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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</b>	<b>Load Match</b>	<b>Distributed Loss Savings</b>	<b>Distributed PV Value</b>
<i>25 Year Levelized Values</i>	<b>(\$/kWh)</b>	<b>(No Losses)</b>	<b>(%)</b>	<b>(\$/kWh)</b>
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 Cos	\$0.0325	48.6%	10.8%	\$0.0175
Avoided Distribution Capacity Cost	\$0.0041	54.6%	12.4%	\$0.0025
Avoided Environmental Cost	\$0.0359		9.8%	\$0.0394
Avoided Voltage Control Cost				
<u>Solar Integration Cost</u>				
<b>TOTAL</b>				<b>\$0.1136</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	\$0.114	\$0.114	\$0.0927	0.093
2021	0.940	1.022	\$0.114	\$0.107	\$0.0948	0.089
2022	0.884	1.045	\$0.114	\$0.100	\$0.0969	0.086
2023	0.831	1.068	\$0.114	\$0.094	\$0.0991	0.082
2024	0.781	1.092	\$0.114	\$0.089	\$0.1013	0.079
2025	0.735	1.117	\$0.114	\$0.083	\$0.1035	0.076
2026	0.691	1.141	\$0.114	\$0.078	\$0.1058	0.073
2027	0.649	1.167	\$0.114	\$0.074	\$0.1082	0.070
2028	0.611	1.193	\$0.114	\$0.069	\$0.1106	0.068
2029	0.574	1.220	\$0.114	\$0.065	\$0.1131	0.065
2030	0.540	1.247	\$0.114	\$0.061	\$0.1156	0.062
2031	0.508	1.275	\$0.114	\$0.058	\$0.1182	0.060
2032	0.477	1.303	\$0.114	\$0.054	\$0.1208	0.058
2033	0.449	1.332	\$0.114	\$0.051	\$0.1235	0.055
2034	0.422	1.362	\$0.114	\$0.048	\$0.1263	0.053
2035	0.397	1.392	\$0.114	\$0.045	\$0.1291	0.051
2036	0.397	1.423	\$0.114	\$0.045	\$0.1319	0.052
2037	0.351	1.455	\$0.114	\$0.040	\$0.1349	0.047
2038	0.330	1.487	\$0.114	\$0.037	\$0.1379	0.045
2039	0.310	1.521	\$0.114	\$0.035	\$0.1410	0.044
2040	0.291	1.554	\$0.114	\$0.033	\$0.1441	0.042
2041	0.274	1.589	\$0.114	\$0.031	\$0.1473	0.040
2042	0.258	1.625	\$0.114	\$0.029	\$0.1506	0.039
2043	0.242	1.661	\$0.114	\$0.028	\$0.1540	0.037
2044	0.228	1.698	\$0.114	\$0.026	\$0.1574	0.036
				\$1.496		\$1.504

**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%	pear 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
			Reserve planning margin	7.9%	
			Years until new Generation is needed	0	
<b>PV Energy</b>			<b>Distribution</b>		
Simulated - First year annual energy	1,452	kWh per kW-AC	Capacity-related distribution capital costs -System	\$96	\$ per kW
year annual energy		kWh per kW-AC	Capacity-related distribution capital costs - Mpls	N/A	\$ per kW
Actual- First year annual energy	1,563		Capacity-related distribution capital costs - Mtka	N/A	\$ per kW
			Capacity-related distribution capital costs -Edina	N/A	\$ per kW
<b>Transmission</b>			Capacity-related distribution capital costs - SE	N/A	\$ per kW
Capacity-related transmission capital cost	\$50.33	\$ per kW	Capacity-related distribution capital costs -MG	N/A	\$ per kW
<b>Power Generation</b>			Capacity-related distribution capital costs - Newport	N/A	\$ per kW
Peaking CT, simple cycle			Capacity-related distribution capital costs - St. Paul	N/A	\$ per kW
Installed Cost	\$476	\$/kW	Capacity-related distribution capital costs - NW	N/A	\$ per kW
Heat Rate	9,738	BTU/kWh	Capacity-related distribution capital costs - WBL	N/A	\$ per kW
Intermediate CCGT			Distribution capital cost escalation	2.00%	per year
Installed Cost	\$1,022	\$/kW	Peak Load (Weather Normalized)	6,420	MW
Heat Rate	6,547	BTU/kWh	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			Costs			Disc. Costs				
	Guaranteed NG Price	Burner Tip NG Price	Heat Rate	Utility	VOS	p.u. PV Production	Utility	VOS	Discount Factor	Utility	VOS
	\$/mmBtu	\$/mmBtu	mmBtu/kWh	\$/kWh	\$/kWh	(kWh)	(\$)	(\$)	(risk free)	(\$)	(\$)
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>
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**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

