

*****PUBLIC VERSION*****

**Evaluation of Otter Tail Power Company's Hoot Lake Environmental
Retrofit as the Least Cost Option Compared to Other Alternatives**

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On Behalf of

**South Dakota Commission Staff
Docket No: EL14-082**

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A. EXECUTIVE SUMMARY

On August 29, 2014, Otter Tail Power Company, (“OTP” or “Company”) filed a petition with the South Dakota Public Utilities Commission (“Commission”) for approval of an Environmental Quality Cost Recovery Tariff (“ECR Rider”). OTP is seeking cost recovery related to the Air Quality Control System (“AQCS”) environmental retrofit at Big Stone generating station and the environmental retrofit at Hoot Lake generating station.

On behalf of Commission Staff, KM Energy Consulting, LLC (“KM_EC”) was tasked with evaluating whether both these environmental retrofits were least cost alternatives compared to other alternatives in order to reliably serve energy and capacity needs. The review and evaluation of the AQCS project is reported in a separate document. This report presents the evaluation of the Hoot Lake retrofit. Similar to the Big Stone AQCS project evaluation, this assessment is based on assessing the reasonableness of the Hoot Lake environmental retrofit project at the time the decision was made (2012).

The Hoot Lake plant is solely owned by OTP and consists of two coal-fired units and is located in Minnesota. Unit #2 is 60 MW and came on line in 1959 and Unit #3 is 80 MW and came on line in 1964. For the period 2002-2011, the baseload units had capacity factors of 77% and 74%, respectively. Both units were retrofitted in 1972 with electrostatic precipitators that remove approximately 98% of the fly ash. According to the petition filed at the Commission, the Company states that in order to comply with EPA’s final Mercury and Air Toxins (“MATS”) Rule, it needs to upgrade these precipitators by April 15, 2015.

The Minnesota Public Utilities Commission required that the Company conduct a Baseload Diversification Study to identify whether Hoot Lake should be retired, retrofitted or refurbished. On October 3, 2012, OTP submitted the results of its study. OTP analyzed three Scenarios:

- Scenario 2015, which entailed retiring the plant in 2015 and replacing it with natural gas fired generation;
- Scenario 2020, which consisted of retrofitting the plant to become MATS compliant and retiring the plant in 2020; and
- Scenario 2040, which comprised of refurbishing the plant and implementing additional environmental retrofits post 2020.

OTP stated that it chose 2020 as the threshold year for retirement because it does not expect any other significant environmental regulation based costs prior to this time. The Company's preferred option was Scenario 2020. The cost of the environmental retrofit was estimated at \$10 million in this Scenario. OTP conducted sensitivity analysis for key assumptions including changes in natural gas and coal prices, capital costs, \$/ton CO2 and load growth. A review of the analysis and assumptions indicates that the MATS retrofit is the least cost option as simulated in Scenario 2020. In other words, spending \$10 million to delay retirement of the plant is more cost effective than retiring the plant in 2015 and replacing with new generation at that time. To be clear, the evaluation is focused on the near term decision regarding whether to replace Hoot Lake with an alternative supply side resource or delay the retirement and install the MATS retrofit – it does not render an opinion on whether Hoot Lake should indeed be retired in 2020.

The Hoot Lake environmental retrofit was approved in Minnesota and was supported by North Dakota Commission staff in the proceeding at Minnesota. Further, feedback from the Company indicates that the North Dakota PSC was unanimously in favor of the Company's approach. South Dakota Commission Staff also participated in the Baseload Diversification Study and was supportive of the decision to retrofit Hoot Lake.

B. HOOT LAKE ENVIRONMENTAL RETROFIT

The Hoot Lake plant is solely owned by OTP and consists of two coal-fired units and is located in Minnesota. Unit #2 is 60 MW and came on line in 1959 and Unit #3 is 80 MW and came on line in 1964. Unit #1 was a 7.5 MW coal unit that was retired in 2005. Both of the operating units burn low-sulfur western subbituminous coal and both units were retrofit in 1972 with electrostatic precipitators that remove approximately 98% of the fly ash.¹ According to the petition filed at the MN Commission, the Company states that the EPA's final Mercury and Air Toxins ("MATS") Rule requires that these precipitators be upgraded by April 15, 2015.

