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August 26, 2020

VIA U. S. AND ELECTRONIC MAIL

Mr. Steven M. Kahl, Executive Secretary
North Dakota Public Service Commission
State Capitol Building, Dept. 0408
600 East Boulevard
Bismarck, ND 58505-0480

RE: CORRECTION - 2020-2034 UPPER MIDWEST RESOURCE PLAN SUPPLEMENT
(CASE NO. PU-19-220)

Dear Mr. Kahl:

Pursuant to the provisions of the Settlement approved by the Commission in Case No. PU-07-776, Northern States Power Company, doing business as Xcel Energy, herewith submits eight (8) copies of its *2020-2034 Upper Midwest Resource Plan Supplement Errata* (Errata) filed with the Minnesota Public Utilities Commission August 25, 2020.

This Errata corrected analysis provided in the *Supplement to our 2020-2034 Upper Midwest Integrated Resource Plan* filed June 30, 2020. In Section 2.C.4 of the Supplement, the Company provided analysis on the cost-effectiveness of replacing some of the wind and solar selected in our Preferred Plan with hybrid wind-plus-storage or solar-plus-storage resources.

In recent discovery, we found that the analysis contained an erroneous assumption that the storage portion of the solar-plus-storage resource would receive accredited capacity of 45 percent of the installed capacity. We have corrected that input to 100 percent and conducted updated analysis.

Please contact me or Chris Shaw at (612) 330-7674 or christopher.j.shaw@xcelenergy.com if you have any questions regarding this filing.

Sincerely,

David H. Sederquist
Sr. Regulatory/Financial Consultant
Xcel Energy

cc: Pat Fahn
Jack Schuh
Adam Renfandt

18 PU-19-220 Filed 08/26/2020 Pages: 28
2020-2034 Upper Midwest Resource Plan Supplement Errata
Northern States Power Company
David Sederquist



414 Nicollet Mall
Minneapolis, MN 55401

August 25, 2020

—Via Electronic Filing—

Will Seuffert
Executive Secretary
Minnesota Public Utilities Commission
121 7th Place East, Suite 350
St. Paul, MN 55101

RE: ERRATA
2020-2034 UPPER MIDWEST INTEGRATED RESOURCE PLAN
DOCKET NO. E002/RP-19-368

Dear Mr. Seuffert:

Northern States Power Company, doing business as Xcel Energy, submits this Errata to correct analysis provided in the June 30, 2020 Supplement to its 2020-2034 Upper Midwest Integrated Resource Plan to the Minnesota Public Utilities Commission.

The Company provided analysis on the cost-effectiveness of renewables-plus-storage hybrid resources in Section 2.C.4 of the Supplement. Using the EnCompass model, the Company conducted analysis to test the economic viability of replacing some of the wind and solar selected in our Supplement Preferred Plan with hybrid wind-plus-storage or solar-plus-storage resources – together referred to as renewable-plus-storage resources.

In responding to questions from intervenors, we discovered that the solar-plus-storage analysis contained an error in the input for the capacity of the storage portion of the hybrid resource. The analysis provided in the Supplement included an assumption that the storage portion of the solar-plus-storage resource would receive accredited capacity of 45 percent of the installed capacity. We have corrected that input to 100 percent and conducted updated analysis. The wind-plus-storage analysis provided in the Supplement was correct. The methodology used for the updated analysis of the solar-plus-storage resource is the same as we described with our initial analysis, beginning on page 52 of the Supplement and repeated here for reference:

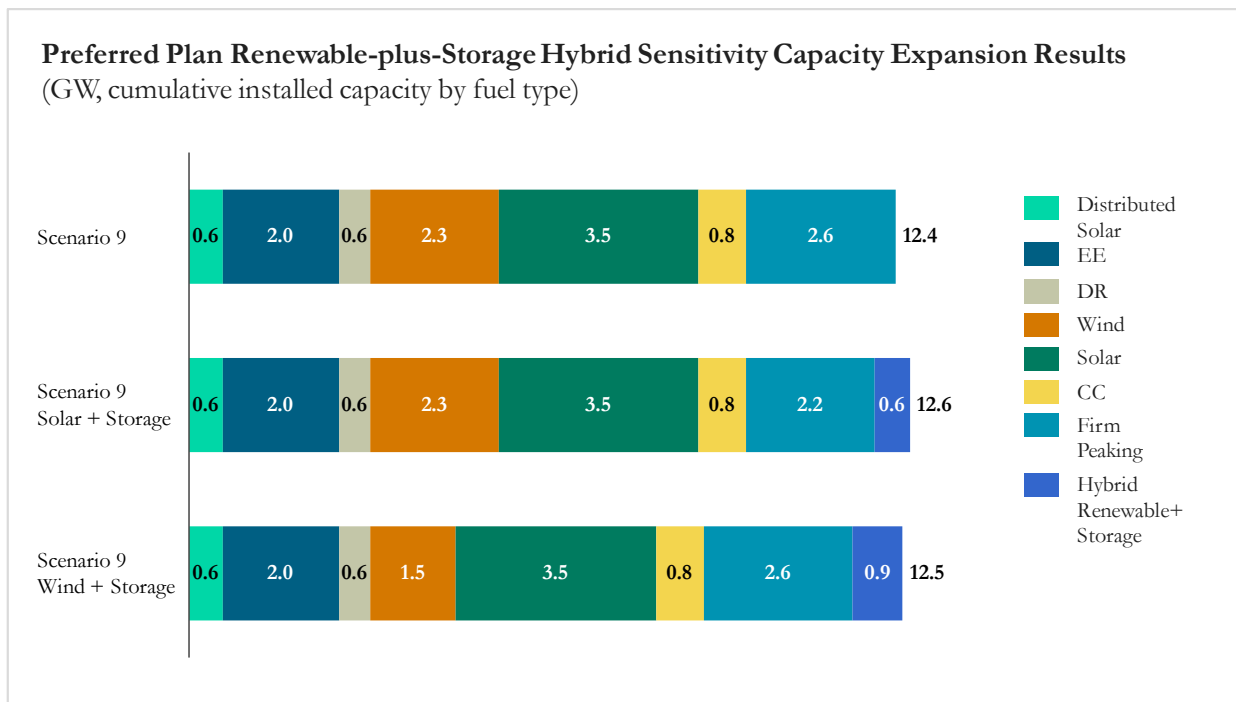
The Company conducted sensitivities that test the economic viability of replacing some of the wind and solar selected in our Supplement Preferred Plan with hybrid

