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July 31, 2023

VIA E-FILING
Will Seuffert
Executive Secretary
Minnesota Public Utilities Commission
121 7th Place East, Suite 350
St. Paul, MN 55101-2147

Re: **In the Matter of Minnesota Power's Petition for Approval of the Annual Forecast of Automatic Adjustment Charges for the period of January 2024 through December 2024**
Docket No. E015/AA-23-180
Reply Comments

Dear Mr. Seuffert:

Minnesota Power respectfully submits these Reply Comments in response to the Initial Comments submitted on June 30, 2023, by the Minnesota Department of Commerce, Division of Energy Resources in the above referenced Docket.

Please contact me at (218) 355-3570 or mpodratz@mnpower.com if you have any questions regarding this compliance filing. For all discovery related inquiries please email mpodratz@mnpower.com and discoverymanager@mnpower.com.

Sincerely,

Marcia A. Podratz

Marcia A. Podratz
Regulatory Compliance Principal

MAP:th
Attach.

STATE OF MINNESOTA
BEFORE THE
MINNESOTA PUBLIC UTILITIES COMMISSION

In the Matter of Minnesota Power's Petition for Approval of the Annual Automatic Adjustment Charges for the period of January 2024 through December 2024	Docket No. E015/AA-23-180 **MINNESOTA POWER'S REPLY COMMENTS**

I. INTRODUCTION

On June 30, 2023, the Minnesota Department of Commerce, Division of Energy Resources ("Department") submitted its Comments in the above-referenced Docket.

In these Reply Comments, Minnesota Power provides responses to the Department's requested information:

1. Results of the Midcontinent Independent System Operator ("MISO") Planning Resource Auction and updates to the 2024 Fuel and Purchased Energy ("FPE") Forecast,[1]
2. Adjusted 2024 FPE Forecast and information supporting all changes,[2] and
3. The reasons for the $20.5 million decrease in MISO Market sales between its 2023 and 2024 forecast.[3]

Also, at the end of Section X. Outage Costs – Forced and Planned, the Department mentions additional information to be provided by Minnesota Power in Reply Comments.[4] Minnesota Power clarified with the Department that the additional information to be provided was in reference to the other items previously listed.

[1] Department's June 30, 2023, Comments, page 17.
[2] Ibid.
[3] Ibid, pages 12 and 17.
[4] Ibid, page 16.

II. RESPONSES TO REQUESTED INFORMATION

A. Results of the MISO Planning Resource Auction

This year's MISO Planning Resource Auction capacity prices cleared extremely low. For the 2023 FPE Forecast period (June 2023 to December 2023) the total capacity sale revenue is $23,330. For the 2024 FPE Forecast period (January 2024 to May 2024) the total capacity sale revenue is only $771. This is an immaterial amount of revenue for 2024 and doesn't necessitate an update to the 2024 FPE Forecast.

B. Adjusted 2024 FPE Forecast

There have not been significant changes to Minnesota Power's initial 2024 FPE Forecast submitted on May 1, 2023, that would justify a forecast refresh at this time.

However, after the 2024 FPE Forecast was prepared, Minnesota Power noticed that the planned outage schedule included in Attachment 5 of its May 1, 2023, filing was not the correct version and differed slightly from what was used in the forecast preparation. An updated Trade Secret Attachment 5 with a revised Planned Outages table (on page 6 of 8) and Outage Cost spreadsheet (on page 8 of 8) is attached to these Reply Comments. This updated version reflects the outage timing and duration assumptions that were used in the production cost modeling for generation output in the 2024 FPE Forecast. It does not change the FPE forecast calculation or rates.

C. Decrease in MISO Market Sales

Minnesota Power's projected MISO market sales decreased from a $56.7 million credit in the 2023 FPE Forecast to a $36.2 million credit in the 2024 FPE Forecast, or a $20.5 million decrease.[5] The decrease in projected MISO market sales occurred because there is less Boswell generation forecasted in 2024. Reduced Boswell generation results in less generation available for asset-based sales, which are reflected in MISO market sales. For 2024, MP forecasted about **[TRADE SECRET DATA BEGINS** [redacted]

[5] Ibid, page 12.