OTP also states in the petition that it reviewed various compliance options including retiring Hoot Lake in 2015, refurbishing Hoot Lake to operate as a Coal Unit for long-term operation, or installing minimal cost upgrades and planning for retirement in the 2020 timeframe.

¹ See OTP's Baseload Diversification Study submitted to the Minnesota Public Utilities Commission in docket E017/RP-10-623 on October 3, 2012, page 9.

This analysis was conducted in order to fulfill the Minnesota Public Utility Commission's order point associated with the Company's 2010 IRP to file a Baseload Diversification Study ("BDS") with a special focus on evaluating retirement and repowering options for the Hoot Lake plant.² This study was submitted to the MN Commission on October 3, 2012. At the time the study was submitted, the Hoot Lake MATS environmental retrofit was estimated to cost \$10 million.

C. RESEARCHABLE ISSUES REGARDING THE EVALUATION OF THE HOOT LAKE MATS RETROFIT

To ascertain whether the MATS retrofit is the least cost option compared to other alternatives, the following issues were examined:

1. Energy and capacity needs from a load perspective
2. Scenarios and sensitivity analysis conducted

Similar to the OTP AQCS evaluation, the evaluation was conducted based on the circumstances surrounding the decision to implement the MATS retrofit in 2012.

1. ENERGY AND CAPACITY NEEDS

The Hoot Lake plant fulfills 20% of OTP's capacity and energy needs. It is a baseload plant with a 10-year average capacity factor for the period 2002-2011 of 77% and 74% (including overhaul years) for unit #2 and #3, respectively. Figure 6 in the BDS also shows that on average, both the units have had high availability factors. OTP uses an econometric forecasting model to forecast a 15 year outlook for demand and energy for each of the customer classes except pipeline customers. The demand and energy growth for the pipelines is added separately based on communications with the pipeline customers. Once the base energy and demand forecast is complete, it uses the confidence interval bands to develop a low case and a high case. The growth rates for energy and demand included in the BDS are similar to the rates used in the 2010 IRP which are evaluated in the January 25, 2013 report regarding the Big Stone AQCS project. The reference case for demand and energy in the 2010 IRP has a growth rate of 1.65% and 1.66% for demand and energy, respectively. In the BDS, the growth rates are 1.69%

² See Minnesota Commission Order issued on February 9, 2012, in docket E017/RP-10-623

and 1.75% for demand and energy respectively³. The differences are largely attributable to changes in pipeline demand and energy growth. In the 2010 IRP, the near term growth was higher and in the BDS the growth rate is higher in the later years. The Department of Commerce in Minnesota conducted a statistical analysis comparing the energy and demand forecast used in the 2010 IRP for the Big Stone AQCS project to the Hoot Lake MATS project in the BDS in 2012 and concluded that the revised forecasts in 2012 fall within the confidence interval bands from 2010.⁴

Without retrofitting Hoot Lake to become MATS compliant, the plant would need to be retired in 2015. If that were to occur, a capacity deficiency of 105 MW occurs in 2015 (*See* Figure 4, BDS). Without Hoot Lake, OTP would need to procure, on average, roughly 570,000 MWh of energy. *See* response to Commission Staff's data request 3-1. Thus, the Company would be deficient from an energy and capacity perspective without taking action to either retrofit existing generation or acquire new supply side resources, or a combination of both. There is a need for supply side resources to reliably serve native load requirements.