wind-plus-storage or solar-plus-storage resources. These options are not examined in the initial capacity expansion modeling for process purposes, as adding too many generic resource options to the model optimization slows the modeling process. However, we can evaluate whether a hybrid option is an economic alternative to standalone renewables by manually replacing some of the wind and solar the plan selects with hybrid wind-plus-storage or solar-plus-storage options.

To conduct this test, the Company took the EnCompass optimized expansion plan for Scenario 9 (the Supplement Preferred Plan) and manually replaced the first occurring solar generic resource with a combined solar-plus-storage resource. We then reoptimized the expansion plan around this new, manually included resource.

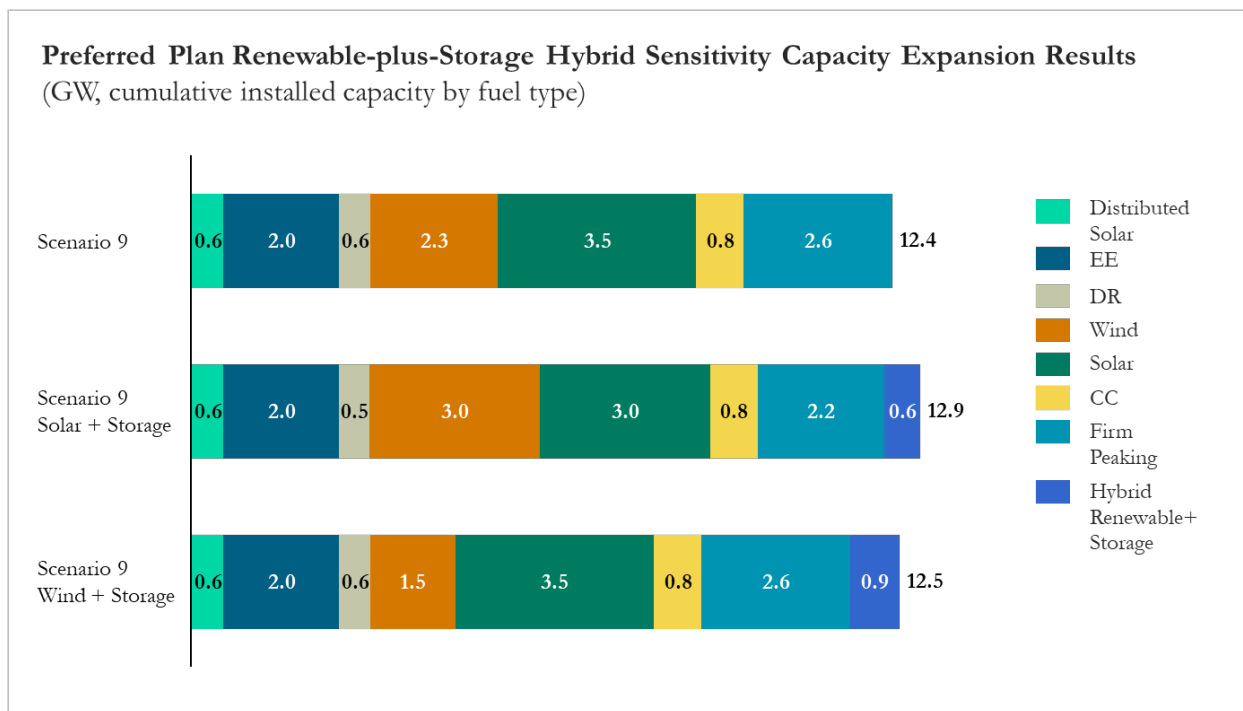
Below we provide Figure 2-21 as provided in the Supplement then updated with the corrected storage capacity.

