



414 Nicollet Mall  
Minneapolis, MN 55401

**PUBLIC DOCUMENT –  
NOT PUBLIC DATA EXCISED**

August 30, 2019

**—Via Electronic Filing—**

Daniel P. Wolf  
Executive Secretary  
Minnesota Public Utilities Commission  
121 7<sup>th</sup> Place East, Suite 350  
St. Paul, MN 55101

RE: VOS CALCULATION  
COMMUNITY SOLAR GARDENS PROGRAM  
DOCKET NO. E002/M-13-867

Dear Mr. Wolf:

Northern States Power Company, doing business as Xcel Energy, submits this Value of Solar (VOS) calculation for vintage year 2020.<sup>1</sup>

The levelized VOS rate for 2020 is 11.32 cents per kWh.<sup>2</sup> On an annual basis (non-levelized), the bill credit ranges from 9.24 cents per kWh for production in Year 1 to 15.69 cents per kWh for production in Year 25. This calculation represents a per kWh increase of 0.20 cents for year 1 and increase of 0.27 cents in year 25 from the 2019 VOS Vintage calculation of 9.04 cents per kWh in the first year and 15.42 cents per kWh in the final year. The increase in pricing is primarily driven by the avoided distribution costs component, higher NYMEX natural gas pricing, and increase in the solar weighted heat rate. The increase associated with the previously mentioned items was partially offset by the use of actual production data and lower Combustion Turbine and Combine Cycle costs.

We provide as Attachment M proposed tariff sheets to implement the 2020 VOS Vintage Year Bill Credit Rates as part of the Solar\*Rewards Community program.

Finally, the Company also provides at Attachment Q the results of the 2020 calculation incorporating the current (rather than proposed) approach to the

---

<sup>1</sup> Once approved, the 2020 VOS Vintage Year Bill Credit Rate table is applicable to applications deemed complete from the date of the filing of the tariff containing this rate table until the 2021 VOS Vintage Year Bill Credit Rate table is effective. The 2020 VOS Vintage Year Bill Credit Rate table is applied for the 25 years of subscribed production from the gardens associated with this rate table.

<sup>2</sup> This rate incorporates the Company's cost per kW input to the Avoided Distribution Capacity component as filed in this docket on May 1, 2019 and in Docket No. E002/M-14-65 on August 2, 2019.

**PUBLIC DOCUMENT –  
NOT PUBLIC DATA EXCISED**

Avoided Distribution Capacity component. The Company provides this calculation for informational purposes only.

Below is a list of all the attachments included in the 2020 VOS filing:

- Attachment A – 2020 VOS Model LIVE
- Attachment B – 2020 Distribution Capacity Value LIVE
- Attachment C – Fleet Data LIVE
- Attachment D – Fuel Price Overhead LIVE TRADE SECRET
- Attachment E – PLR LIVE
- Attachment F – Loss Saving Energy LIVE
- Attachment G – ELCC and Loss Savings LIVE
- Attachment H – NYMEX NG Forward Pricing 2019-30 LIVE
- Attachment I – Transmission Capacity MISO OATT 5YR Calculation LIVE
- Attachment J – 2018 Treasury Rates LIVE
- Attachment K – General and Fuel Price Escalation LIVE
- Attachment L – Environmental Costs LIVE
- Attachment M – Tariff Sheets
- Attachment N – List of Input Changes
- Attachment O – Production Data LIVE
- Attachment P – Stakeholder Meeting Presentation
- Attachment Q – Informational Calculation 2020 VOS Model LIVE

Please note, Attachment D contains Not Public information protected by the Minnesota Data Practices Act. That information has economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means by other persons and is subject to efforts by the Company to protect the information from public disclosure. Xcel Energy maintains this information as a trade secret based on its economic value from not being generally known and not being readily ascertainable by proper means by other persons who can obtain economic value from its disclosure or use. For this reason, we ask that the data be treated as non-public data pursuant to Minn. Stat. § 13.37, subd. 1(b).

**A. Filing Requirements**

The VOS calculations are filed in compliance with Order point 4 of the Commission’s March 22, 2019 Order (the Order). Order Point 4 of the Order requires the Company to do the following:

- a. File by September 1.
- b. Include in the filing –
  - 1. A list of all changed parameters as permitted by the approved VOS Methodology, and any updated input values,

**PUBLIC DOCUMENT –  
NOT PUBLIC DATA EXCISED**

2. A discussion—along with any necessary tables, charts, and explanations—of how these changes will affect the VOS rate, as well as variables within the rate, and
  3. Sufficient evidence and data to support these changes.
- c. Convene a meeting no later than August 1 to explain in detail to those in attendance each of the items identified above.

The date of this filing is August 30, 2019, in compliance with Order Point 4a noted above. Our compliance with the remainder of the Order is provided below.

*A list of all changed parameters as permitted by the approved VOS Methodology, and any updated input values.*

Please see Attachment N for a list of input changes, reasons for the change and the impact of the change.

*A discussion—along with any necessary tables, charts, and explanations—of how these changes will affect the VOS rate, as well as variables within the rate.*

Most of the changes represent an update of annual data due to the passage of time. However, there were a few inputs updated for other reasons and we will discuss those here.

First, the Company used actual first year production data from roughly 300 MWs of gardens for the first 12 month of production input in Table 5. 300 MWs is a sufficient data source to provide a reasonable proxy for the production input.<sup>3</sup> Continuing to use the simulated production data has the impact of underrepresenting actual production and artificially raises the Value of Solar rate. Given that the VOS methodology expressly prefers the use of actual data, and in recognition of the robust data set available, we believe it is reasonable to rely on actual production data for the 2020 calculation.

Second, the Company updated the discount rate to reflect the ROE consistent with the Commission’s verbal deliberations at the May 23, 2019 hearing of the Transmission Cost Recovery Rider Docket (No. E002/M-17-797).

Third, the Company has proposed a new cost per kW input for the Avoided Distribution Capacity component to replace the current methodology. The

---

<sup>3</sup> Adding a single system of random orientation, tilt, tracking characteristics, and capacity (within reason) to this data set does not materially change the observed hourly PV Fleet Shape, consistent with FN 11 in the Minnesota Value of Solar Methodology, April 1, 2014.

**PUBLIC DOCUMENT –  
NOT PUBLIC DATA EXCISED**

Company filed this proposal on May 1, 2019 in E002/M-13-867 and Petitioned for a methodology change in Docket E002/M-14-65 on August 2, 2019.

Finally, the Company updated the O&M and distribution escalation rates to be consistent with the escalation inputs used in the Company most recent Integrated Resource Plan (IRP).

*Sufficient evidence and data to support these changes.*

Please Attachment O for the 300 MW of data used for the actual first twelve months of production input.

*Convene a meeting no later than August 1 to explain in detail to those in attendance each of the items identified above.*

The Company hosted a 2020 Value of Solar stakeholder meeting on July 31, 2019. The presentation provided at this meeting is included as Attachment P to this filing. The notes from this meeting were filed in this docket on August 12, 2019.

We have electronically filed this document with the Minnesota Public Utilities Commission, and copies have been served on the parties on the attached service list. Please contact Nick Paluck at [Nick.Paluck@xcelenergy.com](mailto:Nick.Paluck@xcelenergy.com) or (612) 330-2905 or me at [Lisa.R.Peterson@xcelenergy.com](mailto:Lisa.R.Peterson@xcelenergy.com) or (612) 330-7681 if you have any questions regarding this filing.

Sincerely,

/s/

LISA R. PETERSON  
MANAGER, REGULATORY ANALYSIS

Enclosures  
c: Service List

## CONTENTS

Figure ES-1. VOS Calculation Table: economic value, load match, loss savings and distributed PV value - System Wide & Each Planning Area

Figure ES-2. VOS Rate Table: Calculation of the inflation-adjusted VOS - System Wide & Each Planning Area

Table 3. Fixed assumptions used in the methodology

Table 4. Environmental costs by year

Table 5. VOS Data table --required format showing example parameters used in the example calculation.

Table 6. Azimuth and tilt angle

Table 7. Losses to be considered

Table 8. Economic value of avoided fuel costs

Table 9. Economic value of avoided plant O&M - fixed

Table 10. Economic value of avoided plant O&M - variable

Table 11. Economic value of avoided generation capacity cost.

Table 12. Economic value of avoided reserve capacity cost.

Table 13. Economic value of avoided transmission capacity cost.

Table 13. Economic value of avoided transmission capacity cost.

Table 14. Determination of deferrable costs.

Table 15. Economic value of avoided distribution capacity cost. (two pages) - System Wide & Each Planning Area

Table 17. Economic value of avoided environmental costs

Table 18. Calculation of the inflation-adjusted VOS

Note: Table 1, 2 and 16 were not included as they are not required for the VOS calculation. Table 7 (Losses to be considered) are included in Fig. ES-1

Figure ES-1. VOS Calculation Table: economic value, load match, loss savings and distributed PV value

<b>CURRENT POSITION</b>	<b>Economic Value (\$/kWh)</b>	<b>Load Match (No Losses) (%)</b>	<b>Distributed Loss Savings (%)</b>	<b>Distributed PV Value (\$/kWh)</b>
<i>25 Year Levelized Values</i>				
Avoided Fuel Cost	\$0.0274		9.8%	\$0.0301
Avoided Plant O&M - Fixed	\$0.0027	48.6%	10.8%	\$0.0014
Avoided Plant O&M - Variable	\$0.0012		9.8%	\$0.0014
Avoided Generation Capacity Cost	\$0.0367	48.6%	10.8%	\$0.0197
Avoided Reserve Capacity Cost	\$0.0029	48.6%	10.8%	\$0.0016
Avoided Transmission Capacity Cost	\$0.0325	48.6%	10.8%	\$0.0175
Avoided Distribution Capacity Cost	\$0.0034	54.6%	12.4%	\$0.0021
Avoided Environmental Cost	\$0.0359		9.8%	\$0.0394
Avoided Voltage Control Cost				
<u>Solar Integration Cost</u>				
<b>TOTAL</b>				<b>\$0.1132</b>

**Figure ES-2. 1st-Year VOS Rate calculation**

Year	Discount Factor	Escalation Factor	VOS Levelized	Disc.	VOS Inflation Adj. (\$/kWh)	Disc
2020	1.000	1.000	\$0.113	\$0.113	\$0.0924	0.092
2021	0.940	1.022	\$0.113	\$0.106	\$0.0944	0.089
2022	0.884	1.045	\$0.113	\$0.100	\$0.0966	0.085
2023	0.831	1.068	\$0.113	\$0.094	\$0.0987	0.082
2024	0.781	1.092	\$0.113	\$0.088	\$0.1009	0.079
2025	0.735	1.117	\$0.113	\$0.083	\$0.1032	0.076
2026	0.691	1.141	\$0.113	\$0.078	\$0.1055	0.073
2027	0.649	1.167	\$0.113	\$0.074	\$0.1078	0.070
2028	0.611	1.193	\$0.113	\$0.069	\$0.1102	0.067
2029	0.574	1.220	\$0.113	\$0.065	\$0.1127	0.065
2030	0.540	1.247	\$0.113	\$0.061	\$0.1152	0.062
2031	0.508	1.275	\$0.113	\$0.057	\$0.1178	0.060
2032	0.477	1.303	\$0.113	\$0.054	\$0.1204	0.057
2033	0.449	1.332	\$0.113	\$0.051	\$0.1231	0.055
2034	0.422	1.362	\$0.113	\$0.048	\$0.1258	0.053
2035	0.397	1.392	\$0.113	\$0.045	\$0.1286	0.051
2036	0.397	1.423	\$0.113	\$0.045	\$0.1315	0.052
2037	0.351	1.455	\$0.113	\$0.040	\$0.1344	0.047
2038	0.330	1.487	\$0.113	\$0.037	\$0.1374	0.045
2039	0.310	1.521	\$0.113	\$0.035	\$0.1405	0.044
2040	0.291	1.554	\$0.113	\$0.033	\$0.1436	0.042
2041	0.274	1.589	\$0.113	\$0.031	\$0.1468	0.040
2042	0.258	1.625	\$0.113	\$0.029	\$0.1501	0.039
2043	0.242	1.661	\$0.113	\$0.027	\$0.1534	0.037
2044	0.228	1.698	\$0.113	\$0.026	\$0.1569	0.036
				\$1.491		\$1.498

