portfolio 1 Minus Base Case



The impact of adding Solar Portfolio 2 to the base case is shown in Figure 2 below. Figure 2 shows that Solar Portfolio 2 generally decreases system costs and overall CO₂ emissions. In

terms of energy production, for every MWh from coal that the Solar Portfolio 2 displaced, on average, about 4.8 MWh of natural gas were displaced. The cost impacts range from an increase of \$36.0 PVSC to a decrease of \$113.7 million PVSC with the average impact being a cost decrease \$34.9 million PVSC.⁵ The impact on CO₂ emissions ranges from an increase of 15.4 million tons to a decrease of 20.3 million tons with the average impact being a decrease of 5.0 million tons.

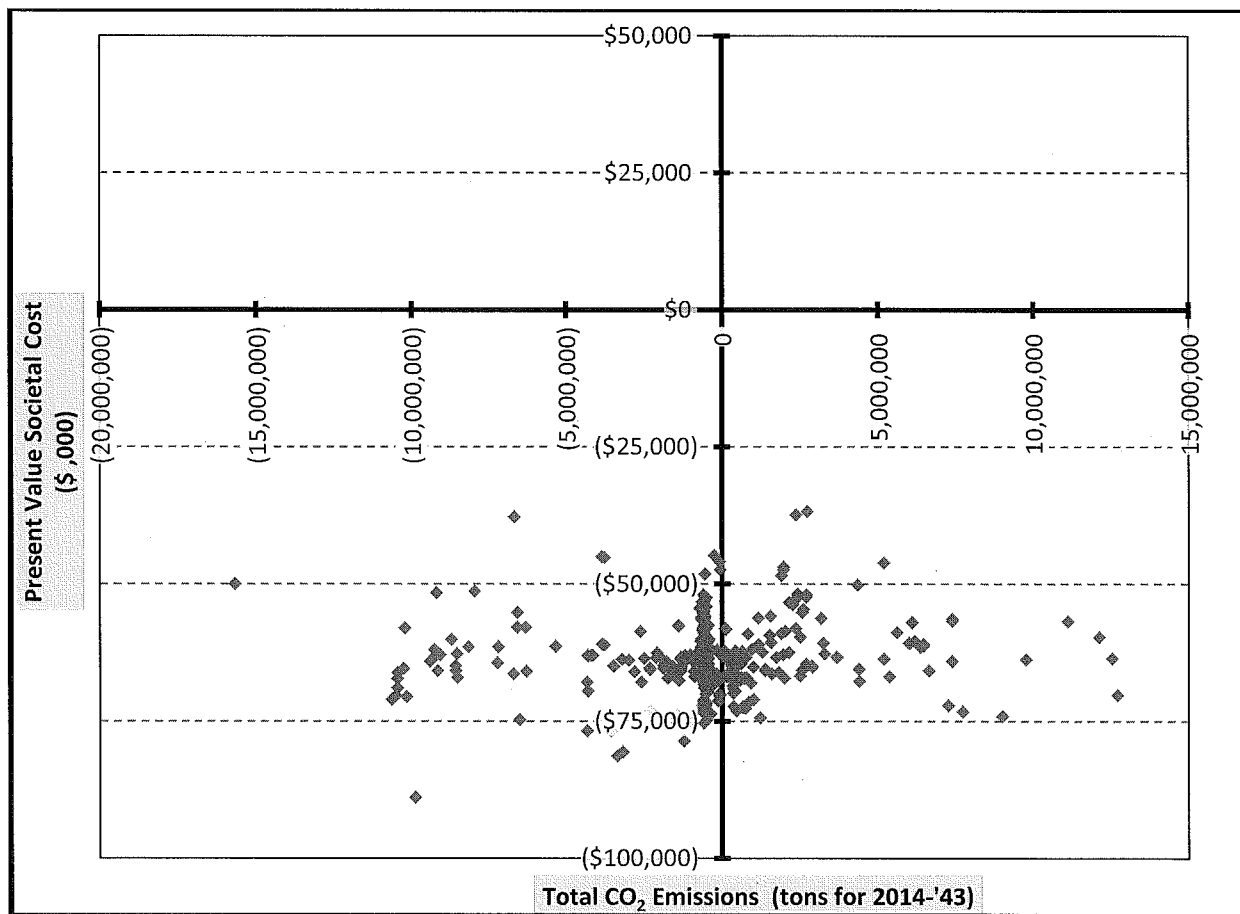
Figure 2: Solar Portfolio 2 Minus Base Case



