Consulting Agreement Study

Completed for

[redacted]

("Transmission Customer")

Proposed Transmission

PacifiCorp East

[redacted]

November 2016

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1.0 Description

Transmission Customer and PacifiCorp Transmission are parties to a Transmission Consulting Study Agreement ("Agreement"). The Agreement allows for the Transmission Customer to engage PacifiCorp Transmission for transmission planning consulting services where PacifiCorp shall act as Transmission Customer's consultant to evaluate specific study requests submitted from time to time by Transmission Customer, and provide high level descriptions and general cost estimates of facility requirements, for possible Network Resource designations or terminations.

In accordance with Section 2 of the Agreement, Transmission Customer requests that PacifiCorp Transmission provide assistance in evaluating the following potential wind resource (as identified and briefly summarized below):

1. The proposed 149.50 megawatt wind facility ("[redacted]") delivering energy to the [redacted] substation at 345 kV with an assumed in-service date of December 31, 2018.

In regard to this request Transmission Customer specifically requested that the following be addressed:

1. Confirmation that Transmission Customer has sufficient network integrated transmission rights to deliver the output of [redacted] through management of its existing network rights; and

2. Evaluation of PacifiCorp Transmission's main grid system to identify any system constraints.

2.0 Overall Assumptions

A 2015 heavy summer case was modified to simulate the 2018 heavy summer scenario was utilized to perform the study.

3.0 Study Results

For reference purposes, a diagram of the [redacted] area transmission system has been provided as Figure 1.

Figure 1 – [redacted] Area Transmission.

4.0 Network Integration Transmission Service Rights

With regard to item #1, a review of Transmission Customer's network load and resources within the [redacted], Idaho, load pocket was undertaken. Data from the 2016 Load and Resource Study was used for this analysis. The following tables provide both Transmission Customer's forecasted load and total forecasted load for the [redacted] area.

[redacted]	Historical Load (PI)*		2016 Coincident Summer Peak Load Forecast (MW)									
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Transmission Customer's Load			460	467	475	482	491	498	505	512	519	526
Total [redacted] Load	822	819	816	827	840	851	864	875	887	898	909	920
Transmission Customer's % of Total				56%	57%	57%	57%	57%	57%	57%	57%	57%

[redacted]	Historical Load (PI)*		2016 Coincident Winter Peak Load Forecast (MW)									
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Transmission Customer's Load			239	244	248	252	256	261	265	270	274	277
Total [redacted] Load	700	683	690	698	707	715	722	732	740	748	756	763
Transmission Customer's % of Total			35%	35%	35%	35%	35%	36%	36%	36%	36%	36%

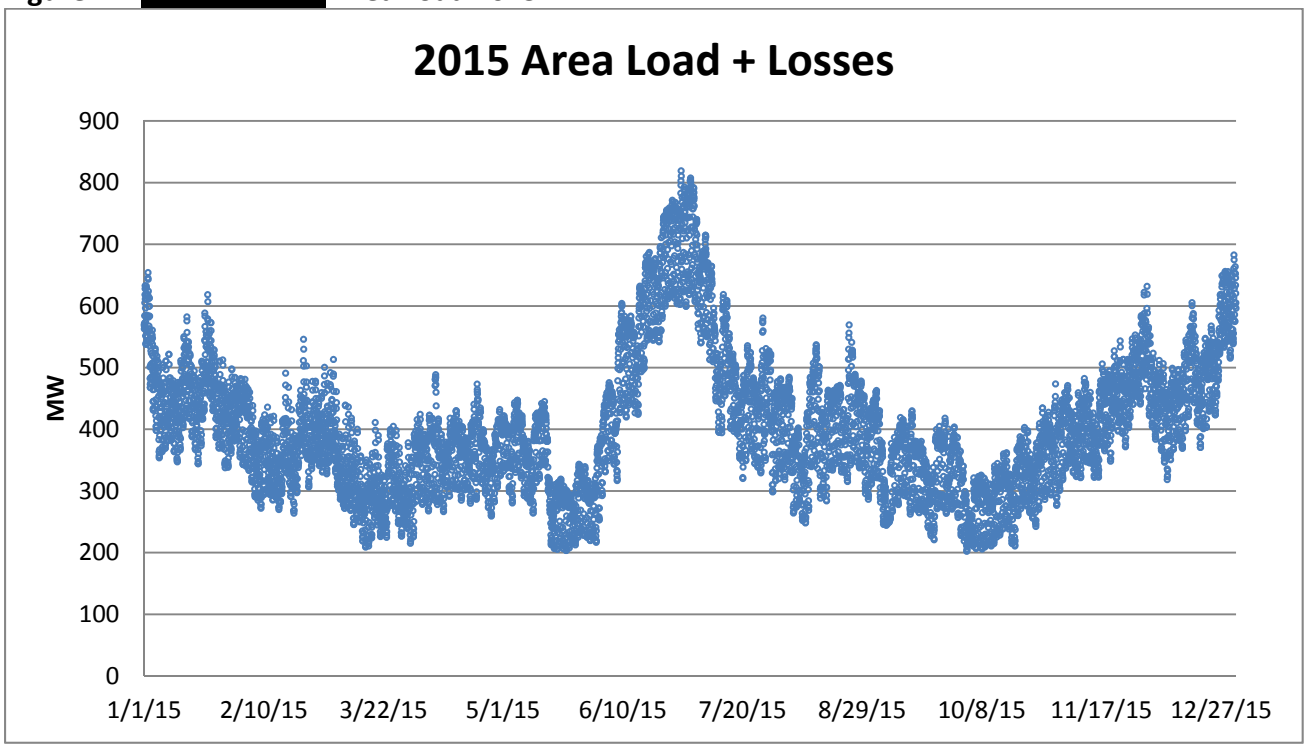
As can be seen in Figure 2, the [redacted] area is a summer peaking area with limited hydro resources, thus the area is typically a net importer of power during most of the year. Transmission Customer's peak network load within the [redacted] area is expected to exceed 150 MW during both winter and summer seasons; Transmission Customer's resources (purchased) have historically been less than this amount. Therefore, during peak load conditions and peak wind conditions, no transmission rights to export power from the area would be required.