<b>Validation: Present Value</b>	<b>\$52</b>	<b>\$52</b>
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**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>
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**Table 11. Economic value of avoided generation capacity cost.**

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

**\$0.0367**

<b>Validation: Present Value</b>	\$721	\$721
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**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					Disc. Costs		
	Capacity Cost	Utility Capacity	PV Capacity	Utility	VOS	PV Production	Utility	VOS	Discount Factor	Utility	VOS
	\$/kW-yr	pu.	kW	\$/kWh	\$/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-vr	(MW)	(\$M)	(\$M)	\$/yr	(MW)	(\$M)	(\$M)	\$/yr
2020	\$115	50	\$6	\$6	\$8				\$7
2021	\$117	50	\$6	\$6	\$8	50	\$5.9	\$5.5	\$7
2022	\$119	50	\$6	\$5	\$8	50	\$6.0	\$5.3	\$7
2023	\$122	51	\$6	\$5	\$8	50	\$6.1	\$5.1	\$7
2024	\$124	51	\$6	\$5	\$8	51	\$6.3	\$4.9	\$7
2025	\$127	51	\$6	\$5	\$8	51	\$6.4	\$4.7	\$7
2026	\$129	51	\$7	\$5	\$8	51	\$6.6	\$4.6	\$7
2027	\$132	52	\$7	\$4	\$8	51	\$6.8	\$4.4	\$7
2028	\$135	52	\$7	\$4	\$8	52	\$6.9	\$4.2	\$7
2029	\$137	52	\$7	\$4	\$8	52	\$7.1	\$4.1	\$7
2030	\$140	52	\$7	\$4	\$8	52	\$7.3	\$3.9	\$7
2031	\$143	52	\$7	\$4	\$8	52	\$7.5	\$3.8	\$7
2032	\$146	53	\$8	\$4	\$8	52	\$7.6	\$3.6	\$7
2033	\$149	53	\$8	\$4	\$8	53	\$7.8	\$3.5	\$7
2034	\$152	53	\$8	\$3	\$8	53	\$8.0	\$3.4	\$7
2035	\$155	53	\$8	\$3	\$8	53	\$8.2	\$3.3	\$7
2036	\$158	54	\$8	\$3	\$8	53	\$8.4	\$3.1	\$7
2037	\$161	54	\$9	\$3	\$8	54	\$8.6	\$3.0	\$7
2038	\$164	54	\$9	\$3	\$8	54	\$8.8	\$2.9	\$7
2039	\$167	54	\$9	\$3	\$8	54	\$9.0	\$2.8	\$7
2040	\$171	54	\$9	\$3	\$8	54	\$9.3	\$2.7	\$7
2041	\$174	55	\$10	\$3	\$8	54	\$9.5	\$2.6	\$7
2042	\$178	55	\$10	\$3	\$8	55	\$9.7	\$2.5	\$7
2043	\$181	55	\$10	\$2	\$8	55	\$9.9	\$2.4	\$7
2044	\$185	55	\$10	\$2	\$8	55	\$10.2	\$2.3	\$7
2039	\$188					55	\$10.4	\$2.2	
				\$95				\$91	