Figure 2-21: Preferred Plan Sensitivity Testing – Hybrid Renewables-plus-Storage Capacity Expansion Results



Errata

Figure 2-21: Preferred Plan Sensitivity Testing – Hybrid Renewables-plus-Storage Capacity Expansion Results



As discussed in the Supplement:

After the capacity expansion modeling step, we then conducted a full 8,760 production costing run on this sensitivity just as we did with the baseload study, in order to evaluate the cost and dispatch data and compare to the Supplement Preferred Plan cost outcomes. These analyses show that – given current assumptions regarding technology costs and our system needs – hybrid renewables-plus-storage resources are not expected to be a cost-effective alternative to standalone renewables. These results are driven by the relative forecasted prices for firm peaking, solar, and storage resources. In both hybrid cases, the storage addition replaced either firm peaking (for the solar hybrid) or solar (for the wind hybrid). That said, these results are based on forecasted technology prices that may change in the future. We fully intend to closely monitor developments for hybrid resource options, both in terms of price and performance, and will adapt our solicitations, modeling approaches and resource procurement accordingly as conditions change.

Compared to the analysis provided in the Supplement, the corrected storage capacity offsets stand-alone solar additions and increases additions of wind as shown above. This results in more renewable energy added to the system relative to our initial analysis.

Below we provide Table 2-7 as provided in the Supplement then updated with the corrected storage capacity.

Table 2-7: Supplement Preferred Plan Hybrid Sensitivities PVSC and PVRR Deltas from Scenario 9

Scenario	PVSC Deltas (\$2020 millions)	PVRR Deltas (\$2020 millions)
Scenario 9 (Supplement Preferred Plan)	--	--
Scenario 9 Solar-plus-Storage	\$29	\$44
Scenario 9 Wind-plus- Storage	\$212	\$182

Errata

Table 2-7: Supplement Preferred Plan Hybrid Sensitivities PVSC and PVRR Deltas from Scenario 9

Scenario	PVSC Deltas (\$2020 millions)	PVRR Deltas (\$2020 millions)
Scenario 9 (Supplement Preferred Plan)	--	--
Scenario 9 Solar-plus-Storage	\$8	\$62
Scenario 9 Wind-plus- Storage	\$212	\$182

As shown above, the updated analysis results in reduced costs on a Present Value Societal Cost (PVSC) basis and increased cost on a Present Value Revenue Requirements (PVRR) basis. The costs of emissions are included in the capacity optimization, and, as noted above, more renewable energy is added to the system. Relative to our initial analysis, costs increase when the impact of emissions are excluded. The corrected results show that while solar-plus-storage remains slightly more costly, the costs are similar – and solar-plus-storage could be cost-effective in the near future. In the Supplement, we noted that we intend to closely monitor developments for hybrid resource options, both in terms of price and performance, and will adapt our solicitations, modeling approaches, and resource procurements accordingly as conditions change. The corrected results affirm the importance of considering hybrid resources in future resource acquisitions.

We also provide as Attachment A to this filing, redlined updates to six Tables in the Supplement to reflect three other errors we have discovered since our filing. First, we corrected the Strategist results for the 50 percent solar ELCC scenario in Tables X-11

and X-12.¹ Second, we corrected the gas demand charge in Tables IV-14 and IV-22.² Finally, we corrected reliability metrics for one of the scenarios in the reliability analysis in Table 10-2 of the Supplement and Table XI-2 of Attachment A to the Supplement. All updates to these Tables are reflected in [blue](#) font. We note that the corrected pages do not contain any Trade Secret information.

Please contact me at (612) 330-6064 or bria.e.shea@xcelenergy.com if you have any questions regarding this filing.

/s/

BRIA SHEA
DIRECTOR
REGULATORY & GOVERNMENT AFFAIRS

Enclosure
c: Service List

¹ The Strategist files previously provided to parties in the discovery process include the correct data.

² The modeling inputs previously provided to parties in the discovery process include correct data.

Xcel Energy

Docket No. E002/RP-19-368

Section 2: Modeling Framework and Results

analysis on Scenario 9 and several sensitivity portfolios, to help us understand portfolio performance under actual historical meteorological conditions that reflected more variation than the default planning assumptions used in our capacity expansion models. We tested these sensitivities in EnCompass only, as Strategist is not capable of performing 8,760-hour analysis.

We note that we have not proposed changes to our Supplement Preferred Plan based on these sensitivity results, rather provide them for the Commission's and stakeholders' information.

a. Renewables-plus-storage hybrid resources

The Company conducted sensitivities that test the economic viability of replacing some of the wind and solar selected in our Supplement Preferred Plan with hybrid wind-plus-storage or solar-plus-storage resources. These options are not examined in the initial capacity expansion modeling for process purposes, as adding too many generic resource options to the model optimization slows the modeling process. However, we can evaluate whether a hybrid option is an economic alternative to standalone renewables by manually replacing some of the wind and solar the plan selects with hybrid wind-plus-storage or solar-plus-storage options.