During periods of low [redacted] load and high wind conditions with the [redacted] facility near its maximum output of 150 MW, transmission rights to export power would be necessary to move power to other network load. High wind conditions are typically not observed during summer months.

Figure 2 depicts the historical load in the [redacted] area for 2015. Prior years portray a similar load profile. Minimum load in the area of approximately 210 MW is seen the shoulder months of spring and fall. As Transmission Customer's load is approximately 35% of the total area load during winter months (November – March), this figure was used for conservatism to determine the need for transmission service rights. While area load is expected to grow over 1% annually, again for conservatism, no growth in minimum load was assumed, which results in the highest amount of transmission rights needed.

If Transmission Customer's load is 35% of minimum load (210 MW) during a high wind period, this results in Transmission Customer's load of 74 MW with a need to export approximately 76 MW. Existing Transmission Customer's transmission rights are well in excess of this and thus are sufficient to deliver this output. This assumes Transmission Customer's management of its network resources to stay within its existing network rights on the transmission system.

Figure 2 – [redacted] Area Load 2015



4.1 Conclusion

Transmission Customer has sufficient network integration transmission rights to deliver the output of [redacted] through management of its existing network rights.

5.0 Main Grid System Constraints

With regard to item #2, analysis showed that the addition of the [redacted] farm interconnecting to the [redacted] 345 kV bus changes the flows west of Bridger. The addition of [redacted] distributes flows more evenly on the three 345 kV lines west of Bridger as compared to the flows without the wind farm. The more even distribution of flows results in less power flowing through the Bridger – Threemile Knoll 345 kV line and increases power flow across the two Bridger – Populus 345 kV lines as shown in table below.

Table 1 – Bridger West Power Flow With and Without [redacted] Generation

Transmission Line	MW Flows With [redacted]	MW Flows Without [redacted]
Bridger – Threemile Knoll 345 kV	809.6	852.9
Bridger – Populus # 1 345 kV	788.9	775.4
Bridger – Populus # 2 345 kV	789.9	776.4
Total Bridger West Flows	2388.4	2404.7

Due to the flow changes the criticality of the Bridger – Threemile Knoll 345 kV line outage is slightly reduced; therefore, the amount of generation required to be tripped as part of the Bridger Remedial Action Scheme (RAS) could potentially change. With this change in the megawatt flows, the outage of the Bridger – Populus 345 kV # 2 line causes an overload on the Bridger – Populus 345 kV # 1 line above its emergency rating, which was not observed before.
The overload mentioned above could be resolved with any of the following options:

1. Modify the Bridger RAS to ensure that the appropriate amount of Bridger generation is tripped for either the Bridger – Populus #1 or #2 345 kV line outage, or other outages as appropriate.

    a. Based on the arming level calculations worksheet used for the Bridger RAS, the amount of Bridger generation unit trip required with the [redacted] project in-service changes for the outage states between Bridger- Populus and Bridger-Threemile Knoll. The change in the generator trip amount shown by the arming level spreadsheet is approximately 15-20 MW. However, this analysis considered only one operating condition; not all combinations of outages were performed for this analysis. A detailed review of the changes to the Bridger RAS may be necessary if the Project moves forward with this option.

2. Implement a new, separate RAS that would trip the [redacted] generation under outage conditions, rather than modify the Bridger RAS.

3. