

# Update to Otter Tail IRP and Supplemental IRP Review Report

*Prepared for:*

NORTH DAKOTA PUBLIC SERVICE  
COMMISSION  
Bismarck, North Dakota



One Campbell Plaza  
St. Louis, Missouri 63139  
314-781-7770

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Update to Otter Tail IRP and Supplemental IRP Review Report  
CDG Engineers  
Kevin Cox

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## INTRODUCTION/BACKGROUND

Upon review of CDG's "Otter Tail Integrate Resource Plan (2021) and Supplemental Integrated Resource Plan (2023) Review and Analysis" report (Report), CDG in discussions with Otter Tail, discovered that in modeling Otter Tail's system, one generic resource was included with inaccurate capital costs. The prior Report included results derived from modeling fractional and full unit combustion turbines (CT). However, in setting up the model, the fractional 1/4-sized CT the model only included capital for the first year of the study, resulting in no capital costs assigned when the unit was selected in 2033.

The ND Alternate Preferred Plan remains the same except that no fractional CT is added in 2033. This update reflects the correct capital cost for the fractional CT and updates the discussion in the initial review.

## UPDATED MODELING

The modeling performed in the Report remains largely unchanged. The "Surplus/Replacement Transmission Availability", the "Preferred Plan", and the "Extreme Modeling/Reliability Modeling" sections found in the prior Report are updated and discussed in the following sections.

### Surplus/Replacement Transmission Availability Update

The expansion plan shown in Table 6 of the Report is updated in Table 1 below. The "Same Case with Generation Agnostic Replacement/Surplus Generation" case is the resource plan that is selected when the Base Case is allowed to select resources other than wind and solar (i.e., thermal resources). The plan builds less capacity with any new capacity additions deferred to later in the IRP planning period. Compared with the base case, the new plan results in 50MW of additional solar generation and in 100MW of less wind generation at a lower cost. Other than the lack of the CT resource, this result is consistent with the prior Report.

Table 1 - Expansion Plan for Generation Agnostic Replacement Generation (Table 6 in original Report)

		<b>Remodeled Base Case (Corrected for PRMR)</b>	<b>Same Case with Generation Agnostic Replacement/Surplus Generation</b>
<b>Withdraw from Coyote 12/31/2040</b>	<b>NPVRR (\$000)</b>	1,907,771	1,906,654
	<b>2023</b>	Hoot Lake Solar	Hoot Lake Solar
	<b>2024</b>		
	<b>2025</b>	Wind Repowers	Wind Repowers
	<b>2026</b>		
	<b>2027</b>		
	<b>2028</b>	25 MW Solar – Surplus+Cap ITC	25 MW Solar – Surplus+Cap ITC
	<b>2029</b>		
	<b>2030</b>		
	<b>2031</b>	25 MW Solar - Surplus+Cap, ITC 50 MW Wind - Generic, PTC	50 MW Wind - Generic, PTC
	<b>2032</b>	125 MW Solar - Surplus, ITC 125 MW Solar - Surplus+Cap, ITC 150 MW Wind - Generic, PTC	200 MW Solar - Surplus, ITC 125 MW Solar - Surplus+Cap, ITC
	<b>2033</b>		
	<b>2034</b>		50 MW Wind - Generic
	<b>2035</b>		
	<b>2036</b>		
	<b>2037</b>		

## Preferred Plan Update

The ND Alternate Preferred Plan was rerun with the corrected 1/4 CT capital costs as well as the ITC/PTC extension (reflecting the safe harbor provisions through 2034). The updated expansion plan is shown in Table 2 as Scenario 3 (labeled Table 12 in the prior Report). The plan differs from the prior ND Alternate Preferred Plan in that it does not select a CT in 2033. However, the PVRR is approximately \$46.4M less than Otter Tail's Preferred Plan.

CDG also ran a production cost simulation of an expansion plan sent by Otter Tail representing the updated modeling of the CT resource. This modeling is close to the ND Alternate Preferred Plan, but with the addition of a 25MW solar resource in 2026 and the replacement of 50 MW of wind with 50 MW solar in 2031. This expansion plan is more costly and adds more resources and is shown in Table 2 as Scenario 4. CDG then ran another expansion plan with the 2026 solar plant moved to 2034 (Scenario 5). The rationale for running this model was to isolate the economic effect of the 2026 solar addition. Both runs have a higher cost than the updated ND Alternate Preferred Plan and moving the 2026 solar plant to 2034 slightly decreased the revenue requirements across the IRP planning period.

