

MONTANA-DAKOTA UTILITIES CO.

Before the Public Service Commission of North Dakota

Case No. PU-25-\_\_\_

Direct Testimony  
of  
Brian J. Giggee

1 **Q. Please state your name and business address.**

2 A. My name is Brian J. Giggee and my business address is 400 North  
3 Fourth Street, Bismarck, North Dakota 58501.

4 **Q. By whom are you employed and in what capacity?**

5 A. I am the Director of Electric System Operations and Planning for  
6 Montana-Dakota Utilities Co. (Montana-Dakota).

7 **Q. Please describe your duties and responsibilities with Montana-**  
8 **Dakota.**

9 A. I have managerial responsibility for overseeing the day-to-day  
10 operations of the Company's electric control center, electric system  
11 operations and planning department, and electric communication  
12 department. The electric system operations and planning department is  
13 responsible for the electric resource planning and expansion studies for  
14 the Company.

15 **Q. Please outline your educational and professional background.**

16 A. I hold a Bachelor of Science Degree in Electrical Engineering from  
17 South Dakota School of Mines and Technology. My work experience

1 includes thirteen years as a planning engineer, four years of experience  
2 managing the planning engineers, and two months of managing the  
3 system operations & planning department for Montana-Dakota.

4 **Q. What is the purpose of your testimony in this proceeding?**

5 A. I provide support for the Company's request for an Advance  
6 Determination of Prudence for the Company's purchase of a 49%  
7 undivided interest in the Badger Wind Project as a least cost generation  
8 resource for the Company's integrated electric system. I am also  
9 sponsoring Exhibit No. \_\_\_\_ (BJG-1).

10 **Q. Can you describe the analysis process that Montana-Dakota**  
11 **conducted with Badger Wind Project as part of the 2024 IRP?**

12 A. In the 2024 IRP<sup>1</sup>, summer and winter cases for the current  
13 Midcontinent Independent System Operator (MISO) Resource Adequacy  
14 rules and summer and winter cases for the future MISO direct loss of load  
15 (DLOL) methodology that has been approved by the Federal Energy  
16 Regulatory Commission (FERC) and will go into effect starting with the  
17 2028-2029 MISO Planning Year. Montana-Dakota included the Badger  
18 Wind Project as a supply option in the 2024 IRP as a single sensitivity run  
19 in all four of the cases labeled the "New Wind Opportunity". In all four of  
20 the cases the "New Wind Opportunity" had a lower net present value  
21 (NPV) over the fifty-year study period than each of the four Base Cases.  
22 Only one sensitivity was run in the 2024 IRP as the Badger Wind Project

---

<sup>1</sup> MDU 2024 Integrated Resource Plan in Case No. PU-24-294.

1 was presented to the Company at the later stages of the 2024 IRP  
2 process and was not fully analyzed.

3 **Q. What additional analysis did Montana-Dakota conduct with the**  
4 **Badger Wind Project outside of what was included in the 2024 IRP?**

5 A supplemental analysis in Exhibit No. \_\_\_\_ (BJG-1) was done after  
6 the filing of the 2024 IRP including the Badger Wind ownership option  
7 (122.5 MW) and remainder PPA (27.5 MW) into the 2024 IRP Base Cases  
8 and all sensitivities. In all four cases, the Badger Wind Purchase options  
9 were selected in the modeling and the results provided a lower NPV over  
10 the fifty-year study period than the Base Cases from the 2024 IRP. The  
11 2024 IRP Winter DLOL Base Case, which had the earliest need for a  
12 resource of the Base Cases in the 2024 IRP, had a simple cycle  
13 combustion turbine selected in 2027 for capacity need, but with the  
14 Badger Wind Project options selected and the capacity credit received  
15 from the Badger Wind Project it delays the addition of a new resource until  
16 2033.