2. SUPPLY OPTIONS AND SCENARIOS CONSIDERED

The Company evaluated the following three Scenarios:

- a. **Scenario 2015 – Expedited Retirement:** This Scenario consisted of retiring Hoot Lake in 2015 and replacing it with natural gas generation. The Company evaluated alternatives such as boiler conversion to natural gas, simple cycle and combined cycle generation. OTP reported that while this would eliminate the estimated \$10 million for the MATS retrofit, such an action would result in spending over \$200 million prior to 2020, the year when it finds it necessary to replace Hoot Lake. The costs are associated with building a combined cycle plant and adding natural gas and additional transmission infrastructure in its place.
- b. **Scenario 2020 – Expected Retirement:** This is the Company's preferred Scenario and consisted of deferring any new plant investment by five years and implementing the \$10 million MATS retrofit. OTP also stated that deferring the cost of replacing the plant with

³ *See* BDS Appendix C, page 4, Figure 26

⁴ *See* Department of Commerce Comments submitted to Minnesota Commission on November 20, 2012, in docket E017/RP-10-623

new generation prevents an overlapping of the associated capital expenditures with cost recovery for the Big Stone AQCS project.

- c. **Scenario 2040 – Long Term Coal Operation:** This Scenario consisted of refurbishing the facility for long term operation and included the MATS retrofit, as well as an additional \$125 million to meet likely environmental regulations and upgrading equipment for reliable operations for another 20 years.

OTP indicated that it chose 2020 as the threshold year for replacing Hoot Lake with new generation because prior to this year, it does not expect any significant costs associated with environmental regulations. The table below shows a summary of the various potential air, water and solid waste related environmental regulations that were considered at the time the BDS was submitted.⁵ As shown in this table, OTP expected at that time that there were potentially three EPA regulations – revised Cross State Air Pollution (“CSAPR”) Rule, Mercury and Air Toxins (“MATS”) Rule and Clean Water Act 316(b) Rule, that would potentially impact Hoot Lake prior to 2020.

With respect to CSAPR, the Company included the SO₂ and NO_x \$/ton estimates from EPA (see Figure 32, Appendix C). At the time the study was being conducted, the D.C. Circuit Court’s decision was pending and the Company included these costs.

With respect to MATS, the Company included the retrofit regarding the precipitators as discussed earlier.

With respect to the Clean Water Act, the Company expects there to be minimal impact, especially prior to 2020.⁶

⁵ See Figure 7, BDS report, page 12.

⁶ See Appendix A, BDS report for more details regarding the assessment of federal and state environmental regulations.

Table 1: Environmental Rule Impacts to Hoot Lake and Likelihood of Impact Prior to 2020⁷

Rule	Status	Anticipated Hoot Lake Plant Impact	Anticipated Compliance Timeframe	Likelihood of Rule impact prior to 2020 (Capital\$)	Likelihood of Rule impact prior to 2020 (Operating\$)
Acid Rain Program	Final	Maintain banked allowances (SO ₂); Operate existing low NO _x burners	Ongoing	None	None
2010 SO ₂ and NO ₂ NAAQS	Final	Low impact anticipated; Minnesota has no monitored violations	2017 - 2022	Low	Low
Clean Air Interstate Rule	Final	None – Rule stayed for the State of Minnesota	None	None	None
Cross-State Air Pollution Rule	Vacated	Rule would have required SO ₂ allowance purchases	Unknown	Low	Possible (costs included in analysis starting in 2013)
Regional Haze Program – Best Available Retrofit Technology	Final – EPA Approved MN SIP	None – HLP2 not BART eligible and HLP3 deemed not subject to BART	None	None	None
Regional Haze Program – SIP Revisions	Next MPCA SIP due by July 31, 2018	Likely reductions of SO ₂ , NO _x , and PM	Post 2020	Low	Low
Mercury and other Hazardous Air Pollutants (MATS)	Final	Requires PM and mercury reductions, possibly HCl	April 2015	Yes (included in analysis)	Yes (included in analysis)
Minnesota TMDL	Final	70% reduction in mercury air emission; Compliance achieved through MATS	2025	Included (MATS Rule)	Included (MATS Rule)
Greenhouse Gas Regulation – Tailoring Rule	Final	PSD Review for projects that result in a significant net CO ₂ increase	No PSD projects planned	Low	Low
Clean Water Act Section 316(b)	Proposed Rule	Unknown – EPA issued a NODA to request further comment on proposed rule. Final rule expected June 2013.	Up to 8 years after final rule	Moderate \$0 -\$2 million	Moderate
Effluent Guidelines	Proposed Rule Expected Nov. 2012	Unknown	Up to 5 years after final rule	Low	Low
Coal Combustion Residuals	Proposed Rule	Unknown – EPA proposed two significantly different options. Impact to HLP could be low due to managing an active dry ash disposal site with a synthetic liner and leachate collection.	Unknown – pending final rule	Low	Low - additional costs included after 2020

