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Northern States Power Company  
 Electric Operations - State of South Dakota  
 COGENERATION AND SMALL POWER PRODUCTION FILING

Docket No. EL21-\_\_\_\_  
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**Calculation of Net Annual Avoided Capacity Costs**

[TRADE SECRET BEGINS]

(1) Completed Cost of C.T. Unit (2021 \$)	[REDACTED] /kW
(2) Inflation Net of Technical Progress	2.00%
(3) Average Service Life	40 Years
(4) Discount Rate (After Tax)	6.75%
Calculation of Marginal Capital Carry Charge Rate	
(5) Present Value of Revenue Requirements (2021)	[REDACTED] /kW
(6) Annuity Factor Adjustment for Inflation **	5.67%
(7) Present Value of Revenue Requirements Adjusted for Inflation (5)*(6)	[REDACTED] /kW
(8) Marginal Capital Carrying Charge Rate (7)/(1)	[REDACTED] /kW
(9) First Year Revenue Requirement (1)*(8)	[REDACTED] /kW
(10) Present Value at 6.75% for 0 years	[REDACTED] /kW
(11) Present Value of Average Annual Fuel Savings	[REDACTED] /kW
(12) Annual Avoided Capacity Cost (10)-(11)	[REDACTED] /kW
(13) Adjusted for 15% Reserve Margin (12)*1.15	[REDACTED] /kW
(14) Plus Fixed O & M \$/kW (2021 \$) (13)+O&M	[REDACTED] /kW
(15) Adjusted for losses (14)/0.9652	[REDACTED] /kW
 (16) NET ANNUAL AVOIDED CAPACITY COST	 \$56.78 /kW
 (17) Net Annual Avoided Capacity Cost Average Over All Hours (16)*100/8760	  0.648 ¢/kWh
 (18) In \$/KWh (17)/100	 \$0.0065 /kWh

**Data Source**

Cost reflects current forecast for future capacity resources (CT). Value sourced from NSP IRP 2020-2034 thermal assumptions, escalated to current year.

Updated per IRP Modeling Assumptions  
 40 Years reflects the financial remaining life set for the most recent CT in Minnesota. The Company would expect to request the same expected life in a future South Dakota rate treatment.

Updated PVRR calculation based on current assumptions.

Calculated Value (see box below)

Calculated value, per formula provided.

Calculated value, per formula provided.

Calculated value, per formula provided.

Calculated value, per formula provided.

Evaluated per EnCompass economic dispatch modeling. (1)

Calculated value, per formula provided.

Calculated value, per formula provided.

Calculated value, per formula provided.

Calculated value, per formula provided.

Calculated value, per formula provided.

Calculated value, per formula provided.

\*\*  $AC = (r-j)(1+j)^{(t-1)} \left[ \frac{1}{1-(1+j)^n} - \frac{1}{(1+r)^n} \right]$   
 Where AC = Annual Charge in year t  
 t = Year (=1)  
 K = Total Present Value Cost of Original Investment  
 r = Discount Rate (Overall Marginal Cost of Capital) (6.75%)  
 j = Inflation Rate Net of Technology Progress (2.00%)  
 n = Expected Service Life of Investment (40 Years)

O&M \$/kW/year average annual

[REDACTED]

Evaluated per EnCompass economic dispatch modeling. (1)

[TRADE SECRET ENDS]

(1) The Company uses the Encompass software to model the economic dispatch of the generation fleet meet forecasted needs. Fuel, variable and fixed O&M where valued based on operational dispatch of the future CT.

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Thermal Generic Information, IRP 2020-2034, Modeling Assumptions	
<b>Source:</b>	Engineering & Construction
<b>Date/Vintage:</b>	Sept 2018
<b>Updated On:</b>	12/21/2018
<b>Updated By:</b>	Jon Landrum
<b>Verified (Yes/No):</b>	Yes
<b>Note:</b>	Levelized cost includes initial cap ex, on-going cap ex, fixed O&M, and gas demand costs. CTs are assumed to be dual fuel. All Costs are 2018\$

Thermal Generic Information	
Resource	Generic CT
Technology	7H
Location Type	Greenfield
Cooling Type	Dry
Book life	40
Nameplate Capacity (MW)	374
Summer Peak Capacity (MW)	331
Capital Cost (\$000) 2018\$	\$193,500
Electric Transmission Delivery (\$000) 2018\$	\$74,804
Ongoing Capital Expenditures (\$000-yr) 2018\$	\$1,784
Gas Demand (\$000-yr) 2018\$	\$2,165
Capital Cost (\$/kW) 2018\$	\$517
Electric Transmission Delivery (\$/kW) 2018\$	\$200
Ongoing Capital Expenditures (\$/kW-yr) 2018\$	\$4.77
Gas Demand (\$/kW-yr) 2018\$	\$5.79
Fixed O&M Cost (\$000/yr) 2018\$	\$1,253
Variable O&M Cost (\$/MWh) 2018\$	\$0.99
Levelized \$/kw-mo (All Fixed Costs) 2018\$	\$8.06
Summer Heat Rate 100% Loading (btu/kWh)	9,264
Summer Heat Rate 75% Loading (btu/kWh)	9,738
Summer Heat Rate 50% Loading (btu/kWh)	11,120
Summer Heat Rate 25% Loading (btu/kWh)	11,558
Forced Outage Rate	3%
Maintenance (weeks/yr)	2
CO2 Emissions (lbs/MMBtu)	118
SO2 Emissions (lbs/MWh)	0.00
NOx Emissions (lbs/MWh)	0.90
PM10 Emissions (lbs/MWh)	0.03
Mercury Emissions (lbs/MMWh)	0.00