TRADE SECRET DATA ENDS] MWh less market sales than 2023 due to Boswell generation being close to **[TRADE SECRET DATA BEGINS** [redacted] **TRADE SECRET DATA ENDS]** MWh less in 2024 compared to 2023, as shown in Table 1 below.

Table 1 – 2023 vs. 2024 Boswell Generation and MISO Market Sales

	2023	2024	Difference
	[TRADE SECRET DATA BEGINS		
Boswell Generation MWhs	[redacted]		
MISO Market Sale MWhs	[redacted]		
		TRADE SECRET DATA ENDS]	
MISO Market Sale Dollars	$ 56,706,435	$ 36,239,777	$ (20,466,658)

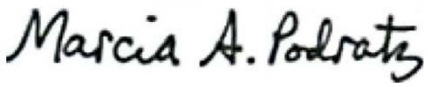
The reduction in Boswell generation is partly due to a longer planned unit outage for scheduled maintenance in 2024 and partly due to assumed lower MISO market prices for energy. The longest planned outage in the 2023 FPE Forecast was **[TRADE SECRET DATA BEGINS** [redacted] **TRADE SECRET DATA ENDS]** days, while the longest planned outage in the 2024 FPE Forecast was **[TRADE SECRET DATA BEGINS** [redacted] **TRADE SECRET DATA ENDS]** days. There was a large decrease in forecasted MISO Locational Marginal Prices ("LMP"), from nearly a $**[TRADE SECRET DATA BEGINS** [redacted] **TRADE SECRET DATA ENDS]** /MWh LMP in the 2023 FPE Forecast to an average $**[TRADE SECRET DATA BEGINS** [redacted] **TRADE SECRET DATA ENDS]** /MWh LMP assumed in the 2024 FPE forecast. There was also an increase in projected delivered coal costs ($/MMBtu) for Boswell generation in the 2024 FPE Forecast compared to the 2023 FPE Forecast. Lower MISO market prices along with higher Boswell fuel costs led to reduced dispatch of Boswell generation. The combination of all of these factors results in less revenue from sales to the MISO market.

III. CONCLUSION

Minnesota Power appreciates the time and diligent work of the Department during this regulatory review process for the 2024 FPE Forecast and looks forward to a Commission hearing on this docket.

Dated: July 31, 2023

Sincerely,



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Forecasted Planned and Unplanned Outages and Forecasted Replacement Power Costs

Docket No. E999/AA-08-995

Outage Methodology for Large Units (Boswell Units 3 & 4)

Planned Outage Methodology

Long-term planned outage schedules for Boswell Energy Center are based on Original Equipment Manufacturer ("OEM") guidelines, FM Global Insurance provider recommendations, and historical plant operational and maintenance records.

Planned outages are scheduled for major turbine maintenance. For Boswell Units 3 and 4, the OEM guidelines recommend a major inspection and maintenance of the turbine every 100,000 hours, or approximately every 10 years. The major turbine maintenance planned outages are typically 8-10 weeks in duration.

The Low Pressure ("LP") turbine, turbine valves, and generator inspections and repairs are scheduled based on the OEM recommended intervals. The OEM recommendations are to inspect valves, generators, and LP turbine every five years. The valve and generator planned outages are typically 4-6 weeks in duration.

Planned outages are scheduled between the major five and ten-year outages for major boiler related outages, including boiler chemical cleans. The major boiler planned outages are typically 2-4 weeks in duration. The actual outage length is adjusted for the known work scope.

Planned outages are then scheduled for inspections, boiler cleaning and other identified work in order to ensure unit reliability in the higher demand seasons of winter and summer. One of the reasons for frequent boiler inspection is to assure that the combustion systems and pollution control equipment are operating as designed to assure compliance. The outages are typically 3-10 days. If the unit has a longer unplanned/forced outage that is close to the next planned outage, the planned outage duration and/or timing may be adjusted due to planned outage work being performed during unplanned/forced outages. The goal is always to minimize the overall number of days a year a unit is unavailable for service.

Planned maintenance outages are scheduled for a minimum rolling 24-month period and updated on a daily basis as needed per MISO requirements. In addition, the 10-year long-term planned outage schedule is reviewed and updated at least annually.