⁵ If contingencies involving either low capital costs for expansion units or no CO₂ costs are excluded from the analysis the addition of Solar Portfolio 2 always decreases PVSC.

The difference between adding Solar Portfolio 1 and Solar Portfolio 2 to the base case is shown in Figure 3 below. Figure 3 shows that Solar Portfolio 2 decreases system costs relative to Solar Portfolio 1 and Solar Portfolio 2 has similar system CO₂ emissions when compared to Solar Portfolio 1. The difference in cost impacts for any one contingency range from a decrease of \$36.8 PVSC (Solar Portfolio 2 is cheaper than Solar Portfolio 1) to a decrease of \$88.9 million PVSC with the average impact being a cost decrease \$63.6 million PVSC. The impact on CO₂ emissions ranges from an increase of 12.7 million tons to a decrease of 15.7 million tons with the average impact being a decrease of 0.4 million tons.

Figure 3: Solar Portfolio 2 Minus Solar Portfolio 1



Regarding the impact on the least cost expansion plan, the results were similar for Solar Portfolio 1 and Solar Portfolio 2. In about 70 percent of the contingencies no change occurred. When there was an impact, the main result was a decrease in other energy resources (wind or CC). Specifically, the addition of the solar mandate decreased the number of optional units selected as follows:

- wind in about 20 percent of the contingencies;
- CC units in 11 percent of the contingencies; and
- CT units in 2 percent of the contingencies.⁶

The addition of the solar mandate occasionally increased the number of optional units selected as follows:

- wind in 1 percent of the contingencies;
- CC units in 5 percent of the contingencies; and
- CT units in 7 percent of the contingencies.

In summary, Solar Portfolio 2 has a significantly lower PVSC than Solar Portfolio 1 and Solar Portfolio 2 results in similar system CO₂ emissions when compared to Solar Portfolio 1.

⁶ The percentages did differ for Solar Portfolio 1 and Solar Portfolio 2, but by small amounts.

Attachment 2: Department Estimate of Xcel's Solar Energy Standard Requirement

I. Minnesota's Solar Energy Standard

In 2014, the Minnesota Legislature adopted Minn. Stat. §216B.1691, Subd. 2f establishing a Solar Energy Standard (SES) requiring public utilities to obtain at least 1.5 percent of their total Minnesota retail sales from solar energy by the end of 2020, with at least 10 percent of the 1.5 percent from solar facilities with a nameplate capacity of 20 kilowatts or less. The statute establishes a goal of obtaining ten percent of Minnesota retail sales from solar energy by 2030.

In addition, the SES statute excludes retail sales to customers that are iron mining extraction and processing facilities, or paper mills, wood products manufacturers, sawmills, or oriented strand board manufacturers from the calculation of 1.5 percent of retail sales.

Renewable Energy Credits (RECs) have typically carried a four-year shelf life, meaning they could be retired toward RES compliance in the year of generation or the next four years. In its April 25, 2014 Order in Docket E999/CI-13-542¹, the Commission determined that any Solar Renewable Energy Credit (S-REC) from a solar facility installed and generating electricity after August 1, 2013, but before January 2020 shall have a 4-year shelf life commencing January 2020. All S-RECs created after January 2020 shall have a four year shelf life. In other words, utilities will be able to retire S-RECs created between August 1, 2013 and December 31, 2019 towards their SES compliance through 2024. By allowing utilities to retire S-RECs generated prior to the start of the SES in 2020 for an additional four years, utilities will not be penalized for the early acquisition of solar energy prior to 2020.