Legend: Air related Water related Solid waste related

3. ROBUSTNESS TESTING

The BDS provides the assumptions used for the various inputs in the model including load growth, capital cost assumptions of various alternatives, fuel prices, emission prices and

⁷ See BDS report, page 12

costs associated with additional natural gas and transmission infrastructure required if Hoot Lake were to be replaced by a natural gas alternative.⁸ The Company assumed costs per KW of larger sized generation than a one-for-one replacement and a 50% ownership in the generic projects such as simple cycle and combined cycle generation. Since larger units have economies of scale savings, this is a reasonable assumption. For the purposes of this analysis and for siting purposes, it is also reasonable to assume that the natural gas option would be constructed at Hoot Lake. The \$/KW assumptions used for the supply side alternatives in the reference case are reasonable and as follows:

- MATS Compliance - \$67/KW
- Simple Cycle - \$575/KW
- Combined Cycle - \$1,054/KW
- Natural Gas Conversion - \$105/KW

The cost to refurbish Hoot Lake and potential compliance with environmental regulations post 2020 was estimated at \$916/KW.

Similar to the 2010 IRP study, the Company obtained natural gas and other fuel price forecasts from Wood Mackenzie, a consulting firm that is known in the industry for providing such forecasts.

OTP ran 126 sensitivities that included low, mid and high cases for changes in load growth, capital costs, externalities and fuel costs. It is important not to rely on a single point estimate when dealing with forecasts since there are so many assumptions inherent in the analysis. Robustness testing is critical so it can be verified that under a range of assumptions, a particular scenario is predominantly least cost.

The results of the sensitivity analysis are included in Exhibit 1. This Exhibit shows the incremental differences in the various sensitivity cases of the Present Value of the Revenue Requirements (“PVR”) associated with Scenario 2015 and Scenario 2040 when compared with Scenario 2020. The figure shows the results of the modeling analysis using (a) Zero externalities,

⁸ [Begin Confidential]

[End confidential] (See Appendix B, BDS).

(b) \$16/ton CO2 assumption starting in 2023 and (c) \$21.50/ton CO2 assumption starting in 2012. These various assumptions stemmed from either complying with requirements from various jurisdictions in which OTP serves loads or industry expert perspectives.⁹ The Zero externality assumption complies with North Dakota statutes that do not allow the inclusion of externalities.¹⁰ OTP used the \$16/ton CO2 assumption in its reference case to be consistent with Wood Mackenzie's inclusion of this assumption in its fuel price forecasts. The \$21.50/ton CO2 price starting in 2012 was used to comply with the Minnesota Commission's requirements. It should be noted that in 2012, there was no proposed rule from EPA regarding CO2. There are several insightful observations from this figure:

- a) Scenario 2020, which entails the \$10 million MATS retrofit is the least cost under the majority of the sensitivities conducted.
- b) If externalities are not considered at all, Scenario 2020 is least cost across the ranges of (a) load assumptions, (b) capital costs, and (c) 25%-50% lower natural gas prices than the reference case.¹¹ Further, refurbishing Hoot Lake (Scenario 2040) is least cost if natural gas prices included in the reference case were to increase by 25%-50%. Scenario 2015, which entails shutting down Hoot Lake in 2015 and replacing with natural gas generation is not least cost in any of the sensitivity cases including a 50% reduction in natural gas prices as compared to the reference case.
- c) If the \$16/ton CO2 assumption is used starting 2023, Scenario 2020 is least cost in all cases except if there was a 50% reduction in natural gas prices.
- d) If the \$21.50/ton CO2 assumption is used starting 2012, Scenario 2020 is least cost in the majority of cases. However, Scenario 2015 is least cost in a handful of cases if natural gas prices are 25%-50% lower, if there is low load growth, or market purchases are not limited to the first five years of the study horizon.