Unplanned Outage Methodology

Minnesota Power utilizes the average of the previous ten years of the NERC Generating Availability Data System ("GADS") Equivalent Unplanned Outage Factor ("EUOF") to calculated unplanned outages. The EUOF is the percent of hours during the year (given period) the unit was in an unplanned outage. The ten-year average ensures one good or bad year does not over- or under-state forecasted unit performance.

Causes of Unplanned Outages

Tube Leaks

Tube leaks are statistically the most common cause of outages in coal fired power plants. The following are the most common causes of tube leaks:

Thermal fatigue manifests itself as cracking of the boiler tubes - sometimes as very small "micro" cracks and sometimes as large cracks. This occurs as a result of changing boiler temperatures, usually when the boiler swings up or down to follow load and when the boilers start up and shut down. This is a similar effect to bending a paper clip back and forth - after so many cycles it eventually breaks. Minimizing boiler "swings" (base loading) helps decrease the impact of thermal fatigue. However, with the energy markets being what they are with the ever increasing impacts of intermittent wind generation, we are seeing more and more swings in output.

Soot blower erosion occurs throughout the boiler in every soot blower location. Soot blowers use high pressure steam or high pressure air to do the cleaning. The ash removal is necessary to prevent the boiler from plugging up. When the boiler plugs up, it restricts air flow which will cause the boiler to come offline and require manual ash and slag removal. Common practices to mitigate soot blower erosion are to add a weld overlay (commonly called "pad welding") to existing tubes, add tube shields which are essential sacrificial attachments to the tubes, change soot blower media pressure (usually not an

option), and replace tubes in the affected areas. The use of the soot blowers is essential in keeping the units on line. Coal composition can differ from mine to mine or even within the same mine. As we look to find the best low cost fuel blend for our customers, certain coals may cause more fouling than others. The increased potential of this fouling requires both the frequency and duration of soot blowing to increase which minimizes the buildup on the boiler tubes. Due to increased soot blowing activities, we have implemented the use of different weld overlay alloys throughout the boiler in an effort to maintain unit reliability.

Fly ash erosion occurs when fly ash and combustion gases pass rapidly across superheated boiler tube surfaces. Because of the abrasiveness of fly ash, the surface of boiler tubes in the high flow areas slowly erode. Many things contribute to the amount of erosion, such as gas path restrictions (plugging - see reasons for soot blowing above), variations in coal quality (higher ash content), and other additives that are added to the fuel mix typically for emission control, etc.

Chemical attack is becoming a common source of tube failures due to the corrosiveness of many of the additives being used to control emissions. When these chemicals come in contact with very hot boiler tubes, their normal corrosiveness is significantly increased. Since there tend to be few options for using alternate less corrosive additives, a common solution is to look at tube materials that perform better in the corrosive environment. This is usually a very expensive fix and can have environmental compliance implications.

Corrosion fatigue occurs as a co-joint action of cyclic strain and a corrosive environment acting to produce failure earlier than pure fatigue or corrosion acting along. Boswell 3 has been especially prone to this due to the original boiler design.

Dissimilar metal welds "DMW" failures occur at the weld juncture where carbon steel or low alloy steels (ferritic side) are welded to stainless or higher alloy steels (austenitic side) and used in high temperature applications. The large difference in coefficient of expansion of the two steels, which is exacerbated by thermal cycling, results in cracking at the toe of the weld joining the two materials. Using austenitic stainless filler material for the DMW

junction, which is required when making these weld joints, also increases the stress on the toe of the weld on the ferritic side of the weldment.

Minnesota Power's boiler reliability program proactively identifies areas of the boilers where tube leaks are likely to occur to reduce the risk of future failures. The program uses a combination of visual inspections, non-destructive testing methods, tube sample analysis, tube failure history, and industry experiences to minimize forced outages due to unexpected tube leaks.

To give some perspective on the challenges with any boiler reliability program, consider the following:

- Boswell-3 boiler has 473,891 ft (89.7 miles) of varying diameter boiler tubes
- Boswell-4 boiler has 779,905 ft (147.6 miles) of varying diameter boiler tubes
- The boiler tube surface area where a leak can occur is several hundred thousand square feet in either boiler.