**Table 3. Fixed Assumptions to be used for the VOS calculations**

<b>Fuel Prices</b>			<b>Environmental Externalities</b>		
Guaranteed NG Fuel Prices			Environmental Discount Rate	5.30%	per year
2020	\$2.671	\$/mmBtu	Environmental Costs	separate table	
2021	\$2.639	\$/mmBtu	<b>Economic Assumptions</b>		
2022	\$2.645	\$/mmBtu	General Escalation Rate	2.23%	per year
2023	\$2.720	\$/mmBtu	<b>Treasury Yields</b>		
2024	\$2.823	\$/mmBtu	1 Year	2.17%	
2025	\$2.935	\$/mmBtu	2 Year	2.05%	
2026	\$3.047	\$/mmBtu	3 Year	2.01%	
2027	\$3.159	\$/mmBtu	5 Year	2.04%	
2028	\$3.271	\$/mmBtu	7 Year	2.14%	
2029	\$3.380	\$/mmBtu	10 Year	2.25%	
2030	\$3.490	\$/mmBtu	20 Year	2.49%	
2031	\$3.596	\$/mmBtu	30 Year	2.68%	
Fuel Price Escalation	2.23%				
<b>PV Assumptions</b>					
PV Degradation Rate	0.50%				
PV Life	25				



**Table 4. Environmental costs by year.**

Year	Analysis Year	CO2 Cost \$/mmBtu	PM 2.5 Cost \$/mmBtu	CO Cost \$/mmBtu	NOx Cost \$/mmBtu	Pb Cost \$/mmBtu	SO2 Cost \$/mmBtu	Total Cost \$/mmBtu
2020	0	\$2.807	\$0.021	\$0.000	\$0.286	\$0.000	\$0.004	\$3.117
2021	1	\$2.924	\$0.021	\$0.000	\$0.292	\$0.000	\$0.004	\$3.241
2022	2	\$3.045	\$0.021	\$0.000	\$0.299	\$0.000	\$0.004	\$3.369
2023	3	\$3.170	\$0.022	\$0.000	\$0.305	\$0.000	\$0.004	\$3.502
2024	4	\$3.299	\$0.022	\$0.000	\$0.312	\$0.000	\$0.004	\$3.638
2025	5	\$3.433	\$0.023	\$0.000	\$0.319	\$0.000	\$0.004	\$3.779
2026	6	\$3.570	\$0.023	\$0.000	\$0.326	\$0.000	\$0.004	\$3.924
2027	7	\$3.712	\$0.024	\$0.000	\$0.334	\$0.000	\$0.004	\$4.074
2028	8	\$3.859	\$0.025	\$0.000	\$0.341	\$0.000	\$0.004	\$4.229
2029	9	\$4.010	\$0.025	\$0.000	\$0.349	\$0.000	\$0.004	\$4.388
2030	10	\$4.166	\$0.026	\$0.000	\$0.356	\$0.000	\$0.004	\$4.553
2031	11	\$4.344	\$0.026	\$0.000	\$0.364	\$0.000	\$0.004	\$4.740
2032	12	\$4.528	\$0.027	\$0.000	\$0.373	\$0.000	\$0.005	\$4.932
2033	13	\$4.718	\$0.027	\$0.000	\$0.381	\$0.000	\$0.005	\$5.131
2034	14	\$4.915	\$0.028	\$0.000	\$0.389	\$0.000	\$0.005	\$5.337
2035	15	\$5.117	\$0.029	\$0.000	\$0.398	\$0.000	\$0.005	\$5.549
2036	16	\$5.326	\$0.029	\$0.000	\$0.407	\$0.000	\$0.005	\$5.768
2037	17	\$5.542	\$0.030	\$0.000	\$0.416	\$0.000	\$0.005	\$5.993
2038	18	\$5.765	\$0.031	\$0.000	\$0.425	\$0.000	\$0.005	\$6.227
2039	19	\$5.996	\$0.031	\$0.000	\$0.435	\$0.000	\$0.005	\$6.467
2040	20	\$6.233	\$0.032	\$0.000	\$0.444	\$0.000	\$0.005	\$6.715
2041	21	\$6.457	\$0.033	\$0.000	\$0.454	\$0.000	\$0.006	\$6.950
2042	22	\$6.688	\$0.033	\$0.000	\$0.464	\$0.000	\$0.006	\$7.192
2043	23	\$6.926	\$0.034	\$0.000	\$0.475	\$0.000	\$0.006	\$7.441
2044	24	\$7.171	\$0.035	\$0.000	\$0.485	\$0.000	\$0.006	\$7.698

**Table 5. VOS Data table -- required format showing assumptions used in the VOS calculation.**

	Input Data	Units		Input Data	Units
<b>Economic Factors</b>			<b>Power Generation - Continued</b>		
Start Year for VOS applicability	2020	Year	Other		
Discount Rate (After-tax WACC)	6.36%	Percentage	Solar weighted Heat Rate	7,742	BTU per kWh
<b>Load Match Analysis</b>			Fuel Price Overhead	\$0.004	\$ per MMBtu
ELCC (no loss)	48.6%	% of rating	Generation life	40	years
PLR (no loss)	54.6%	% of rating	Heat Rate degradation	0.10%	per year
Loss Savings - Energy	9.8%	% of PV output	O&M cost (first year) - Fixed	\$3.42	per kW-yr
Loss Savings - PLR	12.4%	% of PV output	O&M cost (first year) - Variable	\$0.0010	\$ per kWh
Loss Savings - ELCC	10.8%	% of PV output	O&M cost escalation rate	2.00%	per year
<b>PV Energy</b>			Reserve planning margin	7.9%	
Simulated - First year annual energy	1,452	kWh per kW-AC	Years until new Generation is needed	0	
year annual energy		kWh per kW-AC	<b>Distribution</b>		
Actual- First year annual energy	1,563		Capacity-related distribution capital costs -System	\$96	\$ per kW
<b>Transmission</b>			Capacity-related distribution capital costs - Mpls	N/A	\$ per kW
Capacity-related transmission capital cost	\$50.33	\$ per kW	Capacity-related distribution capital costs - Mtk	N/A	\$ per kW
<b>Power Generation</b>			Capacity-related distribution capital costs -Edina	N/A	\$ per kW
Peaking CT, simple cycle			Capacity-related distribution capital costs - SE	N/A	\$ per kW
Installed Cost	\$476	\$/kW	Capacity-related distribution capital costs -MG	N/A	\$ per kW
Heat Rate	9,738	BTU/kWh	Capacity-related distribution capital costs - Newport	N/A	\$ per kW
Intermediate CCGT			Capacity-related distribution capital costs - St. Paul	N/A	\$ per kW
Installed Cost	\$1,022	\$/kW	Capacity-related distribution capital costs - NW	N/A	\$ per kW
Heat Rate	6,547	BTU/kWh	Capacity-related distribution capital costs - WBL	N/A	\$ per kW
			Distribution capital cost escalation	2.00%	per year
			Peak Load (Weather Normalized)	6,420	MW
			Peak Load Growth	0.43%	per year

**Table 6. Azimuth and Tilt Angles**

	Array KW	% of Total	Azimuth	Tilt	
1	3,209	4.9%	52	25	
2	2,974	4.5%	140	21	
3	2,906	4.4%	167	19	
4	18,979	28.9%	180	12	
5	3,939	6.0%	180	21	
6	7,997	12.2%	180	26	
7	6,676	10.2%	180	30	
8	3,296	5.0%	180	35	
9	947	1.4%	180	42	
10	5,453	8.3%	180	48	
11	2,769	4.2%	184	19	
12	964	1.5%	197	26	
13	2,816	4.3%	212	18	
14	1,207	1.8%	237	24	
15	1,577	2.4%	271	22	
<b>TOTAL</b>	<b>65,709</b>	<b>100%</b>	<b>176.4</b>	<b>23.2</b>	<b>Weighted Average</b>

**Table 8. Economic Value of Avoided Fuel Costs.**

Year				Prices		p.u. PV Production (kWh)	Costs		Discount Factor (risk free)	Disc. Costs	
	Guaranteed NG Price	Burner Tip NG Price	Heat Rate	Utility	VOS		Utility	VOS		Utility	VOS
	\$/mmBtu	\$/mmBtu	mmBtu/kWh	\$/kWh	\$/kWh		(\$)	(\$)		(\$)	(\$)
2020	\$2.67	\$2.67	7,742	\$0.021	\$0.0274	1,563	\$32	\$43	1.000	\$32	\$43
2021	\$2.64	\$2.64	7,750	\$0.020	\$0.0274	1,555	\$32	\$43	0.979	\$31	\$42
2022	\$2.64	\$2.65	7,757	\$0.021	\$0.0274	1,547	\$32	\$42	0.960	\$31	\$41
2023	\$2.72	\$2.72	7,765	\$0.021	\$0.0274	1,540	\$33	\$42	0.942	\$31	\$40
2024	\$2.82	\$2.83	7,773	\$0.022	\$0.0274	1,532	\$34	\$42	0.923	\$31	\$39
2025	\$2.93	\$2.94	7,781	\$0.023	\$0.0274	1,524	\$35	\$42	0.904	\$32	\$38
2026	\$3.05	\$3.05	7,789	\$0.024	\$0.0274	1,517	\$36	\$42	0.883	\$32	\$37
2027	\$3.16	\$3.16	7,796	\$0.025	\$0.0274	1,509	\$37	\$41	0.863	\$32	\$36
2028	\$3.27	\$3.28	7,804	\$0.026	\$0.0274	1,502	\$38	\$41	0.842	\$32	\$35
2029	\$3.38	\$3.38	7,812	\$0.026	\$0.0274	1,494	\$40	\$41	0.822	\$32	\$34
2030	\$3.49	\$3.49	7,820	\$0.027	\$0.0274	1,487	\$41	\$41	0.801	\$33	\$33
2031	\$3.60	\$3.60	7,828	\$0.028	\$0.0274	1,479	\$42	\$41	0.781	\$33	\$32
2032	\$3.68	\$3.68	7,835	\$0.029	\$0.0274	1,472	\$42	\$40	0.762	\$32	\$31
2033	\$3.76	\$3.76	7,843	\$0.030	\$0.0274	1,464	\$43	\$40	0.742	\$32	\$30
2034	\$3.84	\$3.85	7,851	\$0.030	\$0.0274	1,457	\$44	\$40	0.723	\$32	\$29
2035	\$3.93	\$3.93	7,859	\$0.031	\$0.0274	1,450	\$45	\$40	0.704	\$32	\$28
2036	\$4.01	\$4.02	7,867	\$0.032	\$0.0274	1,443	\$46	\$40	0.685	\$31	\$27
2037	\$4.10	\$4.11	7,875	\$0.032	\$0.0274	1,435	\$46	\$39	0.666	\$31	\$26
2038	\$4.20	\$4.20	7,883	\$0.033	\$0.0274	1,428	\$47	\$39	0.648	\$31	\$25
2039	\$4.29	\$4.30	7,890	\$0.034	\$0.0274	1,421	\$48	\$39	0.629	\$30	\$25
2040	\$4.39	\$4.39	7,898	\$0.035	\$0.0274	1,414	\$49	\$39	0.611	\$30	\$24
2041	\$4.48	\$4.49	7,906	\$0.035	\$0.0274	1,407	\$50	\$39	0.594	\$30	\$23
2042	\$4.58	\$4.59	7,914	\$0.036	\$0.0274	1,400	\$51	\$38	0.577	\$29	\$22
2043	\$4.69	\$4.69	7,922	\$0.037	\$0.0274	1,393	\$52	\$38	0.561	\$29	\$21
2044	\$4.79	\$4.80	7,930	\$0.038	\$0.0274	1,386	\$53	\$38	0.544	\$29	\$21