To conduct this test, the Company took the EnCompass optimized expansion plan for Scenario 9 (the Supplement Preferred Plan) and manually replaced the first occurring solar generic resource with a combined solar-plus-storage resource. We then reoptimized the expansion plan around this new, manually included resource. Following the same process, we tested replacing the first occurring generic wind resource with a combined wind-plus-storage resource. Given the additional capacity associated with the storage component of the hybrid resource, the re-optimized result typically either deferred to a later date, or avoided, ~~firm peaking capacity (modeled as~~ CTs), relative to Scenario 9.

, as shown in Figure 2-21 below

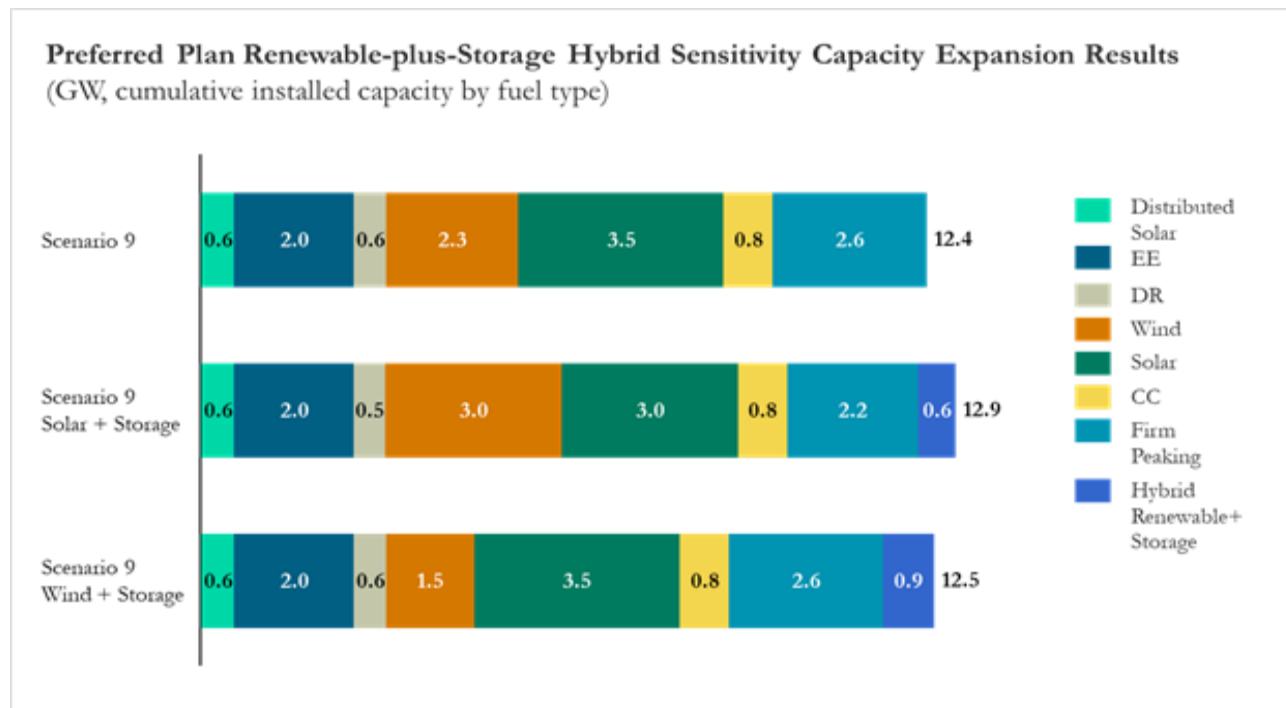
↑
other resource additions

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Docket No. E002/RP-19-368

Section 2: Modeling Framework and Results

Figure 2-21: Preferred Plan Sensitivity Testing – Hybrid Renewables-plus-Storage Capacity Expansion Results



After the capacity expansion modeling step, we then conducted a full 8,760 production costing run on this sensitivity just as we did with the baseload study, in order to evaluate the cost and dispatch data and compare to the Supplement Preferred Plan cost outcomes. These analyses show that – given current assumptions regarding technology costs and our system needs – hybrid renewables-plus-storage resources are not expected to be a cost-effective alternative to standalone renewables. These results are driven by the relative forecasted prices for firm peaking, solar, and storage resources. In both hybrid cases, the storage addition replaced either firm peaking (for the solar hybrid) or solar (for the wind hybrid). That said, these results are based on forecasted technology prices that may change in the future. We fully intend to closely monitor developments for hybrid resource options, both in terms of price and performance, and will adapt our solicitations, modeling approaches and resource procurement accordingly as conditions change.