Table 2 – Expansion Plans for Base Case and Preferred Plans (Table 12 from original report)

Scenario #		1	2	3	4	5
Scenario Name		<i>Otter Tail Base Case (As Filed)</i>	<i>Otter Tail Preferred Plan (As Filed)</i>	<i>ND Alternate Preferred Plan (Updated)</i>	<i>Otter Tail Updated Expansion Plan - Production Cost</i>	<i>Otter Tail Updated Expansion Plan with delayed 2026 Solar - Production Cost</i>
	NPVRR (\$000)	1,966,608	1,949,704	1,903,324	1,904,972	1,904,726
Delta From Scenario 2	(\$000)	16,904	-	-46,380	-44,732	-44,978
	2023	Hoot Lake Solar	Hoot Lake Solar	Hoot Lake Solar	Hoot Lake Solar	Hoot Lake Solar
	2024					
	2025	Wind Repowers	Wind Repowers	Wind Repowers	Wind Repowers	Wind Repowers
	2026				25 MW Solar – Surplus+Cap, ITC	
	2027		100 MW Solar – Surplus+Cap, ITC			
	2028		50 MW Solar – Surplus, ITC 50 MW Solar – Surplus+Cap, ITC			
	2029	50 MW Solar – Surplus+Cap, ITC 300 MW Wind – Generic, PTC	200 MW Wind – Generic, PTC			
	2030		100 MW Solar – Surplus, ITC			
	2031	25 MW Surplus Battery, ITC	150 MW Wind – Generic, PTC	50 MW Wind – Generic, PTC	50 MW Solar – Surplus+Cap, ITC	50 MW Solar – Surplus+Cap, ITC
	2032	150 MW Solar – Surplus, ITC 100 MW Solar – Surplus+Cap, ITC 25 MW Surplus Battery, ITC 100 MW Wind – Generic, PTC	100 MW Solar – Surplus, ITC 25 MW Surplus Battery, ITC			
	2033					
	2034			150 MW Solar Surplus+Cap, ITC 250 MW Wind – Generic, PTC	125 MW Solar Surplus+Cap, ITC 250 MW Wind – Generic, PTC	150 MW Solar Surplus+Cap, ITC 250 MW Wind – Generic, PTC
	2035					
	2036					
	2037				72 MW Partial CT	72 MW Partial CT

## Extreme Weather Modeling/Reliability Modeling

The reliability modeling was updated to reflect the new expansion plan for the ND Alternate Preferred Plan. The primary change to the expansion plan was the removal of a 144MW CT in 2033. This dispatchable resource had a significant impact on the number of Loss of Load Hours (LOLH) as shown in Figure 1 (Figure 6 of the original Report). The LOLH for the ND Alternate Preferred Plan and the Otter Tail Preferred Plan are similar despite the Otter Tail Preferred Plan adding 325MW more capacity and having a \$46 Million higher NPVRR in the IRP period.

Figure 2 shows the impact of reliability on the 2035 annual revenue requirements. Because the capital costs for the CT were understated in the original report this skewed the overall revenue requirements showing a lower value. With the CT removed in the updated expansion plan, the ND Alternate Preferred Plan's 2035 revenue requirements (Figure 2 or Figure 7 of the original Report) are now similar to the Otter Tail 2040 Preferred Plan.