<b>Validation: Present Value</b>	<b>\$779</b>	<b>\$779</b>
----------------------------------	--------------	--------------

**Table 9. Economic value of avoided plant O&M - fixed**

Year	O&M Fixed	Utility Capacity	PV Capacity	Prices		p.u. PV Production	Costs		Discount Factor	Disc. Costs	
				Utility	VOS		Utility	VOS		Utility	VOS
				\$/kWh	\$/kWh		(\$)	(\$)		(\$)	(\$)
2020	\$3.42	1.00	1.00	\$0.0022	\$0.0027	1,563	\$3.42	\$4.14	1.000	\$3.42	\$4.14
2021	\$3.49	0.999	0.995	\$0.0022	\$0.0027	1,555	\$3.48	\$4.12	0.940	\$3.27	\$3.88
2022	\$3.56	0.998	0.990	\$0.0023	\$0.0027	1,547	\$3.53	\$4.10	0.884	\$3.12	\$3.63
2023	\$3.63	0.997	0.985	\$0.0024	\$0.0027	1,540	\$3.59	\$4.08	0.831	\$2.98	\$3.39
2024	\$3.71	0.996	0.980	\$0.0024	\$0.0027	1,532	\$3.65	\$4.06	0.781	\$2.85	\$3.17
2025	\$3.78	0.995	0.975	\$0.0025	\$0.0027	1,524	\$3.71	\$4.04	0.735	\$2.72	\$2.97
2026	\$3.86	0.994	0.970	\$0.0025	\$0.0027	1,517	\$3.76	\$4.02	0.691	\$2.60	\$2.78
2027	\$3.93	0.993	0.966	\$0.0026	\$0.0027	1,509	\$3.82	\$4.00	0.649	\$2.48	\$2.60
2028	\$4.01	0.992	0.961	\$0.0027	\$0.0027	1,502	\$3.89	\$3.98	0.611	\$2.37	\$2.43
2029	\$4.09	0.991	0.956	\$0.0027	\$0.0027	1,494	\$3.95	\$3.96	0.574	\$2.27	\$2.27
2030	\$4.17	0.990	0.951	\$0.0028	\$0.0027	1,487	\$4.01	\$3.94	0.540	\$2.16	\$2.13
2031	\$4.26	0.989	0.946	\$0.0028	\$0.0027	1,479	\$4.07	\$3.92	0.508	\$2.07	\$1.99
2032	\$4.34	0.988	0.942	\$0.0029	\$0.0027	1,472	\$4.14	\$3.90	0.477	\$1.97	\$1.86
2033	\$4.43	0.987	0.937	\$0.0030	\$0.0027	1,464	\$4.20	\$3.88	0.449	\$1.89	\$1.74
2034	\$4.52	0.986	0.932	\$0.0031	\$0.0027	1,457	\$4.27	\$3.86	0.422	\$1.80	\$1.63
2035	\$4.52	0.985	0.928	\$0.0031	\$0.0027	1,450	\$4.25	\$3.84	0.397	\$1.69	\$1.52
2036	\$4.70	0.984	0.923	\$0.0032	\$0.0027	1,443	\$4.41	\$3.82	0.397	\$1.75	\$1.52
2037	\$4.79	0.983	0.918	\$0.0033	\$0.0027	1,435	\$4.48	\$3.80	0.351	\$1.57	\$1.33
2038	\$4.89	0.982	0.914	\$0.0034	\$0.0027	1,428	\$4.55	\$3.78	0.330	\$1.50	\$1.25
2039	\$4.99	0.981	0.909	\$0.0034	\$0.0027	1,421	\$4.62	\$3.77	0.310	\$1.43	\$1.17
2040	\$5.09	0.980	0.905	\$0.0035	\$0.0027	1,414	\$4.70	\$3.75	0.291	\$1.37	\$1.09
2041	\$5.19	0.979	0.900	\$0.0036	\$0.0027	1,407	\$4.77	\$3.73	0.274	\$1.31	\$1.02
2042	\$5.29	0.978	0.896	\$0.0037	\$0.0027	1,400	\$4.85	\$3.71	0.258	\$1.25	\$0.96
2043	\$5.40	0.977	0.891	\$0.0038	\$0.0027	1,393	\$4.92	\$3.69	0.242	\$1.19	\$0.89
2044	\$5.51	0.976	0.887	\$0.0039	\$0.0027	1,386	\$5.00	\$3.67	0.228	\$1.14	\$0.84

\$0.0027

<b>Validation: Present Value</b>	<b>\$52</b>	<b>\$52</b>
----------------------------------	-------------	-------------

**Table 10. Economic value of avoided plant O&M - variable**

Year	Prices		p.u. PV Production (kWh)	Costs		Discount Factor (risk free)	Disc. Costs	
	Utility	VOS		Utility	VOS		Utility	VOS
	\$/kWh	\$/kWh		(\$)	(\$)		(\$)	(\$)
2020	\$0.0010	\$0.0012	1,563	\$2	\$2	1.000	\$2	\$2
2021	\$0.0011	\$0.0012	1,555	\$2	\$2	0.940	\$2	\$2
2022	\$0.0011	\$0.0012	1,547	\$2	\$2	0.884	\$1	\$2
2023	\$0.0011	\$0.0012	1,540	\$2	\$2	0.831	\$1	\$2
2024	\$0.0011	\$0.0012	1,532	\$2	\$2	0.781	\$1	\$1
2025	\$0.0011	\$0.0012	1,524	\$2	\$2	0.735	\$1	\$1
2026	\$0.0012	\$0.0012	1,517	\$2	\$2	0.691	\$1	\$1
2027	\$0.0012	\$0.0012	1,509	\$2	\$2	0.649	\$1	\$1
2028	\$0.0012	\$0.0012	1,502	\$2	\$2	0.611	\$1	\$1
2029	\$0.0012	\$0.0012	1,494	\$2	\$2	0.574	\$1	\$1
2030	\$0.0013	\$0.0012	1,487	\$2	\$2	0.540	\$1	\$1
2031	\$0.0013	\$0.0012	1,479	\$2	\$2	0.508	\$1	\$1
2032	\$0.0013	\$0.0012	1,472	\$2	\$2	0.477	\$1	\$1
2033	\$0.0013	\$0.0012	1,464	\$2	\$2	0.449	\$1	\$1
2034	\$0.0014	\$0.0012	1,457	\$2	\$2	0.422	\$1	\$1
2035	\$0.0014	\$0.0012	1,450	\$2	\$2	0.397	\$1	\$1
2036	\$0.0014	\$0.0012	1,443	\$2	\$2	0.373	\$1	\$1
2037	\$0.0014	\$0.0012	1,435	\$2	\$2	0.351	\$1	\$1
2038	\$0.0015	\$0.0012	1,428	\$2	\$2	0.330	\$1	\$1
2039	\$0.0015	\$0.0012	1,421	\$2	\$2	0.310	\$1	\$1
2040	\$0.0015	\$0.0012	1,414	\$2	\$2	0.291	\$1	\$1
2041	\$0.0016	\$0.0012	1,407	\$2	\$2	0.274	\$1	\$0
2042	\$0.0016	\$0.0012	1,400	\$2	\$2	0.258	\$1	\$0
2043	\$0.0016	\$0.0012	1,393	\$2	\$2	0.242	\$1	\$0
2044	\$0.0017	\$0.0012	1,386	\$2	\$2	0.228	\$1	\$0
<b>Validation: Present Value</b>							<b>\$24</b>	<b>\$24</b>

**Table 11. Economic value of avoided generation capacity cost.**

Year				Prices		PV Production (kWh)	Costs		Discount Factor	Disc. Costs	
	Capacity Cost	Utility Capacity	PV Capacity	Utility	VOS		Utility	VOS		Utility	VOS
	\$/kW-yr	pu.	kW	\$/kWh	\$/kWh		(\$)	(\$)		(\$)	(\$)
2020	\$57	1.00	1.00	\$0.036	\$0.0367	1,563	\$57	\$57	1.000	\$57	\$57
2021	\$57	0.999	0.995	\$0.036	\$0.0367	1,555	\$57	\$57	0.940	\$53	\$54
2022	\$57	0.998	0.990	\$0.036	\$0.0367	1,547	\$56	\$57	0.884	\$50	\$50
2023	\$57	0.997	0.985	\$0.036	\$0.0367	1,540	\$56	\$56	0.831	\$47	\$47
2024	\$57	0.996	0.980	\$0.036	\$0.0367	1,532	\$56	\$56	0.781	\$44	\$44
2025	\$57	0.995	0.975	\$0.037	\$0.0367	1,524	\$56	\$56	0.735	\$41	\$41
2026	\$57	0.994	0.970	\$0.037	\$0.0367	1,517	\$55	\$56	0.691	\$38	\$38
2027	\$57	0.993	0.966	\$0.037	\$0.0367	1,509	\$55	\$55	0.649	\$36	\$36
2028	\$57	0.992	0.961	\$0.037	\$0.0367	1,502	\$55	\$55	0.611	\$34	\$34
2029	\$57	0.991	0.956	\$0.037	\$0.0367	1,494	\$55	\$55	0.574	\$31	\$31
2030	\$57	0.990	0.951	\$0.037	\$0.0367	1,487	\$55	\$55	0.540	\$29	\$29
2031	\$57	0.989	0.946	\$0.037	\$0.0367	1,479	\$54	\$54	0.508	\$28	\$28
2032	\$57	0.988	0.942	\$0.037	\$0.0367	1,472	\$54	\$54	0.477	\$26	\$26
2033	\$57	0.987	0.937	\$0.037	\$0.0367	1,464	\$54	\$54	0.449	\$24	\$24
2034	\$57	0.986	0.932	\$0.037	\$0.0367	1,457	\$54	\$53	0.422	\$23	\$23
2035	\$57	0.985	0.928	\$0.037	\$0.0367	1,450	\$53	\$53	0.397	\$21	\$21
2036	\$57	0.984	0.923	\$0.037	\$0.0367	1,443	\$53	\$53	0.373	\$20	\$20
2037	\$57	0.983	0.918	\$0.037	\$0.0367	1,435	\$53	\$53	0.351	\$19	\$18
2038	\$57	0.982	0.914	\$0.037	\$0.0367	1,428	\$53	\$52	0.330	\$17	\$17
2039	\$57	0.981	0.909	\$0.037	\$0.0367	1,421	\$53	\$52	0.310	\$16	\$16
2040	\$57	0.980	0.905	\$0.037	\$0.0367	1,414	\$52	\$52	0.291	\$15	\$15
2041	\$57	0.979	0.900	\$0.037	\$0.0367	1,407	\$52	\$52	0.274	\$14	\$14
2042	\$57	0.978	0.896	\$0.037	\$0.0367	1,400	\$52	\$51	0.258	\$13	\$13
2043	\$57	0.977	0.891	\$0.037	\$0.0367	1,393	\$52	\$51	0.242	\$13	\$12
2044	\$57	0.976	0.887	\$0.037	\$0.0367	1,386	\$52	\$51	0.228	\$12	\$12
					\$0.0367						
<b>Validation: Present Value</b>										\$721	\$721

**Table 12. Economic value of avoided reserve capacity cost.**

Year					Prices					Disc. Costs		
	Capacity Cost	Reserve Margin	Utility Capacity	PV Capacity	Utility	VOS	PV Production	Utility	VOS	Discount Factor	Utility	VOS
	\$/kW-yr	%	pu.	kW	\$/kWh	\$/kWh	(kWh)	(\$)	(\$)		(\$)	(\$)
2020	\$57	7.9%	1.00	1.00	\$0.003	\$0.0029	1,563	\$4	\$5	1.000	\$4	\$5
2021	\$57	7.9%	0.999	0.995	\$0.003	\$0.0029	1,555	\$4	\$5	0.940	\$4	\$4
2022	\$57	7.9%	0.998	0.990	\$0.003	\$0.0029	1,547	\$4	\$4	0.884	\$4	\$4
2023	\$57	7.9%	0.997	0.985	\$0.003	\$0.0029	1,540	\$4	\$4	0.831	\$4	\$4
2024	\$57	7.9%	0.996	0.980	\$0.003	\$0.0029	1,532	\$4	\$4	0.781	\$3	\$3
2025	\$57	7.9%	0.995	0.975	\$0.003	\$0.0029	1,524	\$4	\$4	0.735	\$3	\$3
2026	\$57	7.9%	0.994	0.970	\$0.003	\$0.0029	1,517	\$4	\$4	0.691	\$3	\$3
2027	\$57	7.9%	0.993	0.966	\$0.003	\$0.0029	1,509	\$4	\$4	0.649	\$3	\$3
2028	\$57	7.9%	0.992	0.961	\$0.003	\$0.0029	1,502	\$4	\$4	0.611	\$3	\$3
2029	\$57	7.9%	0.991	0.956	\$0.003	\$0.0029	1,494	\$4	\$4	0.574	\$2	\$2
2030	\$57	7.9%	0.990	0.951	\$0.003	\$0.0029	1,487	\$4	\$4	0.540	\$2	\$2
2031	\$57	7.9%	0.989	0.946	\$0.003	\$0.0029	1,479	\$4	\$4	0.508	\$2	\$2
2032	\$57	7.9%	0.988	0.942	\$0.003	\$0.0029	1,472	\$4	\$4	0.477	\$2	\$2
2033	\$57	7.9%	0.987	0.937	\$0.003	\$0.0029	1,464	\$4	\$4	0.449	\$2	\$2
2034	\$57	7.9%	0.986	0.932	\$0.003	\$0.0029	1,457	\$4	\$4	0.422	\$2	\$2
2035	\$57	7.9%	0.985	0.928	\$0.003	\$0.0029	1,450	\$4	\$4	0.397	\$2	\$2
2036	\$57	7.9%	0.984	0.923	\$0.003	\$0.0029	1,443	\$4	\$4	0.373	\$2	\$2
2037	\$57	7.9%	0.983	0.918	\$0.003	\$0.0029	1,435	\$4	\$4	0.351	\$1	\$1
2038	\$57	7.9%	0.982	0.914	\$0.003	\$0.0029	1,428	\$4	\$4	0.330	\$1	\$1
2039	\$57	7.9%	0.981	0.909	\$0.003	\$0.0029	1,421	\$4	\$4	0.310	\$1	\$1
2040	\$57	7.9%	0.980	0.905	\$0.003	\$0.0029	1,414	\$4	\$4	0.291	\$1	\$1
2041	\$57	7.9%	0.979	0.900	\$0.003	\$0.0029	1,407	\$4	\$4	0.274	\$1	\$1
2042	\$57	7.9%	0.978	0.896	\$0.003	\$0.0029	1,400	\$4	\$4	0.258	\$1	\$1
2043	\$57	7.9%	0.977	0.891	\$0.003	\$0.0029	1,393	\$4	\$4	0.242	\$1	\$1
2044	\$57	7.9%	0.976	0.887	\$0.003	\$0.0029	1,386	\$4	\$4	0.228	\$1	\$1
						\$0.0029						
<b>Validation: Present Value</b>										\$57	\$57	



**Table 13. Economic value of avoided transmission capacity cost.**

Year				Prices		PV Production (kWh)	Costs		Discount Factor	Disc. Costs	
	Capacity Cost	Utility Capacity	PV Capacity	Utility	VOS		Utility	VOS		Utility	VOS
	\$/kW-yr	pu.	kW	\$/kWh	\$/kWh		(\$)	(\$)		(\$)	(\$)
2020	\$50	1.00	1.00	\$0.032	\$0.0325	1,563	\$50	\$51	1.000	\$50	\$51
2021	\$50	0.999	0.995	\$0.032	\$0.0325	1,555	\$50	\$51	0.940	\$47	\$47
2022	\$50	0.998	0.990	\$0.032	\$0.0325	1,547	\$50	\$50	0.884	\$44	\$44
2023	\$50	0.997	0.985	\$0.032	\$0.0325	1,540	\$50	\$50	0.831	\$41	\$42
2024	\$50	0.996	0.980	\$0.032	\$0.0325	1,532	\$50	\$50	0.781	\$39	\$39
2025	\$50	0.995	0.975	\$0.032	\$0.0325	1,524	\$49	\$50	0.735	\$36	\$36
2026	\$50	0.994	0.970	\$0.032	\$0.0325	1,517	\$49	\$49	0.691	\$34	\$34
2027	\$50	0.993	0.966	\$0.032	\$0.0325	1,509	\$49	\$49	0.649	\$32	\$32
2028	\$50	0.992	0.961	\$0.032	\$0.0325	1,502	\$49	\$49	0.611	\$30	\$30
2029	\$50	0.991	0.956	\$0.032	\$0.0325	1,494	\$49	\$49	0.574	\$28	\$28
2030	\$50	0.990	0.951	\$0.033	\$0.0325	1,487	\$48	\$48	0.540	\$26	\$26
2031	\$50	0.989	0.946	\$0.033	\$0.0325	1,479	\$48	\$48	0.508	\$24	\$24
2032	\$50	0.988	0.942	\$0.033	\$0.0325	1,472	\$48	\$48	0.477	\$23	\$23
2033	\$50	0.987	0.937	\$0.033	\$0.0325	1,464	\$48	\$48	0.449	\$21	\$21
2034	\$50	0.986	0.932	\$0.033	\$0.0325	1,457	\$48	\$47	0.422	\$20	\$20
2035	\$50	0.985	0.928	\$0.033	\$0.0325	1,450	\$47	\$47	0.397	\$19	\$19
2036	\$50	0.984	0.923	\$0.033	\$0.0325	1,443	\$47	\$47	0.373	\$18	\$17
2037	\$50	0.983	0.918	\$0.033	\$0.0325	1,435	\$47	\$47	0.351	\$16	\$16
2038	\$50	0.982	0.914	\$0.033	\$0.0325	1,428	\$47	\$46	0.330	\$15	\$15
2039	\$50	0.981	0.909	\$0.033	\$0.0325	1,421	\$47	\$46	0.310	\$14	\$14
2040	\$50	0.980	0.905	\$0.033	\$0.0325	1,414	\$46	\$46	0.291	\$14	\$13
2041	\$50	0.979	0.900	\$0.033	\$0.0325	1,407	\$46	\$46	0.274	\$13	\$13
2042	\$50	0.978	0.896	\$0.033	\$0.0325	1,400	\$46	\$45	0.258	\$12	\$12
2043	\$50	0.977	0.891	\$0.033	\$0.0325	1,393	\$46	\$45	0.242	\$11	\$11
2044	\$50	0.976	0.887	\$0.033	\$0.0325	1,386	\$46	\$45	0.228	\$10	\$10
					\$0.0325						
<b>Validation: Present Value</b>										\$639	\$639

**Table 14. Determination of deferrable distribution costs.**

Year	Distribution Project Costs	% Capacity Related	Capacity Related		
	\$	%	\$		
2018	175,490,525	4.5%	7,812,185		
2017	155,018,178	6.6%	10,270,204		
2016	165,929,956	9.6%	15,936,132		
2015	134,867,264	12.1%	16,309,114		
2014	129,899,465	16.3%	21,147,768		
2013	142,118,822	20.3%	28,825,462		
2012	109,286,058	20.8%	22,683,879		
2011	100,102,075	7.5%	7,502,291		
2010	98,267,667	11.0%	10,823,959		
2009	82,821,606	10.6%	8,749,417		
<b>TOTAL 10-YEAR PERIOD</b>	<b>1,293,801,616</b>		<b>150,060,411</b>		

**Table 15. Economic value of avoided distribution capacity cost.**

Year	Conventional Distribution Planning					Deferred Distribution Planning			
	Distribution Cost	New Dist. Capacity	Capital Cost	Disc Capital Cost	Amortized	Def. Dist. Capacity	Def. Capital Cost	Disc Capital Cost	Amortized
	\$/kW-yr	(MW)	(\$M)	(\$M)	\$M/yr	(MW)	(\$M)	(\$M)	\$M/yr
2020	\$96	50	\$5	\$5	\$6				\$6
2021	\$98	50	\$5	\$5	\$6	50	\$4.9	\$4.6	\$6
2022	\$100	50	\$5	\$4	\$6	50	\$5.0	\$4.4	\$6
2023	\$102	51	\$5	\$4	\$6	50	\$5.1	\$4.3	\$6
2024	\$104	51	\$5	\$4	\$6	51	\$5.2	\$4.1	\$6
2025	\$106	51	\$5	\$4	\$6	51	\$5.4	\$3.9	\$6
2026	\$108	51	\$6	\$4	\$6	51	\$5.5	\$3.8	\$6
2027	\$110	52	\$6	\$4	\$6	51	\$5.6	\$3.7	\$6
2028	\$112	52	\$6	\$4	\$6	52	\$5.8	\$3.5	\$6
2029	\$114	52	\$6	\$3	\$6	52	\$5.9	\$3.4	\$6
2030	\$117	52	\$6	\$3	\$6	52	\$6.1	\$3.3	\$6
2031	\$119	52	\$6	\$3	\$6	52	\$6.2	\$3.2	\$6
2032	\$121	53	\$6	\$3	\$6	52	\$6.4	\$3.0	\$6
2033	\$124	53	\$7	\$3	\$6	53	\$6.5	\$2.9	\$6
2034	\$126	53	\$7	\$3	\$6	53	\$6.7	\$2.8	\$6
2035	\$129	53	\$7	\$3	\$6	53	\$6.8	\$2.7	\$6
2036	\$131	54	\$7	\$3	\$6	53	\$7.0	\$2.6	\$6
2037	\$134	54	\$7	\$3	\$6	54	\$7.2	\$2.5	\$6
2038	\$137	54	\$7	\$2	\$6	54	\$7.3	\$2.4	\$6
2039	\$139	54	\$8	\$2	\$6	54	\$7.5	\$2.3	\$6
2040	\$142	54	\$8	\$2	\$6	54	\$7.7	\$2.2	\$6
2041	\$145	55	\$8	\$2	\$6	54	\$7.9	\$2.2	\$6
2042	\$148	55	\$8	\$2	\$6	55	\$8.1	\$2.1	\$6
2043	\$151	55	\$8	\$2	\$6	55	\$8.3	\$2.0	\$6
2044	\$154	55	\$9	\$2	\$6	55	\$8.5	\$1.9	\$6
2039	\$157					55	\$8.7	\$1.9	
					\$79				\$76

**Continued - Table 15. Economic value of avoided distribution capacity cost. *EXAMPLE***

Prices		PV Production	Costs		Discount Factor	Disc. Costs	
Utility \$/kWh	VOS \$/kWh		Utility (\$)	VOS (\$)		Utility (\$)	VOS (\$)
\$0.00335	\$0.0034	1,563	\$5	\$5	1.000	\$5	\$5
\$0.00336	\$0.0034	1,555	\$5	\$5	0.940	\$5	\$5
\$0.00336	\$0.0034	1,547	\$5	\$5	0.884	\$5	\$5
\$0.00336	\$0.0034	1,540	\$5	\$5	0.831	\$4	\$4
\$0.00336	\$0.0034	1,532	\$5	\$5	0.781	\$4	\$4
\$0.00337	\$0.0034	1,524	\$5	\$5	0.735	\$4	\$4
\$0.00337	\$0.0034	1,517	\$5	\$5	0.691	\$4	\$4
\$0.00337	\$0.0034	1,509	\$5	\$5	0.649	\$3	\$3
\$0.00337	\$0.0034	1,502	\$5	\$5	0.611	\$3	\$3
\$0.00338	\$0.0034	1,494	\$5	\$5	0.574	\$3	\$3
\$0.00338	\$0.0034	1,487	\$5	\$5	0.540	\$3	\$3
\$0.00338	\$0.0034	1,479	\$5	\$5	0.508	\$3	\$3
\$0.00339	\$0.0034	1,472	\$5	\$5	0.477	\$2	\$2
\$0.00339	\$0.0034	1,464	\$5	\$5	0.449	\$2	\$2
\$0.00339	\$0.0034	1,457	\$5	\$5	0.422	\$2	\$2
\$0.00339	\$0.0034	1,450	\$5	\$5	0.397	\$2	\$2
\$0.00340	\$0.0034	1,443	\$5	\$5	0.373	\$2	\$2
\$0.00340	\$0.0034	1,435	\$5	\$5	0.351	\$2	\$2
\$0.00340	\$0.0034	1,428	\$5	\$5	0.330	\$2	\$2
\$0.00340	\$0.0034	1,421	\$5	\$5	0.310	\$1	\$1
\$0.00341	\$0.0034	1,414	\$5	\$5	0.291	\$1	\$1
\$0.00341	\$0.0034	1,407	\$5	\$5	0.274	\$1	\$1
\$0.00341	\$0.0034	1,400	\$5	\$5	0.258	\$1	\$1
\$0.00341	\$0.0034	1,393	\$5	\$5	0.242	\$1	\$1
\$0.00342	\$0.0034	1,386	\$5	\$5	0.228	\$1	\$1
					-		
	\$0.0034		Validation: Present Value			\$66	\$66

**Table 17. Economic value of avoided environmental costs**

Environmental Discount Rate 5.30%

Year	Env. Cost \$/mmBtu	Solar Weighted Heat Rate mmBtu/MWh	Prices		p.u. PV Production (kWh)	Costs		Discount Factor (risk free)	Disc. Costs	
			Utility \$/kWh	VOS \$/kWh		Utility (\$)	VOS (\$)		Utility (\$)	VOS (\$)
2020	\$3.12	7,742	\$0.024	\$0.0359	1,563	\$38	\$56	1.000	\$38	\$56
2021	\$3.24	7,750	\$0.025	\$0.0359	1,555	\$39	\$56	0.950	\$37	\$53
2022	\$3.37	7,757	\$0.026	\$0.0359	1,547	\$40	\$56	0.902	\$36	\$50
2023	\$3.50	7,765	\$0.027	\$0.0359	1,540	\$42	\$55	0.857	\$36	\$47
2024	\$3.64	7,773	\$0.028	\$0.0359	1,532	\$43	\$55	0.813	\$35	\$45
2025	\$3.78	7,781	\$0.029	\$0.0359	1,524	\$45	\$55	0.773	\$35	\$42
2026	\$3.92	7,789	\$0.031	\$0.0359	1,517	\$46	\$54	0.734	\$34	\$40
2027	\$4.07	7,796	\$0.032	\$0.0359	1,509	\$48	\$54	0.697	\$33	\$38
2028	\$4.23	7,804	\$0.033	\$0.0359	1,502	\$50	\$54	0.662	\$33	\$36
2029	\$4.39	7,812	\$0.034	\$0.0359	1,494	\$51	\$54	0.628	\$32	\$34
2030	\$4.55	7,820	\$0.036	\$0.0359	1,487	\$53	\$53	0.597	\$32	\$32
2031	\$4.74	7,828	\$0.037	\$0.0359	1,479	\$55	\$53	0.567	\$31	\$30
2032	\$4.93	7,835	\$0.039	\$0.0359	1,472	\$57	\$53	0.538	\$31	\$28
2033	\$5.13	7,843	\$0.040	\$0.0359	1,464	\$59	\$53	0.511	\$30	\$27
2034	\$5.34	7,851	\$0.042	\$0.0359	1,457	\$61	\$52	0.485	\$30	\$25
2035	\$5.55	7,859	\$0.044	\$0.0359	1,450	\$63	\$52	0.461	\$29	\$24
2036	\$5.77	7,867	\$0.045	\$0.0359	1,443	\$65	\$52	0.438	\$29	\$23
2037	\$5.99	7,875	\$0.047	\$0.0359	1,435	\$68	\$51	0.416	\$28	\$21
2038	\$6.23	7,883	\$0.049	\$0.0359	1,428	\$70	\$51	0.395	\$28	\$20
2039	\$6.47	7,890	\$0.051	\$0.0359	1,421	\$73	\$51	0.375	\$27	\$19
2040	\$6.72	7,898	\$0.053	\$0.0359	1,414	\$75	\$51	0.356	\$27	\$18
2041	\$6.95	7,906	\$0.055	\$0.0359	1,407	\$77	\$50	0.338	\$26	\$17
2042	\$7.19	7,914	\$0.057	\$0.0359	1,400	\$80	\$50	0.321	\$26	\$16
2043	\$7.44	7,922	\$0.059	\$0.0359	1,393	\$82	\$50	0.305	\$25	\$15
2044	\$7.70	7,930	\$0.061	\$0.0359	1,386	\$85	\$50	0.290	\$25	\$14

<b>Validation: Present Value</b>	<b>\$771</b>	<b>\$771</b>
----------------------------------	--------------	--------------

**Table 18. Calculation of inflation-adjusted VOS**

Year	Discount Factor	PV Production	Escallation Factor	VOS Levelized	Disc.	VOS Inflation Adj. (\$/kWh)	Disc
2020	1.000	1563	1.000	\$0.113	\$177	\$0.0924	144.402
2021	0.940	1555	1.022	\$0.113	\$166	\$0.0944	138.100
2022	0.884	1547	1.045	\$0.113	\$155	\$0.0966	132.074
2023	0.831	1540	1.068	\$0.113	\$145	\$0.0987	126.311
2024	0.781	1532	1.092	\$0.113	\$136	\$0.1009	120.799
2025	0.735	1524	1.117	\$0.113	\$127	\$0.1032	115.528
2026	0.691	1517	1.141	\$0.113	\$119	\$0.1055	110.487
2027	0.649	1509	1.167	\$0.113	\$111	\$0.1078	105.666
2028	0.611	1502	1.193	\$0.113	\$104	\$0.1102	101.055
2029	0.574	1494	1.220	\$0.113	\$97	\$0.1127	96.645
2030	0.540	1487	1.247	\$0.113	\$91	\$0.1152	92.428
2031	0.508	1479	1.275	\$0.113	\$85	\$0.1178	88.395
2032	0.477	1472	1.303	\$0.113	\$79	\$0.1204	84.537
2033	0.449	1464	1.332	\$0.113	\$74	\$0.1231	80.849
2034	0.422	1457	1.362	\$0.113	\$70	\$0.1258	77.321
2035	0.397	1450	1.392	\$0.113	\$65	\$0.1286	73.947
2036	0.397	1443	1.423	\$0.113	\$65	\$0.1315	75.218
2037	0.351	1435	1.455	\$0.113	\$57	\$0.1344	67.634
2038	0.330	1428	1.487	\$0.113	\$53	\$0.1374	64.683
2039	0.310	1421	1.521	\$0.113	\$50	\$0.1405	61.860
2040	0.291	1414	1.554	\$0.113	\$47	\$0.1436	59.161
2041	0.274	1407	1.589	\$0.113	\$44	\$0.1468	56.579
2042	0.258	1400	1.625	\$0.113	\$41	\$0.1501	54.110
2043	0.242	1393	1.661	\$0.113	\$38	\$0.1534	51.749
2044	0.228	1386	1.698	\$0.113	\$36	\$0.1569	49.491
					\$2,229		\$2,229

**ATTACHMENTS B – L**  
**FILED LIVE**

**Redline**



**SOLAR\*REWARDS COMMUNITY PROGRAM**  
**(Continued)**

Section No. 9  
~~Original~~1st Revised Sheet No. 64.102

**2019 VOS VINTAGE YEAR BILL CREDIT RATE**

The table below shows the 2019 VOS Vintage Year Bill Credit Rates. These are applicable to applications Deemed Complete from March 26, 2019 until the 2020 VOS Vintage Year Bill Credit Rate table is effective.

Year Number	2019 VOS Vintage Year Bill Credit Rate (\$/kWh)	Year Number	2019 VOS Vintage Year Bill Credit Rate (\$/kWh)
Year 1	\$0.0904	Year 14	\$0.1208
Year 2	\$0.0925	Year 15	\$0.1235
Year 3	\$0.0945	Year 16	\$0.1263
Year 4	\$0.0967	Year 17	\$0.1291
Year 5	\$0.0988	Year 18	\$0.1320
Year 6	\$0.1011	Year 19	\$0.1350
Year 7	\$0.1033	Year 20	\$0.1380
Year 8	\$0.1057	Year 21	\$0.1411
Year 9	\$0.1080	Year 22	\$0.1443
Year 10	\$0.1105	Year 23	\$0.1475
Year 11	\$0.1130	Year 24	\$0.1509
Year 12	\$0.1155	Year 25	\$0.1542
Year 13	\$0.1181		

**2020 VOS VINTAGE YEAR BILL CREDIT RATE**

The table below shows the 2020 VOS Vintage Year Bill Credit Rates. These are applicable to applications Deemed Complete from [the effective date of the tariff sheet for these rates following Commission Order] until the 2021 VOS Vintage Year Bill Credit Rate table is effective.

<u>Year Number</u>	<u>2020 VOS Vintage Year Bill Credit Rate (\$/kWh)</u>	<u>Year Number</u>	<u>2020 VOS Vintage Year Bill Credit Rate (\$/kWh)</u>
<u>Year 1</u>	<u>\$0.0924</u>	<u>Year 14</u>	<u>\$0.1231</u>
<u>Year 2</u>	<u>\$0.0944</u>	<u>Year 15</u>	<u>\$0.1258</u>
<u>Year 3</u>	<u>\$0.0966</u>	<u>Year 16</u>	<u>\$0.1286</u>
<u>Year 4</u>	<u>\$0.0987</u>	<u>Year 17</u>	<u>\$0.1315</u>
<u>Year 5</u>	<u>\$0.1009</u>	<u>Year 18</u>	<u>\$0.1344</u>
<u>Year 6</u>	<u>\$0.1032</u>	<u>Year 19</u>	<u>\$0.1374</u>
<u>Year 7</u>	<u>\$0.1055</u>	<u>Year 20</u>	<u>\$0.1405</u>
<u>Year 8</u>	<u>\$0.1078</u>	<u>Year 21</u>	<u>\$0.1436</u>
<u>Year 9</u>	<u>\$0.1102</u>	<u>Year 22</u>	<u>\$0.1468</u>
<u>Year 10</u>	<u>\$0.1127</u>	<u>Year 23</u>	<u>\$0.1501</u>
<u>Year 11</u>	<u>\$0.1152</u>	<u>Year 24</u>	<u>\$0.1534</u>
<u>Year 12</u>	<u>\$0.1178</u>	<u>Year 25</u>	<u>\$0.1569</u>
<u>Year 13</u>	<u>\$0.1204</u>		

(Continued on Sheet No. 9-65)

Date Filed: ~~08-31-18~~08-30-19 By: Christopher B. Clark Effective Date: ~~03-26-19~~  
 President, Northern States Power Company, a Minnesota corporation  
 Docket No. E002/M-13-867 Order Date: ~~03-22-19~~

**Clean**

**SOLAR\*REWARDS COMMUNITY PROGRAM**  
**(Continued)**

Section No. 9  
 1st Revised Sheet No. 64.102

**2019 VOS VINTAGE YEAR BILL CREDIT RATE**

The table below shows the 2019 VOS Vintage Year Bill Credit Rates. These are applicable to applications Deemed Complete from March 26, 2019 until the 2020 VOS Vintage Year Bill Credit Rate table is effective.

Year Number	2019 VOS Vintage Year Bill Credit Rate (\$/kWh)		Year Number	2019 VOS Vintage Year Bill Credit Rate (\$/kWh)
Year 1	\$0.0904		Year 14	\$0.1208
Year 2	\$0.0925		Year 15	\$0.1235
Year 3	\$0.0945		Year 16	\$0.1263
Year 4	\$0.0967		Year 17	\$0.1291
Year 5	\$0.0988		Year 18	\$0.1320
Year 6	\$0.1011		Year 19	\$0.1350
Year 7	\$0.1033		Year 20	\$0.1380
Year 8	\$0.1057		Year 21	\$0.1411
Year 9	\$0.1080		Year 22	\$0.1443
Year 10	\$0.1105		Year 23	\$0.1475
Year 11	\$0.1130		Year 24	\$0.1509
Year 12	\$0.1155		Year 25	\$0.1542
Year 13	\$0.1181			

**2020 VOS VINTAGE YEAR BILL CREDIT RATE**

The table below shows the 2020 VOS Vintage Year Bill Credit Rates. These are applicable to applications Deemed Complete from [the effective date of the tariff sheet for these rates following Commission Order] until the 2021 VOS Vintage Year Bill Credit Rate table is effective.

Year Number	2020 VOS Vintage Year Bill Credit Rate (\$/kWh)		Year Number	2020 VOS Vintage Year Bill Credit Rate (\$/kWh)
Year 1	\$0.0924		Year 14	\$0.1231
Year 2	\$0.0944		Year 15	\$0.1258
Year 3	\$0.0966		Year 16	\$0.1286
Year 4	\$0.0987		Year 17	\$0.1315
Year 5	\$0.1009		Year 18	\$0.1344
Year 6	\$0.1032		Year 19	\$0.1374
Year 7	\$0.1055		Year 20	\$0.1405
Year 8	\$0.1078		Year 21	\$0.1436
Year 9	\$0.1102		Year 22	\$0.1468
Year 10	\$0.1127		Year 23	\$0.1501
Year 11	\$0.1152		Year 24	\$0.1534
Year 12	\$0.1178		Year 25	\$0.1569
Year 13	\$0.1204			

N  
 N

(Continued on Sheet No. 9-65)

Date Filed: 08-30-19 By: Christopher B. Clark Effective Date:  
 President, Northern States Power Company, a Minnesota corporation  
 Docket No. E002/M-13-867 Order Date:

**ATTACHMENTS N & O**  
**FILED LIVE**

**PRELIMINARY**

**2020**

**Value of Solar Overview  
Stakeholder Meeting**

*July 31, 2019*



**PRELIMINARY**



# 2020 VOS Summary

	<b>Current Methodology 2020 VOS</b>	<b>2019 VOS</b>	<b>2020 H/(L) vs. 2019</b>	<b>Proposed 2020 VOS</b>
Avoided Fuel Cost	\$0.0301	\$0.0265	\$0.0036	\$0.0301
Avoided Plant O&M - Fixed	\$0.0014	\$0.0025	-\$0.0011	\$0.0014
Avoided Plant O&M - Variable	\$0.0014	\$0.0014	\$0.0000	\$0.0014
Avoided Generation Capacity Cost	\$0.0197	\$0.0232	-\$0.0035	\$0.0197
Avoided Reserve Capacity Cost	\$0.0016	\$0.0019	-\$0.0003	\$0.0016
Avoided Transmission Capacity Cost	\$0.0175	\$0.0183	-\$0.0008	\$0.0175
Avoided Distribution Capacity Cost	\$0.1373	\$0.0000	\$0.1373	\$0.0021
Avoided Environmental Cost	\$0.0394	\$0.0371	\$0.0023	\$0.0394
Avoided Voltage Control Cost				
Solar Integration Cost				
<b>TOTAL</b>	<b>\$0.2484</b>	<b>\$0.1109</b>	<b>\$0.1375</b>	<b>\$0.1132</b>

**PRELIMINARY**

# Distribution Capacity - Current Methodology

## VOS Distribution Capacity Cost per kW

A. Estimate the percentage of distribution cost that is deferrable per the VOS methodology

	MN Electric Distribution Costs <i>Nominal</i>	Percent Capacity Related	Capacity Related Project Costs <i>Nominal</i>	2020 Inflation Adjustment Inflation Rate	Capacity Related Project Cost <i>Adjusted for Inflation</i>
	( a )	( a / b )	( b )	( c )	( c * b ) = ( d )
1 2018	\$175,490,525	4.5%	\$7,812,185	104.5%	\$8,164,493
2 2017	\$155,018,178	6.6%	\$10,270,204	106.8%	\$10,972,716
3 2016	\$165,929,956	9.6%	\$15,936,132	109.2%	\$17,405,895
4 2015	\$134,867,264	12.1%	\$16,309,114	111.7%	\$18,210,513
5 2014	\$129,899,465	16.3%	\$21,147,768	114.1%	\$24,139,858
6 2013	\$142,118,822	20.3%	\$28,825,462	116.7%	\$33,637,585
7 2012	\$109,286,058	20.8%	\$22,683,879	119.3%	\$27,061,023
8 2011	\$100,102,075	7.5%	\$7,502,291	122.0%	\$9,149,538
9 2010	\$98,267,667	11.0%	\$10,823,959	124.7%	\$13,494,902
10 2009	\$82,821,606	10.6%	\$8,749,417	127.5%	\$11,151,700
2009-18 Total					\$173,388,223

B. Identify Peak Demand historical 10-yr growth rate

	Peak Data MN	KW Growth 2018 vs. 2009	Average Annual Growth Rate
1 2018	6,419,811	27,347	
2 2017	6,493,385		
3 2016	6,700,468		
4 2015	6,579,852		
5 2014	6,801,376		
6 2013	7,124,354		
7 2012	6,947,755		
8 2011	6,951,472		
9 2010	6,727,832		
10 2009	6,392,464		