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

Prices			Costs			Disc. Costs	
Utility	VOS	PV Production	Utility	VOS	Discount Factor	Utility	VOS
\$/kWh	\$/kWh	(kWh)	(\$)	(\$)		(\$)	(\$)
\$0.00403	\$0.0041	1,563	\$6	\$6	1.000	\$6	\$6
\$0.00403	\$0.0041	1,555	\$6	\$6	0.940	\$6	\$6
\$0.00403	\$0.0041	1,547	\$6	\$6	0.884	\$6	\$6
\$0.00403	\$0.0041	1,540	\$6	\$6	0.831	\$5	\$5
\$0.00404	\$0.0041	1,532	\$6	\$6	0.781	\$5	\$5
\$0.00404	\$0.0041	1,524	\$6	\$6	0.735	\$5	\$5
\$0.00404	\$0.0041	1,517	\$6	\$6	0.691	\$4	\$4
\$0.00405	\$0.0041	1,509	\$6	\$6	0.649	\$4	\$4
\$0.00405	\$0.0041	1,502	\$6	\$6	0.611	\$4	\$4
\$0.00405	\$0.0041	1,494	\$6	\$6	0.574	\$3	\$3
\$0.00406	\$0.0041	1,487	\$6	\$6	0.540	\$3	\$3
\$0.00406	\$0.0041	1,479	\$6	\$6	0.508	\$3	\$3
\$0.00406	\$0.0041	1,472	\$6	\$6	0.477	\$3	\$3
\$0.00407	\$0.0041	1,464	\$6	\$6	0.449	\$3	\$3
\$0.00407	\$0.0041	1,457	\$6	\$6	0.422	\$3	\$2
\$0.00407	\$0.0041	1,450	\$6	\$6	0.397	\$2	\$2
\$0.00407	\$0.0041	1,443	\$6	\$6	0.373	\$2	\$2
\$0.00408	\$0.0041	1,435	\$6	\$6	0.351	\$2	\$2
\$0.00408	\$0.0041	1,428	\$6	\$6	0.330	\$2	\$2
\$0.00408	\$0.0041	1,421	\$6	\$6	0.310	\$2	\$2
\$0.00409	\$0.0041	1,414	\$6	\$6	0.291	\$2	\$2
\$0.00409	\$0.0041	1,407	\$6	\$6	0.274	\$2	\$2
\$0.00409	\$0.0041	1,400	\$6	\$6	0.258	\$1	\$1
\$0.00410	\$0.0041	1,393	\$6	\$6	0.242	\$1	\$1
\$0.00410	\$0.0041	1,386	\$6	\$6	0.228	\$1	\$1
	\$0.0041		Validation: Present Value			\$80	\$80

**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>
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**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	\$0.114	\$178	\$0.0927	144.912
2021	0.940	1555	1.022	\$0.114	\$166	\$0.0948	138.588
2022	0.884	1547	1.045	\$0.114	\$155	\$0.0969	132.541
2023	0.831	1540	1.068	\$0.114	\$145	\$0.0991	126.757
2024	0.781	1532	1.092	\$0.114	\$136	\$0.1013	121.226
2025	0.735	1524	1.117	\$0.114	\$127	\$0.1035	115.936
2026	0.691	1517	1.141	\$0.114	\$119	\$0.1058	110.877
2027	0.649	1509	1.167	\$0.114	\$111	\$0.1082	106.039
2028	0.611	1502	1.193	\$0.114	\$104	\$0.1106	101.412
2029	0.574	1494	1.220	\$0.114	\$97	\$0.1131	96.987
2030	0.540	1487	1.247	\$0.114	\$91	\$0.1156	92.754
2031	0.508	1479	1.275	\$0.114	\$85	\$0.1182	88.707
2032	0.477	1472	1.303	\$0.114	\$80	\$0.1208	84.836
2033	0.449	1464	1.332	\$0.114	\$75	\$0.1235	81.134
2034	0.422	1457	1.362	\$0.114	\$70	\$0.1263	77.594
2035	0.397	1450	1.392	\$0.114	\$65	\$0.1291	74.208
2036	0.397	1443	1.423	\$0.114	\$65	\$0.1319	75.483
2037	0.351	1435	1.455	\$0.114	\$57	\$0.1349	67.873
2038	0.330	1428	1.487	\$0.114	\$53	\$0.1379	64.911
2039	0.310	1421	1.521	\$0.114	\$50	\$0.1410	62.079
2040	0.291	1414	1.554	\$0.114	\$47	\$0.1441	59.370
2041	0.274	1407	1.589	\$0.114	\$44	\$0.1473	56.779
2042	0.258	1400	1.625	\$0.114	\$41	\$0.1506	54.302
2043	0.242	1393	1.661	\$0.114	\$38	\$0.1540	51.932
2044	0.228	1386	1.698	\$0.114	\$36	\$0.1574	49.666
					\$2,237		\$2,237