17 Additionally, all the 2024 IRP sensitivities in Exhibit No. \_\_\_\_ (BJG-1)  
18 were run for the summer and winter DLOL cases with the ownership and  
19 remainder PPA options for the Badger Wind Project available in the  
20 model. In the Summer DLOL sensitivities with the Badger Wind Project,  
21 the ownership option was selected in all the sensitivities and the PPA  
22 option was selected in all except for the low market and low market/low  
23 natural gas price. The Winter DLOL sensitivities selected the ownership  
24 option in all the sensitivities and the PPA option in all but one of the

1 sensitivities, the increase of renewables by fifty percent and increase of  
2 demand response by ten percent.

3 Q. **What assumption was used for capacity credit for the Badger Wind**  
4 **Project in the modeling?**

5 A. The Badger Wind capacity credits used in the 2024 IRP Summer  
6 and Winter DLOL and supplemental modeling was based off the initial  
7 2023-2024 DLOL class averages that MISO had provided. The summer  
8 DLOL was at eleven percent or 16.5 MW and the winter DLOL was at  
9 sixteen percent or 24 MW. MISO has recently provided updated values  
10 based off the 2025-26 Planning Year LOLE study and the summer DLOL  
11 has decreased to eight percent and the winter DLOL has increased to  
12 twenty-two percent. Providing additional resource capacity for the winter  
13 DLOL season.

14 Q. **What was the modeled annual ownership and PPA cost of the**  
15 **Badger Wind Project?**

16 A. The 35-year annual revenue requirement for the Badger Wind  
17 ownership interest is: **[TRADE SECRET DATA BEGINS]**

1

2

3

4

[TRADE SECRET DATA ENDS]

5 **Q. How will Montana-Dakota utilize Badger Wind Project to meet**  
6 **customer needs?**

7 A. The Badger Wind project will help keep energy prices to Montana-  
8 Dakota's customers as low as possible and provide a hedge relative to  
9 market price volatility. The Company's most recent long-term forecast  
indicates

1 customer energy requirements will be increasing 0.38 percent per year for  
2 the next five years.

3 The amount of energy that Montana-Dakota purchases from the  
4 MISO energy market was about 29 percent, or 967,340 MWhs, in 2023.  
5 With the expiration of a power purchase agreement with the Minnkota  
6 Power Cooperative (Minnkota) on May 31, 2026, Montana-Dakota would  
7 be relying on additional MISO energy market purchases to replace the  
8 657,000 MWh without the Badger Wind Project.

9 The Badger Wind Project is forecasted to provide 683,280 MWh  
10 (558,012 MWh ownership and 125,268 MWh PPA) annually which on an  
11 energy basis would replace the annual energy from the expiring Minnkota  
12 contract. Without the addition of the Badger Wind Project and the expiring  
13 Minnkota contract, Montana-Dakota would be looking at nearly fifty  
14 percent of the energy to serve customers coming from the MISO energy  
15 market.

16 Purchase of an undivided 49% interest in the Badger Wind Project  
17 along with the remainder PPA is a low-cost generation resource  
18 opportunity for Montana-Dakota that provides numerous benefits including  
19 price protection against future MISO energy prices, price protection  
20 against increases in future natural gas prices, greater fuel source diversity  
21 in the Company's generation mix, and the ability to capture significant  
22 value from Federal Production Tax Credits (PTC) for its customers.

23 **Q. Does this conclude your direct testimony?**

24 **A.** Yes, it does.

PUBLIC DOCUMENT - NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

Comparison of 2024 IRP base models with the Badger Wind Ownership/PPA base models

Summer DLOL models		
	Base Case - Summer DLOL	Badger Wind Ownership/PPA
2024		
2025		
2026		Badger Own(122.5 MW), Badger PPA(27.5 MW)
2027		
2028	PP(10 MW)	
2029	PP(10 MW)	
2030	PP(10 MW)	
2031	PP(20 MW)	
2032	PP(20 MW)	PP(10 MW)
2033	Storage(50 MW)	PP(10 MW)
2034		PP(10 MW)
2035		PP(20 MW)
2036		CT(77.9 MW)
2037		
2038		
2039	PP(10 MW)	
2040	PP(10 MW)	
2041	Storage(50 MW)	
2042		PP(10 MW)
2043		PP(10 MW)
NPV (\$M)	\$2,684.72	\$2,561.11
Difference	0.00%	-4.60%