Xcel Energy

Docket No. E002/RP-19-368

Section 2: Modeling Framework and Results

Table 2-7: Supplement Preferred Plan Hybrid Sensitivities PVSC and PVRR Deltas from Scenario 9

Scenario	PVSC Deltas (\$2020 millions)	PVRR Deltas (\$2020 millions)
Scenario 9 (Supplement Preferred Plan)	--	--
* Scenario 9 Solar-plus-Storage	<u>\$8</u> \$29	<u>\$62</u> \$44
Scenario 9 Wind-plus-Storage	\$212	\$182

b. Sherco CC Size Sensitivities

Our Supplement Preferred Plan includes a Sherco CC sized at approximately the same capacity as “proposed to the Public Utilities Commission in docket number E-002/RP-15-21[.]”²⁷ However, in response to Commission direction, we have developed three different size options – two smaller units and one larger one – to examine whether a differently sized and configured unit would be more economically beneficial. The process we use to test these size options is similar to that which we used for the hybrid renewable-plus-storage options. Starting with Scenario 9 we conducted three EnCompass optimization runs that replaced the default Sherco CC with one of the three alternative sizes (and their associated costs and operational specifications) in each run. This process allowed us to examine how the capacity expansion portfolio would respond to each size alternative. We then conducted a full 8,760-hour production costing simulations for each alternative. Specific detailed assumptions associated with the different CC size options are included in Attachment A, Section IV: Modeling Assumptions and Inputs.

²⁷ Laws of Minnesota 2017, Chapter 5—H.F. No. 113, section 1.

Table 2-10: Summary of Reliability Metrics Analyzed, by Test

Expansion Plan Tested (Test Load and Resource Shapes)	Native Capacity Shortfall Metrics		Flexible Resource Adequacy Metric	Maximum Import Metric
	Number of Native Capacity Shortfall Events	Longest Shortfall Event (hours)	Maximum 3 – Hour Upward Ramp and Occurrence Month (MW)	Hours >95 Percent of 2,300 MW Import Limit
Baseline – Scenario 9 (Default)	0	0	4,760 (February)	9
Scenario 9 (2019)	4	2	5,506 (June)	158
Scenario 9 – High Distributed Solar Future (2019)	14	5	7,221 (June)	157
* Scenario 9 - High Electrification Future (2019)	21 <u>22</u>	6	7,152 (March)	674
Scenario 9 – 50 percent ELCC (2019)	159	22	7,239 (January)	311

While we are still working to fully understand all of the EnCompass model’s capabilities with respect to reliability analyses, we believe the above findings indicate potential risks associated with portfolios that rely more heavily on variable renewables and use-limited resources. As demonstrated in the table above, the Supplement Preferred Plan exhibits few to no issues under the typical conditions that were used as a default assumption for baseload scenario modeling. When evaluated under the 2019 actual historical conditions, we did encounter more periods in which native capacity is insufficient to serve our customers and our import capabilities were at maximum levels, but these events were still relatively uncommon.

The three other portfolios, however, produce more reliability challenges when evaluated under the 2019 actual shapes, either with the magnitude or length of native capacity shortfalls, 3-hour ramping needs, or others. In particular, the “Scenario 9 – 50 Percent ELCC” portfolio experiences the highest number and duration of native load shortfalls, and a high 3-hour ramp. We believe this evaluation helps to confirm that our use of a declining ELCC metric for solar is appropriate. We also note that the

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Docket No. E002/RP-19-368
Attachment A: Supplement Details
IV. Modeling Assumptions & Inputs

Table IV-14: Thermal Generic Information (Costs in 2018 Dollars)

Thermal Generic Information					
Resource	Sherco CC	Generic CC	Generic CT	Generic CT	Generic CT
Technology	7H	7H	7H	7F	7H
Location Type	Brownfield	Greenfield	Brownfield	Brownfield	Greenfield
Cooling Type	Wet	Dry	Dry	Dry	Dry
Book life	40	40	40	40	40
Nameplate Capacity (MW)	835	901	374	232	374
Summer Peak Capacity (MW)	750	856	331	206	331
Capital Cost (\$000) 2018\$	\$837,068	\$906,588	\$174,700	\$114,766	\$193,500
Electric Transmission Delivery (\$000) 2018\$	NA	\$410,505	NA	NA	\$74,804
Ongoing Capital Expenditures (\$000-yr) 2018\$	\$6,200	\$6,200	\$1,784	\$892	\$1,784
* Gas Demand (\$000-yr) 2018\$	\$41,000	\$31,725	\$19,058	\$1,342	\$2,165
Capital Cost (\$/kW) 2018\$	\$1,002	\$1,006	\$467	\$495	\$517
Electric Transmission Delivery (\$/kW) 2018\$	NA	\$455	NA	NA	\$200
Ongoing Capital Expenditures (\$/kW-yr) 2018\$	\$7.42	\$6.88	\$4.77	\$3.85	\$4.77
* Gas Demand (\$/kW-yr) 2018\$	\$49.09	\$37.98	\$21.14	\$5.79	\$5.79
Fixed O&M Cost (\$000/yr) 2018\$	\$6,592	\$6,592	\$1,253	\$1,203	\$1,253
Variable O&M Cost (\$/MWh) 2018\$	\$1.04	\$1.04	\$0.99	\$1.03	\$0.99
Levelized \$/kw-mo (All Fixed Costs) \$2018	\$15.26	\$16.06	\$5.91	\$6.22	\$8.06
Summer Heat Rate 100% Loading (btu/kWh)	6,359	6,848	9,264	10,025	9,264
Summer Heat Rate 75% Loading (btu/kWh)	6,547	6,874	9,738	10,581	9,738
Summer Heat Rate 50% Loading (btu/kWh)	6,985	7,334	11,120	12,515	11,120
Summer Heat Rate 25% Loading (btu/kWh)	8,004	8,404	11,558	13,430	11,558
Forced Outage Rate	3%	3%	3%	3%	3%
Maintenance (weeks/yr)	5	5	2	2	2
CO2 Emissions (lbs/MMBtu)	118	118	118	118	118
SO2 Emissions (lbs/MWh)	0.00	0.00	0.00	0.00	0.00
NOx Emissions (lbs/MWh)	0.05	0.05	0.90	0.32	0.90
PM10 Emissions (lbs/MWh)	0.02	0.02	0.03	0.03	0.03
Mercury Emissions (lbs/MMWh)	0.00	0.00	0.00	0.00	0.00