A tube leak usually begins as a very small hole (0.10 inch or less) in the tube wall which can expand rapidly due to the high temperature and pressure. Considering the huge surface area in a boiler and the very small size of a hole or microscopic crack that results in a tube leak, it is very difficult to effectively screen the entire boiler to prevent all tube leaks. As part of our boiler reliability program, whenever there is an opportunity to get into the boiler to do an inspection – during a forced or schedule outage – critical areas are inspected to evaluate erosion and to determine if repairs are needed. This information is used to plan for future capital expenditures to help minimize future tube leaks. During these inspection opportunities, small leaks are sometimes found and repaired. When a leak occurs, boiler pressure testing is conducted to identify any additional leaks and repair them to avoid a future forced outage. Similar proactive maintenance practices are routinely followed at the other Minnesota Power thermal facilities.

Non-Boiler related outages

Minnesota Power has a Generation Reliability Group that is dedicated to monitoring and improving the reliability of not only the boiler, but also the rotating equipment. The group is comprised of boiler, turbine, pump and pulverizer engineers and specialists as well as specialists in predictive maintenance technologies. They work on a daily basis with the operating and maintenance groups at all facilities to improve the daily operating practices, planning for work and repairs to occur in future outages, and establishing long-term and short-term maintenance plans.

Rotating equipment that is monitored through various predictive technologies is summarized in a monthly reliability meeting with the specific plant. The manager is provided with a monthly scorecard as to their performance as well as identifying concerns and upcoming needs.

Each unit maintains a “hot list” of items that ultimately need to be completed but are awaiting an outage to be addressed because there is an available and safe work around with redundant equipment or operating procedures. Any item that jeopardizes safety or environmental compliance is immediately addressed.

FAC Forecast Assumptions

The FAC Forecast accounts for both planned and unplanned events. The planned outages are based on the long-term planned outage schedule.

Planned Outages: - ***Revised July 31, 2023***

Unit	Start Time	End Time	Duration in Days	MISO #	Reason
	[TRADE SECRET DATA BEGINS				
Boswell 4	[redacted]				
Boswell 3					
Boswell 4					
Boswell 3					
					TRADE SECRET DATA ENDS]

[TRADE SECRET DATA BEGINS [redacted] **TRADE SECRET DATA ENDS]**

Unplanned Outages:

Generation Specifications			
	Econ Min	**Econ Max**	**EUOF** /1
Boswell Unit 3	75 MW	350 MW	7.4%
Boswell Unit 4	185 MW	580 MW	8.5%

/1 The Equivalent Unplanned Outage Factor ("EUOF") is based on a 10-year average.

	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Total
	Boswell 3												
Forced Days	[redacted]												
Forced MWhs													
Outage MWhs Replaced by Purchase													
Purchase Price													
Total Forced Cost													
Unit Cost													
Incremental Cost													
Planned Days													
Planned MWhs													
Outage MWhs Replaced by Purchase													
Purchase Price													
Total Planned Cost													
Unit Cost													
Incremental Cost													
Total Outage Costs													
Total Incremental Costs													

	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Total
	Boswell 4												
Forced Days	[redacted]												
Forced MWhs													
Outage MWhs Replaced by Purchase													
Purchase Price													
Total Cost													
Unit Cost													
Incremental Cost													
Planned Days													
Planned MWhs													
Outage MWhs Replaced by Purchase													
Purchase Price													
Total Cost													
Unit Cost													
Incremental Cost													
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Total Incremental Costs													
Total Outage Costs													
Total Incremental Costs													
	1/	**1/**		**1/**	**1/**	**1/**			**1/**	**1/**		**1/**	

1/ Months that have increased forecasted wind generation, hydro generation and purchases to offset replacement purchase costs and reduce the amount of outage MWh's replaced by purchases.

ORIGINAL:	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Total
Total Outage Costs	[redacted]												
Total Incremental Costs													

STATE OF MINNESOTA	)	AFFIDAVIT OF SERVICE VIA
	) ss	ELECTRONIC FILING
COUNTY OF ST. LOUIS	)	

Tiana Heger of the City of Duluth, County of St. Louis, State of Minnesota, says that on the 31st day of July, 2023, she served Minnesota Power's Reply Comments in **Docket No. E015/AA-23-180** on the Minnesota Public Utilities Commission and the Energy Resources Division of the Minnesota Department of Commerce via electronic filing. The persons on E-Docket's Official Service List for this Docket were served as requested.

Tiana Heger