Summer Current RA models		
	Base Case - Summer	Badger Wind Ownership/PPA
2024		
2025		
2026		Badger Own(122.5 MW), Badger PPA(27.5 MW)
2027		
2028	PP(10 MW)	
2029	PP(10 MW)	
2030	PP(10 MW)	
2031	PP(20 MW)	
2032	PP(20 MW)	
2033	Storage(50 MW)	
2034		
2035		
2036		
2037		PP(10 MW)
2038		PP(10 MW)
2039	PP(10 MW)	PP(10 MW)
2040	PP(10 MW)	PP(20 MW)
2041	Storage(50 MW)	Storage(50 MW)
2042		PP(20 MW)
2043		PP(20 MW)
NPV (\$M)	\$2,644.41	\$2,479.84
Difference	0.00%	-6.22%

PUBLIC DOCUMENT - NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

Comparison of 2024 IRP base models with the Badger Wind Ownership/PPA base models

Winter DLOL models		
	Base Case - Winter DLOL	Badger Wind Ownership/PPA
2024		
2025		
2026		Badger Own(122.5 MW), Badger PPA(27.5 MW)
2027	CT(94.8 MW)	PP(10 MW)
2028		PP(10 MW)
2029		PP(10 MW)
2030		PP(10 MW)
2031		PP(20 MW)
2032		PP(20 MW)
2033		Storage(50 MW)
2034		
2035		
2036	PP(10 MW)	PP(10 MW)
2037	PP(20 MW)	PP(10 MW)
2038	PP(20 MW)	PP(20 MW)
2039	PP(10 MW), Wind(100 MW)	PP(20 MW)
2040	PP(20 MW)	CT(94.8 MW)
2041	Storage(50 MW)	
2042	PP(20 MW)	PP(10 MW)
2043	PP(20 MW)	PP(20 MW)
NPV (\$M)	\$2,934.87	\$2,701.82
Difference	0.00%	-7.94%

Winter Current RA models		
	Base Case - Winter	Badger Wind Ownership/PPA
2024		
2025		
2026		Badger Own(122.5 MW), Badger PPA(27.5 MW)
2027		
2028		
2029		
2030		
2031		
2032		
2033		
2034		
2035	PP(10 MW)	
2036	Wind(100 MW)	
2037		
2038		
2039		
2040		
2041	PP(20 MW), Wind(100 MW)	CT(94.8 MW)
2042	PP(10 MW), Storage(50 MW)	PP(10 MW)
2043	PP(20 MW)	PP(20 MW)
NPV (\$M)	\$2,713.27	\$2,554.02
Difference	0.00%	-12.98%

PUBLIC DOCUMENT - NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

Summer DLOL Base Case and Sensitivities with Badger Wind Ownership/PPA option												
	Base Case - Summer DLOL	High Gas +\$2	High Gas +\$5	High Gas +\$7	Low Gas -\$1	High Market +25%	High Market +50%	Low Market -25%	Low Market -25% & Low Gas -\$1	High Market +25% & High Gas +\$5	High Market +50% & High Gas +\$7	High CT
2024												
2025												
2026	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW)	Badger Own(122.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)
2027												
2028												
2029												
2030												
2031												
2032	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)
2033	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	Storage(50 MW)	Storage(50 MW)	PP(10 MW)	PP(10 MW)	Storage(50 MW)	Storage(50 MW)	Storage(50 MW)
2034	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)			PP(20 MW)	PP(20 MW)			
2035	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)			PP(20 MW)	PP(20 MW)			
2036	CT(77.9 MW)	CT(77.9 MW)	CT(77.9 MW)	CT(77.9 MW)	CT(77.9 MW)			CT(77.9 MW)	CT(77.9 MW)			
2037												
2038												
2039												
2040												
2041						PP(20 MW)	PP(20 MW)			PP(20 MW)	PP(20 MW)	PP(20 MW)
2042	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	Wind(100 MW), PP(20 MW)	Wind(100 MW), PP(20 MW)	PP(10 MW)	PP(10 MW)	Wind(100 MW), PP(20 MW)	Wind(100 MW), PP(20 MW)	Solar(50 MW), PP(20 MW)
2043	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(20 MW)	PP(20 MW)	PP(10 MW)	PP(10 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)
NPV (\$M)	\$2,561.11	\$2,561.71	\$2,562.28	\$2,562.62	\$2,541.35	\$2,733.65	\$2,846.93	\$2,321.99	\$2,307.58	\$2,732.44	\$2,859.70	\$2,569.56
Difference	0.00%	0.02%	0.05%	0.06%	-0.77%	6.74%	11.16%	-9.34%	-9.90%	6.69%	11.66%	0.33%