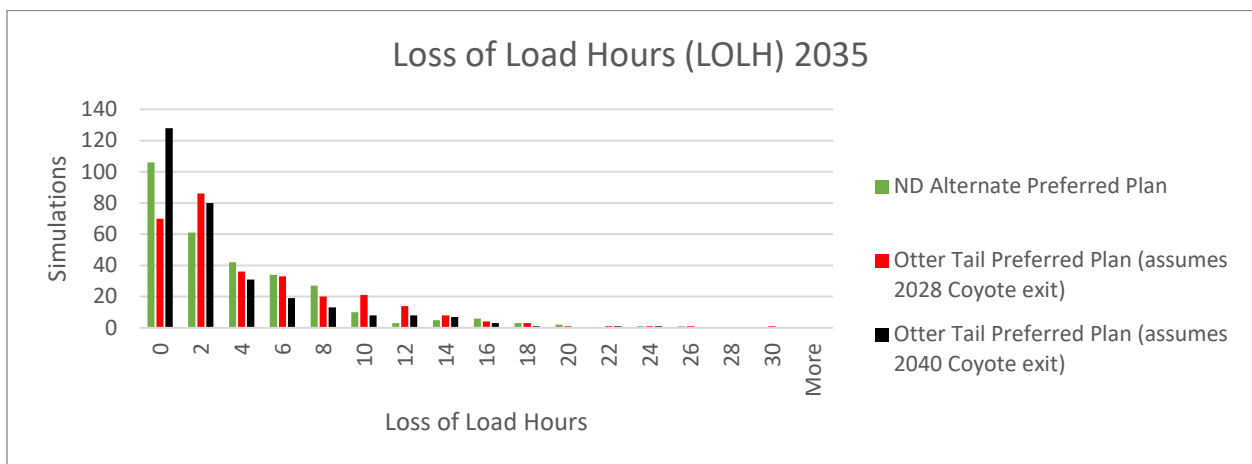


Figure 1 - Distribution of Loss of Load Hours with Stochastic Simulation (Figure 6 of original Report)

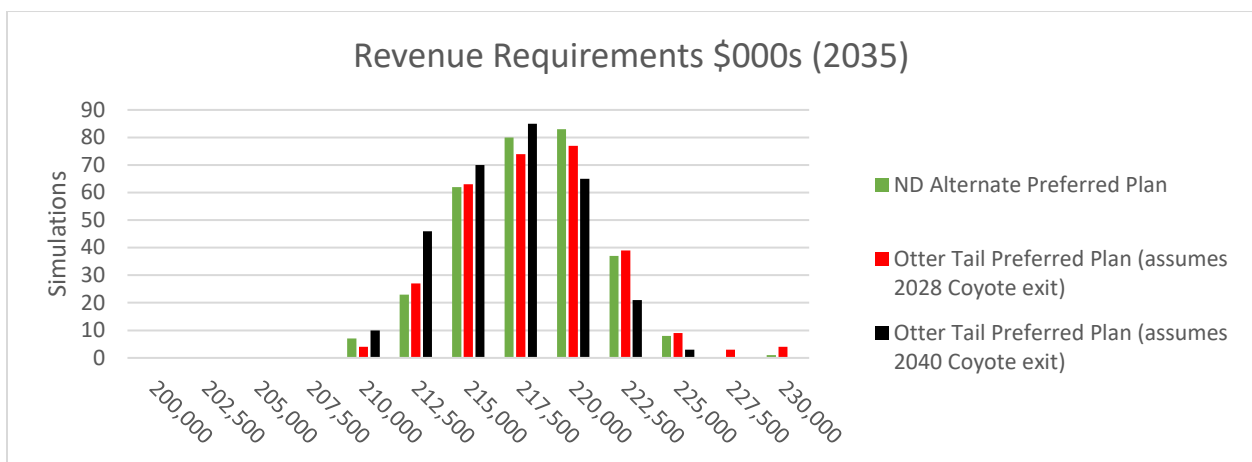


Figure 2 - Distribution of Revenue Requirements with Stochastic Simulation (Figure 7 of original Report)

## UPDATED CONCLUSION/RECOMMENDATIONS

The modeling updates did not significantly alter the conclusions and recommendations of the Report. Despite changes to the expansion plan the Otter Tail Preferred Plan adds more generation than is necessary to meet its PRMR and is more costly than the ND Alternate Preferred Plan during the IRP period. The Otter Tail Preferred Plan relies heavily on solar resources (earlier than is demonstrated in optimally modeled simulations), which provide little or no capacity towards its PRMR. These additions as well as the preparation of adding 200 MW of wind the year after its 5-year action plan is not economic. The ND Alternate Preferred Plan adds none of these resources at a lower cost. With the ND Alternate Preferred Plan not including a dispatchable resource during the IRP period, the reliability is similar to the Otter Tail Preferred Plan. This indicates that the addition of a dispatchable resource may still be necessary to improve reliability.

The updated modeling described in this update resulted in some changes to the ND Alternate Preferred Plan; however, the recommendations of the original Report are still valid. The recommendations from the original Report will serve to offer a more cost-effective 5-year action plan and address the future reliability of North Dakota's energy infrastructure.