B. Estimate of Xcel's Solar Energy Requirement

In response to DOC Information Request No.5 (Attachment B), Xcel provided its forecasted Minnesota retail sales through 2020. Currently, Xcel has no customers requesting exclusion from the SES requirement under Minn. Stat. §216.1691, Subd. 2f; however, the Company states it estimates retail electricity sales to the excluded industry categories listed in will be approximately 282,457 MWhs. In 2020, the first year of the SES, Xcel's SES requirement is estimated at 459,856 MWhs, of which 10 percent or 45,986 MWhs should be from facilities of 20 kW or less.

¹ In the Matter of the Implementation of Solar Energy Standards Pursuant to 2013 Amendments to Minnesota Statutes, Section 216B.1691, *Order Clarifying Solar Energy Standard Requirements and Setting Annual Reporting Requirements*, April 25, 2014, Docket No. E999/CI-13-542.

	MN Retail Sales (MWhs)	SES Excluded Sales (MWhs)	MN Retail Less Excluded	SES Req.	Small Facility <=20 kW	Larger Facility > 20 kW
2014	30,548,731	282,457	30,266,274	453,994	45,399	408,595
2015	30,617,266	282,457	30,334,809	455,022	45,502	409,520
2016	30,770,777	282,457	30,488,320	457,325	45,732	411,592
2017	30,805,300	282,457	30,522,843	457,843	45,784	412,058
2018	30,880,317	282,457	30,597,860	458,968	45,897	413,071
2019	30,939,519	282,457	30,657,062	459,856	45,986	413,870
2020	30,987,364	282,457	30,704,907	460,574	46,057	414,516

Xcel expects to add a total of 257.6 MW's AC in solar resources to its portfolio between now and 2020. Tables 2 and 3 summarize the expected solar capacity and energy additions between 2014 and 2020.

Table 2: Xcel's Forecasted Solar Capacity Additions

	Small Facility Capacity <= 20 kW MWs AC	Larger Facility Cap. >20 kW MWs AC	Total Capacity MWs AC
2014	11.9	10.9	22.8
2015	16.7	24.0	40.7
2016	21.4	186.5	207.9
2017	26.2	194.2	220.4
2018	31.0	201.9	232.9
2019	35.7	209.6	245.3
2020	40.4	217.2	257.6

Table 3: Xcel's Forecasted Solar Energy Additions

	Small Facility <= 20 kW MWs	Larger Facility. >20 kW MWs	Total Annual Energy MWs
2014	11,455	9,176	20,620
2015	17,684	25,143	42,826
2016	23,907	304,802	328,709
2017	30,114	319,171	349,285
2018	36,303	331,016	367,319
2019	42,473	342,794	385,267
2020	48,625	354,505	403,130
Total SRECs available for SES compliance			1,686,607

As noted above, SRECs generated prior to 2020 will have a four-year shelf life beginning in January 2020. Consequently, the Department believes that given Xcel's proposed solar additions, the Company will have sufficient solar generation to meet its forecasted SES requirement in 2020 and for several years going forward.

- Non Public Document – Contains Trade Secret Data
 Public Document – Trade Secret Data Excised
 Public Document

Xcel Energy

Docket No.: E002/M-14-162

Response To: Department of Commerce Information Request No. 5

Requestor: Susan Peirce

Date Received: November 6, 2014

REVISED

Question:

Please provide all analysis undertaken by Xcel to determine the amount of solar energy it needs to acquire to meet the Solar Energy Standard requirement to obtain 1.5 percent of its Minnesota retail sales from solar energy by 2020. Include the following information:

- a. Forecasted retail sales for the period 2014 – 2020.
- b. Forecasted retail sales excluded from the SES requirement under Minn. Stat. §216B.1691, Subd. 2f (d) (1&2).
- c. A list of the customers, their NAICS codes, and annual energy usage for the retail sales excluded from the SES requirement under Minn. Stat. 216B.1691, Subd. Sf(d) (1&2).
- d. The capacity factor for solar energy
- e. The expected annual solar energy and capacity broken down between large scale solar facilities and solar facilities of 20 kW and less needed to meet the 2020 SES requirement.
- f. The expected annual energy and capacity of any existing solar facilities Xcel expects to use towards its SES compliance.

Response:

- a. The forecast of retail sales used in the modeling for the Solar RFP analysis is the August 2014 update to the Company load forecast. Minnesota retail sales from this forecast are shown below:

**Retail Sales
(MWh)**

2014	41,591,419
2015	41,825,988
2016	42,207,372
2017	42,359,384
2018	42,594,448
2019	42,772,154
2020	42,947,334

b. Forecasted exclusion MWh's for the modeling for the Solar RFP analysis is shown below:

**SES Excluded
Sales
(MWh)**

2014	282,457
2015	282,457
2016	282,457
2017	282,457
2018	282,457
2019	282,457
2020	282,457

c. There are zero SES excluded customers, and therefore zero excluded sales at this time. Utilities are preparing filings in compliance with the Commission's verbal decision in Docket No. E999/CI-13-542 addressing plans for notifying customers of potential eligibility for exclusion and the procedures that will follow. Utilities will file draft forms for customers to use in requesting exclusion and a description of how customer requests will be processed.

d. The capacity factor assumed for new fixed-axis solar installations is 14.8% on an AC basis. The capacity factor assumed for generic single-axis tracking solar installations is 19.8%. The capacity factors assumed for the bids in the RFP and for Geronimo's CAPCON bid are in accordance with the bidder-supplied bid forms.

e. The forecasted compliance energy and capacity to meet the MN SES is shown below:

<u>Solar Capacity (AC MW, EOY)</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>
Small Systems (<20kW)	11.9	16.7	21.4	26.2	31.0	35.7	40.4
Larger Systems	10.9	24.0	186.5	194.2	201.9	209.6	217.2
	22.8	40.7	207.9	220.4	232.9	245.3	257.6
<u>Solar Energy (MWh)</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>
Small Systems (<20kW)	11,445	17,684	23,907	30,114	36,303	42,473	48,625
Larger Systems	9,176	25,143	304,802	319,171	331,016	342,794	354,505
	20,620	42,826	328,709	349,285	367,319	385,267	403,130

f. Xcel Energy is currently evaluating which currently installed facilities would be eligible for inclusion in SES compliance. For forecasting purposes, we are currently counting only the 2014 and beyond additions shown above for compliance calculations, though actual SES compliance will be tracked from a starting point of August 1, 2013 consistent with the enabling statute. Current installations that would be credited prior to 2014 will have a negligible impact on compliance, as noted in our June 2, 2014 Annual Report in Docket No. E999/M-14-321.

Revision

In our original response to part a, we inadvertently included total footprint sales instead of Minnesota retail sales. We have corrected the table below to show only Minnesota retail sales.

a. The forecast of retail sales used in the modeling for the Solar RFP analysis is the August 2014 update to the Company load forecast. Minnesota retail sales from this forecast are shown below:

	Retail Sales (MWh)
2014	30,548,731
2015	30,617,266
2016	30,770,777
2017	30,805,300
2018	30,880,317
2019	30,939,519
2020	30,987,364

Preparer: Jon Landrum / Holly Hinman
 Title: Manager, Resource Planning Analytics / Regulatory Policy Specialist
 Department: Resource Planning / NSPM Regulatory
 Telephone: 303-571-2765 / 612-330-5941
 Date: November 18, 2014 **REVISED:** November 24, 2014