Alternative Resources:  
 PP(XX MW) - Purchase Capacity  
 CT (77.9 MW) - Simple Cycle Combustion Turbine Frame Unit(GE 7E.03 LLI)  
 CT (107.3 MW) - Simple Cycle Combustion Turbine Frame Unit(2xGE 7F.05 - MDU 25% of 429 MW Total)  
 Solar(5 MW) - Self built 5 MW solar  
 Wind(100 MW) - Self built 100 MW wind  
 Wind(50 MW) - Self built 50 MW wind  
 Storage(50 MW) - Self built 50 MW Battery Storage  
 CC(200 MW) - Combined Cycle Combustion Turbine(1x1 GE 75.05)  
 CC(329.7 MW) - Heskett 3 & 4 Expansion to Combined Cycle

Case No. PU-25-  
 (BJG-1)  
 Exhibit No. \_\_\_\_\_  
 Page 3 of 8

PUBLIC DOCUMENT - NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

Summer DLOL Base Case and Sensitivities with Badger Wind Ownership/PPA option Continued											
	Base Case - Summer DLOL	Limit Energy 5 years	Limit Energy 10 years	High Growth	Low Growth	Carbon Tax	Coyote Retire 2032	Greenhouse Gas Rule	Lower RA -10%	Renewable +25% Demand Response	Renewable +50% Demand Response
2024									PP(20 MW)		
2025				PP(20 MW)					PP(20 MW)		
2026	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	MW), Badger PPA(27.5 MW), PP(20 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	MW), Badger PPA(27.5 MW), PP(10 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)
2027				CC(329.7 MW)					CT (77.9 MW)		
2028		CC(200 MW)	CC(200 MW)							Wind(50 MW)	Wind(100 MW)
2029											
2030				Wind(100 MW), PP(20 MW)							
2031				CC(200 MW)							
2032	PP(10 MW)					PP(10 MW)	CT(107.3 MW)	CC(200 MW), PP(20 MW)			
2033	PP(10 MW)					Storage(50 MW)		Storage(50 MW)			
2034	PP(10 MW)						PP(10 MW)		PP(10 MW)	PP(10 MW)	
2035	PP(20 MW)			PP(20 MW)			PP(10 MW)		PP(10 MW)	PP(10 MW)	
2036	CT(77.9 MW)			CC(200 MW)	PP(10 MW)		PP(20 MW)		PP(20 MW)	PP(20 MW)	PP(10 MW)
2037					PP(10 MW)		PP(20 MW)		PP(20 MW)	PP(20 MW)	PP(10 MW)
2038					PP(10 MW)		PP(20 MW)		CT (77.9 MW)	Solar(5 MW), PP(20 MW)	PP(20 MW)
2039				PP(20 MW)	PP(20 MW)		Storage(50 MW)	PP(10 MW)		Storage(50 MW)	PP(20 MW)
2040				CC(200 MW)	PP(20 MW)			PP(10 MW)			Storage(50 MW)
2041		Storage(50 MW)	Storage(50 MW)		Storage(50 MW)	Wind(100 MW), PP(10 MW)	PP(10 MW)	Storage(50 MW)		PP(10 MW)	
2042	PP(10 MW)			PP(10 MW)		Wind(100 MW), PP(10 MW)	PP(20 MW)			PP(20 MW)	PP(10 MW)
2043	PP(10 MW)	PP(10 MW)	PP(10 MW)	Storage(50 MW), PP(20 MW)		PP(10 MW)	PP(20 MW)		PP(10 MW)	PP(20 MW)	PP(20 MW)
NPV (\$M)	\$2,561.11	\$3,312.70	\$3,202.57	\$6,091.35	\$2,410.81	\$4,506.91	\$2,580.37	\$2,962.09	\$2,826.28	\$2,629.13	\$2,666.84
Difference	0.00%	29.35%	25.05%	137.84%	-5.87%	75.98%	0.75%	15.66%	10.35%	2.66%	4.13%

Alternative Resources:  
 PP(XX MW) - Purchase Capacity  
 CT (77.9 MW) - Simple Cycle Combustion Turbine Frame Unit(GE 7E.03 LL1)  
 CT (107.3 MW) - Simple Cycle Combustion Turbine Frame Unit(2xGE 7F.05 - MDU 25% of 429 MW Total)  
 Solar(5 MW) - Self built 5 MW solar  
 Wind(100 MW) - Self built 100 MW wind  
 Wind(50 MW) - Self built 50 MW wind  
 Storage(50 MW) - Self built 50 MW Battery Storage  
 CC(200 MW) - Combined Cycle Combustion Turbine(1x1 GE 75.05)  
 CC(329.7 MW) - Heskett 3 & 4 Expansion to Combined Cycle

PUBLIC DOCUMENT - NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

Winter DLOL Base Case and Sensitivities with Badger Wind Ownership/PPA option												
	Base Case - Winter DLOL	High Gas +\$2	High Gas +\$5	High Gas +\$7	Low Gas -\$1	High Market +25%	High Market +50%	Low Market -25%	Low Market -25% & Low Gas -\$1	High Market +25% & High Gas +\$5	High Market +50% & High Gas +\$7	High CT
2024												
2025												
2026	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)
2027	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)
2028	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)
2029	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)
2030	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)
2031	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)
2032	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)
2033	Storage(50 MW)	Storage(50 MW)	Storage(50 MW)	Storage(50 MW)	CC(200 MW)	Storage(50 MW)	Storage(50 MW)	Storage(50 MW)	Storage(50 MW)	Storage(50 MW)	Storage(50 MW)	Storage(50 MW)
2034												
2035												
2036	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)		PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)
2037	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)		PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)
2038	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)		PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)
2039	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)		PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)
2040	CT(94.8 MW)	CT(94.8 MW)	CT(94.8 MW)	CT(94.8 MW)		Wind(50 MW), PP(20 MW)	Wind(50 MW), PP(20 MW)	CT(94.8 MW)	CT(94.8 MW)	Wind(50 MW), PP(20 MW)	Storage(50 MW)	Storage(50 MW)
2041						Storage(50 MW)	Storage(50 MW)			Storage(50 MW)	Wind(100 MW), PP(10 MW)	Wind(50 MW), PP(20 MW)
2042	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)		PP(20 MW)	PP(20 MW)	PP(10 MW)	PP(10 MW)	PP(20 MW)	PP(10 MW)	PP(20 MW)
2043	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)		PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)
NPV (\$M)	\$2,701.82	\$2,702.15	\$2,702.57	\$2,702.77	\$2,640.46	\$2,885.18	\$2,990.00	\$2,457.06	\$2,442.39	\$2,881.24	\$3,011.87	\$2,707.56
Difference	0.00%	0.01%	0.03%	0.04%	-2.27%	6.79%	10.67%	-9.06%	-9.60%	6.64%	11.48%	0.21%

Alternative Resources:  
 PP(XX MW) - Purchase Capacity  
 CT (53.1 MW) - Simple Cycle Combustion Aeroderivative Unit(GE LM 6000 PF+)  
 CT (94.8 MW) - Simple Cycle Combustion Turbine Frame Unit(GE 7E.03 LLI)  
 CT (109.9 MW) - Simple Cycle Combustion Aeroderivative Unit(GE LMS 100 PB+)  
 CT (116.6 MW) - Simple Cycle Combustion Turbine Frame Unit(2xGE 7F.05 - MDU 25% of 429 MW Total)  
 RICE(44.4 MW) - Reciprocating Engine (4 x 11 MW Wartsila 31DF)  
 Wind(100 MW) - Self built 100 MW wind  
 Wind(50 MW) - Self built 50 MW wind  
 Storage(50 MW) - Self built 50 MW Battery Storage  
 CC(200 MW) - Combined Cycle Combustion Turbine(1x1 GE 75.05)  
 CC(365.4 MW) - Heskett 3 & 4 Expansion to Combined Cycle  
 New Wind(150 MW) - New wind opportunity of 150 MW

Case No. PU-25-  
 Exhibit No. (BJG-1)  
 Page 5 of 8

Winter DLOL Base Case and Sensitivities with Badger Wind Ownership/PPA option Continued											
	Base Case - Winter DLOL	Limit Energy 5 years	Limit Energy 10 years	High Growth	Low Growth	Carbon Tax	Coyote Retire 2032	Greenhouse Gas Rule	Lower RA -10%	Demand Response +5%	Demand Response +10%
2024				PP(30 MW)					PP(50 MW)		
2025				PP(60 MW)					PP(50 MW)		
2026	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	MW, Badger PPA(27.5 MW), PP(70 MW), CT(109.9 MW),	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW), Badger PPA(27.5 MW)	MW), Badger PPA(27.5 MW), PP(30 MW), CT(94.8 MW),	Badger Own(122.5 MW), Badger PPA(27.5 MW)	Badger Own(122.5 MW)
2027	PP(10 MW)	PP(10 MW)	PP(10 MW)	CT(94.8 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)
2028	PP(10 MW)	CC(200 MW)	PP(10 MW)	CC(200 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	Wind(50 MW)	Wind(100 MW)
2029	PP(10 MW)		PP(10 MW)		PP(20 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)		
2030	PP(10 MW)		PP(10 MW)		PP(20 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)	PP(10 MW)		
2031	PP(20 MW)		PP(20 MW)		PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(10 MW)	
2032	PP(20 MW)		CC(200 MW)	CC(200 MW)	PP(20 MW)	PP(20 MW)	CT(116.6 MW)	CC(200 MW), Storage(50 MW)	PP(20 MW)	PP(10 MW)	PP(10 MW)
2033	Storage(50 MW)				Storage(50 MW)	CC(200 MW)			Storage(50 MW)	Storage(50 MW)	Storage(50 MW)
2034											
2035				CC(200 MW)		PP(10 MW)					
2036	PP(10 MW)							PP(20 MW)	PP(10 MW)		
2037	PP(10 MW)			PP(20 MW)	PP(10 MW)			PP(20 MW)	PP(20 MW)		
2038	PP(20 MW)	PP(10 MW)	PP(10 MW)	CC(200 MW)	PP(10 MW)	PP(10 MW)		Storage(50 MW)	PP(20 MW)	PP(10 MW)	
2039	PP(20 MW)				PP(10 MW)				PP(20 MW)	PP(10 MW)	
2040	CT(94.8 MW)	PP(10 MW)	PP(10 MW)	CC(200 MW)	PP(10 MW)		PP(10 MW)		CT(94.8 MW)	PP(10 MW)	PP(10 MW)
2041		Storage(50 MW)	Storage(50 MW)		Storage(50 MW)	Wind(100 MW)	Storage(50 MW)	PP(20 MW)		Storage(50 MW)	Storage(50 MW)
2042	PP(10 MW)	PP(10 MW)	PP(10 MW)	CC(200 MW)	PP(10 MW)		PP(10 MW)	Wind(100 MW), PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(10 MW)
2043	PP(20 MW)	PP(20 MW)	PP(20 MW)		PP(10 MW)		PP(10 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)	PP(20 MW)
NPV (\$M)	\$2,701.82	\$3,383.90	\$3,274.66	\$7,186.52	\$2,573.05	\$4,641.64	\$2,735.71	\$3,118.05	\$2,994.67	\$2,771.19	\$2,824.74
Difference	0.00%	25.25%	21.20%	165.99%	-4.77%	71.80%	1.25%	15.41%	10.84%	2.57%	4.55%