Table IV-15: Renewable Generic Information (Costs in 2018 Dollars)

Renewable Generic Information				
Resource	Wind	Utility Scale	Distributed Solar	Distributed Solar
		Solar	Commercial	Residential
ELCC Capacity Credit (%)	16.7%	50% declines to 30%		
Capacity Factor	50.0%	22.0%	18.0%	18.0%
Book life	25	25	25	25
Electric Transmission Delivery (\$/kW)	500	200	0	0

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Docket No. E002/RP-19-368
Attachment A: Supplement Details
IV. Modeling Assumptions & Inputs

Table IV-22: Sherco CC Alternatives

Thermal Generic Information				
Resource	Sherco CC	7HA.01 1x1	7HA.02 1x1	7HA.02 2x1
Technology	7H	7H	7H	7F
Location Type	Brownfield	Brownfield	Brownfield	Brownfield
Cooling Type	Wet	Wet	Wet	Wet
Book life	40	40	40	40
Nameplate Capacity (MW)	835	405	592	1202
Summer Peak Capacity (MW)	750	395	576	1170
Capital Cost (\$000) 2018\$	\$837,068	\$473,751	\$629,206	\$941,199
Electric Transmission Delivery (\$000) 2018\$	NA	NA	NA	NA
Ongoing Capital Expenditures (\$000-yr) 2018\$	\$6,200	\$4,190	\$4,190	\$8,775
* Gas Demand (\$000-yr) 2018\$	\$41,000 \$31,723	\$31,723	\$31,723	\$31,723
Capital Cost (\$/kW) 2018\$	\$1,002	\$1,171	\$1,064	\$783
Electric Transmission Delivery (\$/kW) 2018\$	NA	NA	NA	NA
Ongoing Capital Expenditures (\$/kW-yr) 2018\$	\$7.43	\$10.35	\$7.08	\$7.30
* Gas Demand (\$/kW-yr) 2018\$	\$49.09 \$37.99	\$78.41	\$53.63	\$26.38
Fixed O&M Cost (\$000/yr) 2018\$	\$6,592	\$7,150	\$7,150	\$8,647
Variable O&M Cost (\$/MWh) 2018\$	\$1.04	\$1.72	\$1.72	\$1.09
Levelized \$/kw-mo (All Fixed Costs) \$2018	\$15.26	\$18.36	\$14.11	\$10.95
Summer Heat Rate 100% Loading (btu/kWh)	6,359	6,322	6,208	6,452
Summer Heat Rate 75% Loading (btu/kWh)	6,547	6,419	6,257	6,403
Summer Heat Rate 50% Loading (btu/kWh)	6,985	6,681	6,516	6,812
Summer Heat Rate 25% Loading (btu/kWh)	8,004	7,553	7,388	7,479
Forced Outage Rate	3%	3%	3%	3%
Maintenance (weeks/yr)	5	5	5	5
CO2 Emissions (lbs/MMBtu)	118	118	118	118
SO2 Emissions (lbs/MWh)	0.00	0.00	0.00	0.00
NOx Emissions (lbs/MWh)	0.05	0.05	0.05	0.05
PM10 Emissions (lbs/MWh)	0.02	0.02	0.02	0.02
Mercury Emissions (lbs/MMWh)	0.00	0.00	0.00	0.00

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Docket No. E002/RP-19-368

Attachment A: Supplement Details

X. Modeling Scenario Sensitivity Analysis – PVRR & PVSC Summary

Table X-5: EnCompass Net Present Value Results for North Dakota Scenario and Preferred Plan Sensitivities