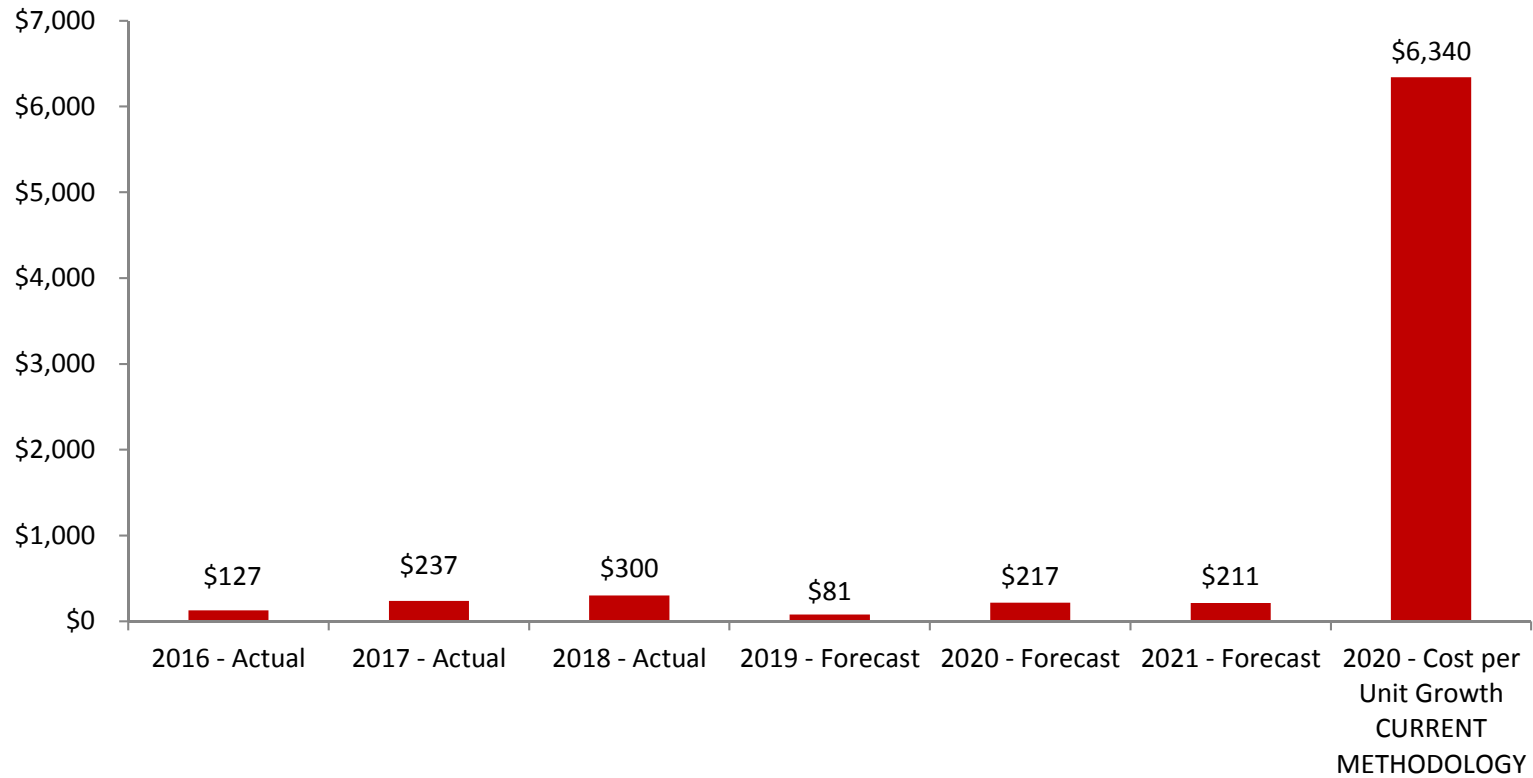
C. Calculate Cost per kW Growth 2009-18

Distribution Cost	\$173,388,223 ( g )	From A
10yrs of KW Growth	27,347 ( h )	From B
Cost per kW	\$6,340 ( i ) = ( g ) / ( h )	
Cost per kW (Inserted into Table 15)	\$6,340 ( j ) = ( i ) unless ( i ) < 0, then 0	

**PRELIMINARY**



# Distribution Cost per kW





**PRELIMINARY**



# 2020 Proposed Avoided Distribution Cost

**System actual cost per KWH**

Year	New Dist. Capacity	Capital Cost - Capacity projects
	(MW)	(\$M)
2017	43.3	\$10.270
2018	26.0	\$7.812
2019	72.8	\$5.862
2020	71.0	\$15.380
2021	75.9	\$16.000
Total	289.0	\$55.324
Cost per kW		\$191.43

Distribution Capacity Cost per kW	\$191.43
Deferral Reduction Factor	50%
Avoided Distribution Capacity Cost per kW	<u>\$95.72</u>

**PRELIMINARY**



# VOS Summary - Recommended 2020 VOS Rates

	<b>Proposed 2020 VOS</b>	<b>2019 VOS</b>	<b>2020 H/(L) vs. 2019</b>	<b>Drivers</b>
Avoided Fuel Cost	\$0.0301	\$0.0265	\$0.0036	NYMEX, SWHR, fuel overhead, Treasury Yields
Avoided Plant O&M - Fixed	\$0.0014	\$0.0025	-\$0.0011	Fixed O&M cost & escalation and actual production
Avoided Plant O&M - Variable	\$0.0014	\$0.0014	\$0.0000	Discount rate offset by O&M escalation
Avoided Generation Capacity Cost	\$0.0197	\$0.0232	-\$0.0035	Actual production, lower CC & CT costs and SWHR
Avoided Reserve Capacity Cost	\$0.0016	\$0.0019	-\$0.0003	Actual production and SWHR
Avoided Transmission Capacity Cost	\$0.0175	\$0.0183	-\$0.0008	Actual production offset by Avg. OATT rate
Avoided Distribution Capacity Cost	\$0.0021	\$0.0000	\$0.0021	Avoided dist. cost per kWh offset by actual production
Avoided Environmental Cost	\$0.0394	\$0.0371	\$0.0023	SWHR and escalation of environmental values
Avoided Voltage Control Cost				
Solar Integration Cost				
<b>TOTAL</b>	<b>\$0.1132</b>	<b>\$0.1109</b>	<b>\$0.0023</b>	

**PRELIMINARY**



# Appendix

# PRELIMINARY



## 2020 VOS – Fixed Input Values

Table 3. Fixed Assumptions to be used for the VOS calculations

	2020 Input Data	2019 Input Data		2020 Input Data	2019 Input Data	
<b>Fuel Prices</b>						
Guaranteed NG Fuel Prices						
2020	\$2.671	\$2.769	\$/mmBtu			
2021	\$2.639	\$2.692	\$/mmBtu			
2022	\$2.645	\$2.681	\$/mmBtu			
2023	\$2.720	\$2.717	\$/mmBtu			
2024	\$2.823	\$2.779	\$/mmBtu			
2025	\$2.935	\$2.846	\$/mmBtu			
2026	\$3.047	\$2.914	\$/mmBtu			
2027	\$3.159	\$2.980	\$/mmBtu			
2028	\$3.271	\$3.045	\$/mmBtu			
2029	\$3.380	\$3.115	\$/mmBtu			
2030	\$3.490	\$3.189	\$/mmBtu			
2031	\$3.596	\$3.267	\$/mmBtu			
Fuel Price Escalation	2.23%	2.25%				
<b>PV Assumptions</b>						
PV Degradation Rate	0.50%	0.50%				
PV Life	25	25				
			<b>Environmental Externalities</b>			
			Environmental Discount Rate	5.30%	5.32%	per year
			Environmental Costs	separate table		separate table
			<b>Economic Assumptions</b>			
			General Escalation Rate	2.23%	2.25%	per year
			<b>Treasury Yields</b>			
			1 Year	2.17%	2.28%	
			2 Year	2.05%	2.50%	
			3 Year	2.01%	2.62%	
			5 Year	2.04%	2.76%	
			7 Year	2.14%	2.86%	
			10 Year	2.25%	2.90%	
			20 Year	2.49%	2.98%	
			30 Year	2.68%	3.07%	

**PRELIMINARY**



# 2020 VOS – Data Input Values

**Table 5. VOS Data table -- required format showing assumptions used in the VOS calculation.**

	2020 Input Data	2019 Input Data	Units		2020 Input Data	2019 Input Data	Units
<b>Economic Factors</b>				<b>Power Generation - Continued</b>			
Start Year for VOS applicability	2020	2019	Year	Other			
Discount Rate (After-tax WACC)	6.36%	6.43%	Percentage	Solar weighted Heat Rate	7,742	7,493	BTU per kWh
<b>Load Match Analysis</b>				Fuel Price Overhead	\$0.004	-\$0.060	\$ per MMBtu
ELCC (no loss)	48.6%	48.6%	% of rating	Generation life	40	40	years
PLR (no loss)	55.2%	55.2%	% of rating	Heat Rate degradation	0.10%	0.10%	per year
Loss Savings - Energy	9.8%	9.8%	% of PV output	O&M cost (first year) - Fixed	\$3.42	\$5.51	per kW-yr
Loss Savings - PLR	12.6%	12.6%	% of PV output	O&M cost (first year) - Variable	\$0.0010	\$0.0010	\$ per kWh
Loss Savings - ELCC	11.0%	11.0%	% of PV output	O&M cost escalation rate	2.00%	2.25%	per year
<b>PV Energy</b>				Reserve planning margin	7.9%	8.2%	
Simulated - First year annual energy		1,452	kWh per kW-AC	Years until new Generation is needed	0	0	
year annual energy			kWh per kW-AC	<b>Distribution</b>			
Actual- First year annual energy	1,563			Capacity-related distribution capital costs	\$96	\$0	\$ per kW
<b>Transmission</b>				Distribution capital cost escalation	2.00%	2.25%	per year
Capacity-related transmission capital cost	\$50.33	\$49.00	\$ per kW	Peak Load (Weather Normalized)	6,420	6,493	MW
<b>Power Generation</b>				Peak Load Growth	0.43%	-0.50%	per year
Peaking CT, simple cycle				<div style="border: 1px solid black; padding: 5px;"> <p><b>NEW SOURCES</b></p> <p>O&amp;M Escalation &gt; IRP Inputs</p> <p>1st Year Production &gt; Actual Production from 200+ Gardens</p> <p>CT &amp; CC Costs &gt; IRP Inputs</p> </div>			
Installed Cost	\$476	\$525	\$/kW				
Heat Rate	9,738	9,978	BTU/kWh				
Intermediate CCGT							
Installed Cost	\$1,022	\$1,051	\$/kW				
Heat Rate	6,547	6,354	BTU/kWh				

# PRELIMINARY



## Solar Weighted Heat Rate

Current Year Calculation		
2019 Calculation Using 2018 Run Data		
	Base Case	Solar
MMBTU NG	32,450	32,275
NG GWh	4,214	4,191
Margin Plant HR	7,700	7,700
Base NG MMBTU	32,450	
FREE Solar NG MWh	4,191	
SWHR	<b>7,742</b>	

Prior Year for Reference		
2018 Calculation Using 2017 Run Data		
	Base Case	Solar
MMBTU NG	54,057	53,646
NG GWh	7,270	7,214
Margin Plant HR	7,436	7,436
Base NG MMBTU	54,057	
FREE Solar NG MWh	7,214	
SWHR	<b>7,493</b>	

<sup>1</sup> Assumed cost for solar is \$0 in these model runs to ensure it is selected

# PRELIMINARY



## 2020 Discount Rate

### 2020 Discount Rate

<u>Capital Structure</u>	<u>Rate</u>	<u>Ratio</u>	Pre-tax	After-Tax
			Weighted	Weighted
			<u>Cost</u>	<u>Cost</u>
Long Term Debt	4.7500%	45.8100%	2.1760%	
Short Term Debt	4.3100%	1.6900%	0.0730%	
Preferred Stock	0.0000%	0.0000%	0.0000%	
Common Equity	9.0600%	52.5000%	4.7570%	
Required Rate of Return			7.0100%	6.3600%
MN Composite Tax rate	28.74%			

### 2019 Discount Rate

<u>Capital Structure</u>	<u>Rate</u>	<u>Ratio</u>	Pre-tax	After-Tax
			Weighted	Weighted
			<u>Cost</u>	<u>Cost</u>
Long Term Debt	4.7500%	45.8100%	2.1760%	
Short Term Debt	4.3100%	1.6900%	0.0730%	
Preferred Stock	0.0000%	0.0000%	0.0000%	
Common Equity	9.2000%	52.5000%	4.8300%	
Required Rate of Return			7.0800%	6.4300%
MN Composite Tax rate	28.74%			

# PRELIMINARY



## 2020 OATT Rate

**Table 5. Avoided Transmission Capacity Cost**

*MISO OATT 5YR Calculation*

	Effective Year	Effective Price	Moving 5YR Avg.	Percent Increase vs. Prior Year
1	2019	51,336	50.33	2.7%
2	2018	47,278	49.00	
3	2017	49,743		
4	2016	54,664		
5	2015	48,610		