⁹ OTP fulfills load requirements for customers in North Dakota, South Dakota and Minnesota. In rough terms, 50% of its load is in Minnesota, 40% in North Dakota and 10% in South Dakota.

¹⁰ North Dakota Century Code states: 49-02-23. Consideration of environmental externality values prohibited. The commission may not use, require the use of, or allow electric utilities to use environmental externality values in the planning, selection, or acquisition of electric resources or the setting of rates for providing electric service. Environmental externality values are numerical costs or quantified values that are assigned to represent either:

1. Environmental costs that are not internalized in the cost of production or the market price of electricity from a particular electric resource; or
2. The alleged costs of complying with future environmental laws or regulations that have not yet been enacted

¹¹ See Figure 8 of the BDS for range of natural gas price sensitivity cases.

Overall, the results demonstrate that Scenario 2020 that includes the \$10 million MATS retrofit is least cost. Alternatives other than Scenario 2020 are least cost primarily at two ends of the spectrum, i.e. (a) when natural gas prices are significantly lower than the reference case combined with higher CO2 costs starting in 2012 or (b) when there is no carbon regulation and natural gas prices are significantly higher. Since CO2 based regulation was not in place in 2012, related results would be unlikely. The MN Department of Commerce also conducted an analysis using \$21.50/ton CO2 starting in 2017 and found that the Scenario 2020 was least cost.¹² In the cases with no CO2 costs, all least cost scenarios include MATS compliance costs (Scenario 2020 and Scenario 2040).

Based on the foregoing discussion, the MATS compliance retrofit is least cost. Further, such an action will maximize the use of the existing plant which has demonstrated high availability factors and it will eliminate the potential of overlapping of cost recovery with the Big Stone AQCS project from a rate impact perspective. The near term cost expenditures of retiring the plant in 2015 and replacing with natural gas fired generation is estimated over \$200 million and would adversely impact ratepayers if these costs were recovered contemporaneously with the AQCS costs.¹³ It is important to note, however, that the evaluation is focused on the near term decision regarding whether to replace Hoot Lake with an alternative supply side resource or delay the retirement and install the MATS retrofit – it does not render an opinion on whether Hoot Lake should indeed be retired in 2020.

The implementation of the Hoot Lake MATS retrofit was approved by the Minnesota Commission. The North Dakota Commission staff submitted comments in support of the MATS retrofit as well.¹⁴

4. UPDATE -2014

In the petition submitted by the Company on August 29, 2014, OTP stated that it expects the MATS retrofit to cost approximately \$8.2 million including AFUDC, \$1.8 million lower than

¹² In November 2012, the revised Minnesota Commission CO2 value approved November 2, 2012 in Docket No. E999/CI-07-1199 deferred the starting date of the \$21.50/ton reference call CO2 value from 2012 to 2017; see Department of Commerce Comments submitted on November 30, 2012 in docket E017/RP-10-623

¹³ See BDS report page 16

¹⁴ See North Dakota Commission staff comments submitted on November 14, 2012; See also response to Commission Staff's data request 2-1.

the amount estimated in 2012. With respect to impacts related to EPA's proposed 111(d) rule, the Company also stated in response to a Commission staff discovery request that since the plant is planned to be retired in the 2020 timeframe, it is highly unlikely that there will be any implications of applying the 111(d) rule to the plant. *See* response to Commission Staff's data request 2-2.

5. CONCLUSION

The Hoot Lake MATS project is the least cost alternative near term compared to other alternatives in order to reliably serve energy and capacity needs. Further, the retrofit will maximize the use of the existing plant which has demonstrated high availability factors and will reduce overlapping cost recovery with the Big Stone AQCS project from a rate impact perspective. The Company expects the Hoot Lake MATS retrofit to cost less than the amount estimated in 2012 and believes it is highly unlikely there will be any implications of applying EPA's 111(d) rule to the Hoot Lake plant.