Child Runs	Description	Base - PVSC	A-PVRR	I-Low Externality	J-Low Externality, Low Regulatory	K-Mid Externality, Mid Regulatory	L-High Externality	M-No Reg or Externality Costs
Scenario 1	Supplement North Dakota Scenario		\$36,750					
Scenario 9	Supplement North Dakota Scenario		\$36,949					
Scenario 9	EARLY COAL; EXTEND MONTI	\$40,823	\$37,563	\$38,910	\$38,205	\$39,526	\$44,203	\$37,286
Scenario 9	Wind Available 2023 @ \$500/kW	\$40,812	\$37,572					
Scenario 9	Solar @ 50% ELCC Throughout	\$40,277	\$36,769					
Scenario 9	Unconstrained Sales/Purchase Volume	\$40,844	\$37,721					
Scenario 9	Sherco CC Alternatives - 7HA01 1x1	\$41,015	\$37,796	\$39,102	\$38,444	\$39,742	\$44,185	\$37,534
Scenario 9	Sherco CC Alternatives - 7HA02 1x1	\$40,855	\$37,600	\$38,948	\$38,275	\$39,577	\$44,091	\$37,365
Scenario 9	Sherco CC Alternatives - 7HA02 2x1	\$40,474	\$37,209	\$38,610	\$37,857	\$39,178	\$44,077	\$36,939
Scenario 9	Solar + Storage: "swap" 1st solar addition	\$40,830 \$40,854	\$37,624 \$37,607	\$38,200 \$38,975	\$37,356 \$38,270	\$39,127 \$39,572	\$44,985 \$44,232	\$36,162 \$37,360
Scenario 9	Wind + Storage: "swap" 1st wind addition	\$41,034	\$37,744	\$39,112	\$38,401	\$39,729	\$44,440	\$37,477
Scenario 9	DSM/DR - Add DR Bundle 2	\$40,860	\$37,588	\$38,946	\$38,243	\$39,563	\$44,231	\$37,323
Scenario 9	DSM/DR - Add EE Bundle 3	\$41,491	\$38,342	\$39,725	\$39,021	\$40,334	\$45,000	\$38,108

* The numbers above represent 2020-2045 total NPV costs.

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Docket No. E002/RP-19-368

Attachment A: Supplement Details

X. Modeling Scenario Sensitivity Analysis – PVRP & PVSC Summary

Table X-6: EnCompass Net Present Value Deltas for North Dakota Scenario and Preferred Plan Sensitivities

Child Runs	Description	Base - PVSC	A-PVRP	I-Low Externality	J-Low Externality, Low Regulatory	K-Mid Externality, Mid Regulatory	L-High Externality	M-No Reg or Externality Costs
Scenario 1	Supplement North Dakota Scenario		\$0					
Scenario 9	Supplement North Dakota Scenario		\$199					
Scenario 9	EARLY COAL; EXTEND MONTI	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Scenario 9	Wind Available 2023 @ \$500/kW	(\$11)	\$9					
Scenario 9	Solar @ 50% ELCC Throughout	(\$545)	(\$793)					
Scenario 9	Unconstrained Sales/Purchase Volume	\$21	\$159					
Scenario 9	Sherco CC Alternatives - 7HA01 1x1	\$193	\$234	\$192	\$239	\$216	(\$18)	\$249
Scenario 9	Sherco CC Alternatives - 7HA02 1x1	\$32	\$38	\$38	\$70	\$51	(\$112)	\$79
Scenario 9	Sherco CC Alternatives - 7HA02 2x1	(\$349)	(\$353)	(\$300)	(\$348)	(\$348)	(\$126)	(\$347)
* Scenario 9	Solar + Storage: "swap" 1st solar addition	\$29 \$8	\$44 \$62	\$65 (\$710)	\$65 (\$848)	\$46 (\$399)	\$29 \$782	\$74 (\$1,124)
Scenario 9	Wind + Storage: "swap" 1st wind addition	\$212	\$182	\$202	\$196	\$203	\$237	\$191
Scenario 9	DSM/DR - Add DR Bundle 2	\$37	\$26	\$36	\$38	\$38	\$28	\$38
Scenario 9	DSM/DR - Add EE Bundle 3	\$668	\$780	\$815	\$816	\$808	\$797	\$822

The Supplement North Dakota Scenario deltas above were derived by comparing the total NPV costs of each scenario to Scenario 1 Supplement North Dakota Scenario. All other deltas were derived by comparing the total NPV costs of each Scenario 9 sensitivity to Scenario 9 – Early Coal; Extend Monti.

Xcel Energy

Docket No. E002/RP-19-368

Attachment A: Supplement Details

X. Modeling Scenario Sensitivity Analysis – PVRR & PVSC Summary

Table X-11: Strategist Net Present Value Results for North Dakota Scenario and Preferred Plan Sensitivities

Child Run	Description	Base - PVSC	A-PVRR	I-Low Externality	J-Low Externality, Low Regulatory	K-Mid Externality, Mid Regulatory	L-High Externality	M-No Reg or Externality Costs
Scenario 1	Supplement North Dakota Scenario		\$37,061					
Scenario 9	Supplement North Dakota Scenario		\$37,373					
Scenario 9	EARLY COAL; EXTEND MONTI	\$42,818	\$37,896	\$40,481	\$38,687	\$40,923	\$49,813	\$37,706
Scenario 9	Wind Available 2023 @ \$500/kW	\$42,818	\$37,896					
* Scenario 9	Solar @ 50% ELCC Throughout	\$42,806	\$37,806					
		\$41,868	\$36,588					
Scenario 9	Sherco CC Alternatives - 7HA01 1x1	\$42,869	\$37,830	\$40,299	\$38,665	\$40,925	\$49,219	\$37,638
Scenario 9	Sherco CC Alternatives - 7HA02 1x1	\$42,772	\$37,719	\$40,246	\$38,558	\$40,826	\$49,342	\$37,537
Scenario 9	Sherco CC Alternatives - 7HA02 2x1	\$42,922	\$37,917	\$40,534	\$38,716	\$40,994	\$50,034	\$37,713
Scenario 9	DSM/DR - Add DR Bundle 2	\$42,840	\$37,862	\$40,424	\$38,667	\$40,921	\$49,698	\$37,665
Scenario 9	DSM/DR - Add EE Bundle 3	\$43,559	\$38,678	\$41,230	\$39,451	\$41,676	\$50,490	\$38,476

The numbers in the table above represent 2020-2045 total NPV costs.