**Table 5. Avoided Transmission Capacity Cost**

*MISO OATT 5YR Calculation*

	Effective Year	Effective Price	Moving 5YR Avg.	Percent Increase vs. Prior Year
1	2018	47,278	49.00	0.7%
2	2017	49,743	48.67	
3	2016	54,664		
4	2015	48,610		
5	2014	44,688		



**ATTACHMENT Q**  
**FILED LIVE**

## CERTIFICATE OF SERVICE

I, Lynnette Sweet, hereby certify that I have this day served copies or summaries 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

xx electronic filing

**Docket No.            E002/M-13-867**

Dated this 30<sup>th</sup> day of August 2019

/s/

---

Lynnette Sweet  
Regulatory Administrator

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Ross	Abbey	ross.abbey@us-solar.com	United States Solar Corp.	100 North 6th St Ste 222C  Minneapolis, MN 55403	Electronic Service	No	OFF_SL_13-867_Official
Michael	Allen	michael.allen@allenergysolar.com	All Energy Solar	721 W 26th st Suite 211  Minneapolis, Minnesota 55405	Electronic Service	No	OFF_SL_13-867_Official
David	Amster Olzweski	david@mysunshare.com	SunShare, LLC	1151 Bannock St  Denver, CO 80204-8020	Electronic Service	No	OFF_SL_13-867_Official
Sara	Baldwin Auck	sarab@irecusa.org	Interstate Renewable Energy Council, Inc.	PO Box 1156  Latham, NY 12110	Electronic Service	No	OFF_SL_13-867_Official
Laura	Beaton	beaton@smwlaw.com	Shute, Mihaly & Weinberger LLP	396 Hayes Street  San Francisco, CA 94102	Electronic Service	No	OFF_SL_13-867_Official
Kenneth	Bradley	kbradley1965@gmail.com		2837 Emerson Ave S Apt CW112  Minneapolis, MN 55408	Electronic Service	No	OFF_SL_13-867_Official
Michael J.	Bull	mbull@mncee.org	Center for Energy and Environment	212 Third Ave N Ste 560  Minneapolis, MN 55401	Electronic Service	No	OFF_SL_13-867_Official
Jessica	Burdette	jessica.burdette@state.mn.us	Department of Commerce	85 7th Place East Suite 500 St. Paul, MN 55101	Electronic Service	No	OFF_SL_13-867_Official
Generic Notice	Commerce Attorneys	commerce.attorneys@ag.state.mn.us	Office of the Attorney General-DOC	445 Minnesota Street Suite 1800  St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_13-867_Official
Arthur	Crowell	Crowell.arthur@yahoo.com	A Work of Art Solar	14333 Orchard Rd.  Minnetonka, MN 55345	Electronic Service	No	OFF_SL_13-867_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Timothy	DenHerder Thomas	timothy@cooperativeenergyfutures.com	Cooperative Energy Futures	3500 Bloomington Ave. S Minneapolis, MN 55407	Electronic Service	No	OFF_SL_13-867_Official
James	Denniston	james.r.denniston@xcelenergy.com	Xcel Energy Services, Inc.	414 Nicollet Mall, Fifth Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_13-867_Official
Jason	Edens	jason@rreal.org	Rural Renewable Energy Alliance	3963 8th Street SW Backus, MN 55435	Electronic Service	No	OFF_SL_13-867_Official
Betsy	Engelking	betsy@geronimoenergy.com	Geronimo Energy	7650 Edinborough Way Suite 725 Edina, MN 55435	Electronic Service	No	OFF_SL_13-867_Official
John	Farrell	jfarrell@ilsr.org	Institute for Local Self-Reliance	1313 5th St SE #303 Minneapolis, MN 55414	Electronic Service	No	OFF_SL_13-867_Official
Sharon	Ferguson	sharon.ferguson@state.mn.us	Department of Commerce	85 7th Place E Ste 280 Saint Paul, MN 551012198	Electronic Service	No	OFF_SL_13-867_Official
Matthew D.	Forsgren	mforsgren@greeneespel.com	GREENE ESPEL PLLP	222 S. Ninth Street, Suite 2200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_13-867_Official
Nathan	Franzen	nathan@geronimoenergy.com	Geronimo Energy	7650 Edinborough Way Suite 725 Edina, MN 55435	Electronic Service	No	OFF_SL_13-867_Official
Hal	Galvin	halgalvin@comcast.net	Provectus Energy Development llc	1936 Kenwood Parkway Minneapolis, MN 55405	Electronic Service	No	OFF_SL_13-867_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Allen	Gleckner	gleckner@fresh-energy.org	Fresh Energy	408 St. Peter Street Ste 220 Saint Paul, Minnesota 55102	Electronic Service	No	OFF_SL_13-867_Official
Sean	Gosiewski	sean@afors.org	Alliance for Sustainability	2801 21st Ave S Ste 100  Minneapolis, MN 55407	Electronic Service	No	OFF_SL_13-867_Official
Scott	Greenbert	scott@nautilussolar.com	Nautilus Solar Energy, LLC	396 Springfield Aver, Ste 2  Summit, NJ 07901	Electronic Service	No	OFF_SL_13-867_Official
Timothy	Gulden	timothy.gulden@yahoo.com	Winona Renewable Energy, LLC	1449 Ridgewood Dr  Winona, MN 55987	Electronic Service	No	OFF_SL_13-867_Official
Kimberly	Hellwig	kimberly.hellwig@stoel.com	Stoel Rives LLP	33 South Sixth Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_13-867_Official
Jan	Hubbard	jan.hubbard@comcast.net		7730 Mississippi Lane  Brooklyn Park, MN 55444	Electronic Service	No	OFF_SL_13-867_Official
John S.	Jaffray	jjaffray@jirpower.com	JJR Power	350 Highway 7 Suite 236  Excelsior, MN 55331	Electronic Service	No	OFF_SL_13-867_Official
Linda	Jensen	linda.s.jensen@ag.state.mn.us	Office of the Attorney General-DOC	1800 BRM Tower 445 Minnesota Street  St. Paul, MN 551012134	Electronic Service	No	OFF_SL_13-867_Official
Julie	Jorgensen	juliejorgensen@greenmark solar.com	Greenmark Solar	4630 Quebec Ave N  New Hope, MN 55428-4973	Electronic Service	No	OFF_SL_13-867_Official
Ralph	Kaehler	ralph.kaehler@novelenergy.biz		N/A	Electronic Service	No	OFF_SL_13-867_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Michael	Kampmeyer	mkampmeyer@a-e-group.com	AEG Group, LLC	260 Salem Church Road  Sunfish Lake, Minnesota 55118	Electronic Service	No	OFF_SL_13-867_Official
Brad	Klein	bklein@elpc.org	Environmental Law & Policy Center	35 E. Wacker Drive, Suite 1600  Suite 1600 Chicago, IL 60601	Electronic Service	No	OFF_SL_13-867_Official
Aaron	Knoll	aknoll@greeneespel.com	Greene Espel PLLP	222 South Ninth Street Suite 2200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_13-867_Official
Jon	Kramer	sundialjon@gmail.com	Sundial Solar	3209 W 76th St  Edina, MN 55435	Electronic Service	No	OFF_SL_13-867_Official
Michael	Krause	michaelkrause61@yahoo.com	Kandiyo Consulting, LLC	433 S 7th Street Suite 2025 Minneapolis, Minnesota 55415	Electronic Service	No	OFF_SL_13-867_Official
Dean	Leischow	dean@sunrisenrg.com	Sunrise Energy Ventures	315 Manitoba Ave  Wayzata, MN 55391	Electronic Service	No	OFF_SL_13-867_Official
Thomas	Melone	Thomas.Melone@AllcoUS.com	Minnesota Go Solar LLC	222 South 9th Street Suite 1600 Minneapolis, Minnesota 55120	Electronic Service	No	OFF_SL_13-867_Official
Andrew	Moratzka	andrew.moratzka@stoel.com	Stoel Rives LLP	33 South Sixth St Ste 4200  Minneapolis, MN 55402	Electronic Service	No	OFF_SL_13-867_Official
Rolf	Nordstrom	rnordstrom@gpisd.net	Great Plains Institute	2801 21ST AVE S STE 220  Minneapolis, MN 55407-1229	Electronic Service	No	OFF_SL_13-867_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Jeff	O'Neill	jeff.oneill@ci.monticello.mn.us	City of Monticello	505 Walnut Street Suite 1 Monticello, Minnesota 55362	Electronic Service	No	OFF_SL_13-867_Official
Eric	Pasi	ericp@ips-solar.com	IPS Solar	2670 Patton Rd  Roseville, MN 55113	Electronic Service	No	OFF_SL_13-867_Official
Dan	Patry	dpatry@sunedison.com	SunEdison	600 Clipper Drive  Belmont, CA 94002	Electronic Service	No	OFF_SL_13-867_Official
Jeffrey C	Paulson	jeff.jcplaw@comcast.net	Paulson Law Office, Ltd.	4445 W 77th Street Suite 224 Edina, MN 55435	Electronic Service	No	OFF_SL_13-867_Official
Joyce	Peppin	joyce@mrea.org	Minnesota Rural Electric Association	11640 73rd Ave N  Maple Grove, MN 55369	Electronic Service	No	OFF_SL_13-867_Official
Generic Notice	Residential Utilities Division	residential.utilities@ag.state.mn.us	Office of the Attorney General-RUD	1400 BRM Tower 445 Minnesota St St. Paul, MN 551012131	Electronic Service	Yes	OFF_SL_13-867_Official
David	Shaffer	shaff081@gmail.com	Minnesota Solar Energy Industries Project	1005 Fairmount Ave  Saint Paul, MN 55105	Electronic Service	No	OFF_SL_13-867_Official
Doug	Shoemaker	dougs@charter.net	Minnesota Renewable Energy	2928 5th Ave S  Minneapolis, MN 55408	Electronic Service	No	OFF_SL_13-867_Official
Eric	Swanson	eswanson@winthrop.com	Winthrop & Weinstine	225 S 6th St Ste 3500 Capella Tower Minneapolis, MN 554024629	Electronic Service	No	OFF_SL_13-867_Official
Thomas P.	Sweeney III	tom.sweeney@easycleanenergy.com	Clean Energy Collective	P O Box 1828  Boulder, CO 80306-1828	Electronic Service	No	OFF_SL_13-867_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Lynnette	Sweet	Regulatory.records@xcelenergy.com	Xcel Energy	414 Nicollet Mall FL 7 Minneapolis, MN 554011993	Electronic Service	No	OFF_SL_13-867_Official
Anna	Tobin	atobin@greeneespel.com	Greene Espel PLLP	222 South Ninth Street Suite 2200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_13-867_Official
Pat	Treseler	pat.jcplaw@comcast.net	Paulson Law Office LTD	4445 W 77th Street Suite 224 Edina, MN 55435	Electronic Service	No	OFF_SL_13-867_Official
Daniel P	Wolf	dan.wolf@state.mn.us	Public Utilities Commission	121 7th Place East Suite 350 St. Paul, MN 551012147	Electronic Service	Yes	OFF_SL_13-867_Official