Alternative Resources:  
 PP(XX MW) - Purchase Capacity  
 CT (53.1 MW) - Simple Cycle Combustion Aeroderivative Unit(GE LM 6000 PF+)  
 CT (94.8 MW) - Simple Cycle Combustion Turbine Frame Unit(GE 7E.03 LLI)  
 CT (109.9 MW) - Simple Cycle Combustion Aeroderivative Unit(GE LMS 100 PB+)  
 CT (116.6 MW) - Simple Cycle Combustion Turbine Frame Unit(2xGE 7F.05 - MDU 25% of 429 MW Total)  
 RICE(44.4 MW) - Reciprocating Engine (4 x 11 MW Wartsila 31DF)  
 Wind(100 MW) - Self built 100 MW wind  
 Wind(50 MW) - Self built 50 MW wind  
 Storage(50 MW) - Self built 50 MW Battery Storage  
 CC(200 MW) - Combined Cycle Combustion Turbine(1x1 GE 75.05)  
 CC(365.4 MW) - Heskett 3 & 4 Expansion to Combined Cycle  
 New Wind(150 MW) - New wind opportunity of 150 MW

Badger Wind Ownership/PPA modeling Extreme Weather (Winter DL0L)					2024 IRP modeling Extreme Weather (Winter DL0L)				
	Normal Weather annual costs(\$M)	Extreme Weather annual costs(\$M)	Normal Weather unserved energy (GWh)	Extreme Weather unserved energy (GWh)		Normal Weather annual costs(\$M)	Extreme Weather annual costs(\$M)	Normal Weather unserved energy (GWh)	Extreme Weather unserved energy (GWh)
5th year	115.23	115.29	0	0	5th year	137.37	137.88	0	0.09
10th year	138.74	138.79	0	0	10th year	159.13	160.61	0	0.64
20th year	252.38	255.96	0	0.53	20th year	267.43	271.46	0.06	0.61

**3.3.1. Extreme Weather vs Normal Weather**

In this scenario, the model was set up in EGEAS to reduce the amount of available on-peak and off-peak MISO purchases by one-third what is assumed to normally be available in the first quarter of the year to show the effects of having less energy available from the market under an extreme weather event. Table 3-9 shows the difference in annual costs and unserved energy for years 5, 10, and 20 of the study periods.

Badger Wind Ownership/PPA modeling Natural Gas Shortage (Winter DLOL)

	Base Case unserved energy (GWh)	NG Shortage unserved energy (GWh)	
5th year	0		0.01
10th year	0		0
20th year	0		2.65

IRP 2024 modeling Natural Gas Shortage (Winter DLOL)

	Base Case unserved energy (GWh)	NG Shortage unserved energy (GWh)	
5th year	0		0.58
10th year	0		3.43
20th year	0.06		3.09

**3.3.2. Natural Gas Fuel Delivery Outages**

In this scenario, the model was set up in EGEAS to reduce the amount of available on-peak and off-peak MISO purchases by one-third of what is assumed to normally be available in the first quarter of the year to show the effects of having potentially less energy available from the market in a natural gas fuel delivery outage event, along with increasing the forced outage rate on the MDU owned combustion turbines to show the effect increased outages associated with natural gas supply. Table 3-10 shows the difference in unserved energy for years 5, 10, and 20 of the study periods.