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## Forecast of Marginal Energy Prices (\$/MWh)

### Summary of Estimated NSP Average System On & Off Peak Marginal Energy Costs in \$/MWh

	Month	On Peak	Off Peak	Average
31	Jan-21	\$29.94	\$23.68	\$25.70
28	Feb-21	\$24.68	\$17.93	\$20.34
31	Mar-21	\$22.03	\$16.67	\$18.66
30	Apr-21	\$20.16	\$15.83	\$17.42
31	May-21	\$22.34	\$14.89	\$17.29
30	Jun-21	\$24.09	\$14.25	\$17.86
31	Jul-21	\$30.55	\$18.10	\$22.31
31	Aug-21	\$29.34	\$17.27	\$21.55
30	Sep-21	\$23.42	\$12.77	\$16.50
31	Oct-21	\$20.68	\$16.28	\$17.77
30	Nov-21	\$22.92	\$14.92	\$17.72
31	Dec-21	\$24.76	\$17.75	\$20.24

**[TRADE SECRET BEGINS**

31	Jan-22
28	Feb-22
31	Mar-22
30	Apr-22
31	May-22
30	Jun-22
31	Jul-22
31	Aug-22
30	Sep-22
31	Oct-22
30	Nov-22
31	Dec-22

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**ENERGY**

NSP Average Summer/Winter Marginal Energy Costs 2021 - 2025							NSP Annual Average Marginal Cost 2021 - 2025				
	Summer On	Summer Off	Average		Winter On	Winter Off	Average		Annual On	Annual Off	Annual Average
2021	26.85	15.65	19.59		23.37	17.28	19.40	2021	24.54	16.73	19.46
2022	[TRADE SECRET BEGINS]										
2023											
2024											
2025											

Summer months are June through September  
 Winter months are Jan-May and Oct-Dec

[TRADE SECRET ENDS]

**Peak Hour Calculation**

**NUMBER OF PEAK HOURS**

The on peak period contains all hours between 9:00 a.m. and 9:00 p.m., Monday through Friday, except the following holidays: New Year's Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day. When a designated holiday occurs on Saturday, the preceding Friday will be designated a holiday. When a designated holiday occurs on Sunday, the following Monday will be designated a holiday.

The off peak period contains all other hours not included in the on peak period. Definition of on peak and off peak period is subject to change with change in Company's system operating characteristics.

	On-Peak	Off-Peak
Winter	2,023	3,809
Summer	<u>1,022</u>	<u>1,906</u>
Total	3,045	5,715

On-Peak Days/Week                      5 Days  
 On-Peak Hour Block                      12 Hours

	Day in Month	On Peak Hours	Off Peak Hours
June	30	257	463
July	31	266	478
4th of July		-12	12
August	31	266	478
September	30	257	463
Labor Day		-12	12
October	31	266	478
November	30	257	463
Thanksgiving		-12	12
December	31	266	478
Christmas		-12	12
January	31	266	478
New Year's Day		-12	12
February	28	240	432
March	31	266	478
Easter		-12	12
April	30	257	463
May	31	266	478
Memorial Day		<u>-12</u>	<u>12</u>
		3,045	5,715

**Line Loss Calculation**

	Summer On-Peak	Summer Off-Peak	Average Summer	Winter On-Peak	Winter Off-Peak	Average Winter	Annual On-Peak	Annual Off-Peak	Annual All Hours
Overall Loss Factors	0.9232	0.9364	0.9318	0.9225	0.9334	0.9296	0.9227	0.9344	0.9303
Loss Factors Representing 50% of Overall Loss Factor	0.9616	0.9682	0.9659	0.9612	0.9667	0.9648	0.9614	0.9672	0.9652

*Information reflects data from 11/2015 MN Rate Case filing.*

NSP (MN & Subs)  
 NSP System Peak Demands  
 Summer/Winter Factors: 12 Months Ending Dec 31, 2019

Month	System MW	
	Full	Net
1	5,924	1,208
2	5,718	1,002
3	5,505	789
4	5,074	358
5	6,288	1,572
6	8,112	3,396
7	8,794	4,078
8	8,261	3,545
9	7,284	2,568
10	5,400	684
11	5,537	821
12	6,077	1,361
Annual Average Hourly Load	<b>4,716</b>	
<b>Average of Monthly Peaks</b>		
Year	6,498	1,782
Summer	8,113	3,397
Winter	5,690	974
Total	13,803	4,371
Summer:Winter Ratio	1.4257	3.4859
Summer Percent	58.77%	77.71%
Winter Percent	41.23%	22.29%
	100.00%	100.00%

**Notes:**

*Full system ratio used to weight actual summer class peaks*

*Net system ratio used to split total peaking plant into summer and winter*