Xcel Energy

Docket No. E002/RP-19-368

Attachment A: Supplement Details

X. Modeling Scenario Sensitivity Analysis – PVRR & PVSC Summary

Table X-12: Strategist Net Present Value Deltas for North Dakota Scenario and Preferred Plan Sensitivities

Child Run	Description	Base - PVSC	A-PVRR	I-Low Externality	J-Low Externality, Low Regulatory	K-Mid Externality, Mid Regulatory	L-High Externality	M-No Reg or Externality Costs
Scenario 1	Supplement North Dakota Scenario		\$0					
Scenario 9	Supplement North Dakota Scenario		\$313					
Scenario 9	<i>EARLY COAL; EXTEND MONTI</i>	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Scenario 9	Wind Available 2023 @ \$500/kW	\$0	\$0					
* Scenario 9	Solar @ 50% ELCC Throughout	(\$14)	(\$949)	(\$1,308)				
Scenario 9	Sherco CC Alternatives - 7HA01 1x1	\$51	(\$66)	(\$183)	(\$22)	\$2	(\$594)	(\$68)
Scenario 9	Sherco CC Alternatives - 7HA02 1x1	(\$45)	(\$177)	(\$235)	(\$129)	(\$97)	(\$471)	(\$170)
Scenario 9	Sherco CC Alternatives - 7HA02 2x1	\$105	\$21	\$53	\$29	\$71	\$220	\$6
Scenario 9	DSM/DR - Add DR Bundle 2	\$22	(\$34)	(\$57)	(\$20)	(\$2)	(\$116)	(\$41)
Scenario 9	DSM/DR - Add EE Bundle 3	\$742	\$782	\$749	\$764	\$753	\$676	\$770

The Supplement North Dakota Scenario deltas above were derived by comparing the total NPV costs of each scenario to Scenario 1 Supplement North Dakota Scenario. All other deltas were derived by comparing the total NPV costs of each Scenario 9 sensitivity to Scenario 9 – Early Coal; Extend Monti.

Xcel Energy

Docket No. E002/RP-19-368

Attachment A: Supplement Details

XI. Supplement Preferred Plan Sensitivities – Reliability Analyses

5. Summary of Findings

Table XI-2 summarizes the results of this analysis from the stress conditions we applied to the capacity expansion Scenarios tested.

Table XI-2: Energy and Capacity Adequacy Metrics for Tested Expansion Plan Scenarios

Expansion Plan (Test Dataset in Parentheses)	Native Capacity Shortfall Metrics					Flexible Resource Adequacy Metric	Maximum Import Metric	Industry Metrics		
	# of Native Capacity Shortfall Events	Average Duration of Shortfall Events (hours)	Average Intensity of Capacity Shortfall (MW)	Longest Shortfall Event (hours)	Peak Capacity Shortfall During 2034 (MW)			Maximum 3 – Hour Upward Ramp (MW)	# of Hours with High Imports	LOLH (Hours)
Baseline – Scenario 9 - Supplement Preferred Plan (Default)	0	0	0	0	0	4,760 (February)	9	0	0	0
Scenario 9 - Supplement Preferred Plan (2019)	4	1.75	363	2	615	5,506 (June)	158	0	0	0
Scenario 9 – High Distributed Solar Future (2019)	14	2.57	481	5	1,232	7,221 (June)	157	0	0	0
* Scenario 9 – High Electrification Future (2019)	22 24	1.95 2.00	376 429	6	1,037	7,152 (March)	674	0	0	0
Scenario 9 – 50 percent ELCC (2019)	159	3.97	604	22	2,629	7,239 (January)	311	5 (2 separate events)	2	2,575

Note: The expansion plan with the greatest shortfall is shown in red font for each metric.

C. Comparison of Plans for a Stress Week

In addition to comparing the results outlined in Table XI-2 above, we provide, as Figures XI-7 through XI-10, a snapshot of each tested Scenario's capacity expansion plan for a "stress week" over December 5-10, 2034 – again using actual customer load and renewable generation patterns from 2019. Seeing how each capacity expansion portfolio is expected to serve a historically observed load pattern provides additional

CERTIFICATE OF SERVICE

I, Lynnette Sweet, hereby certify that I have this day served copies of the foregoing document on the attached list of persons.

xx by depositing a true and correct copy thereof, properly enveloped with postage paid in the United States mail at Minneapolis, Minnesota

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Docket No. E002/RP-19-368

Dated this 25th day of August 2020

/s/

Lynnette Sweet
Regulatory Administrator

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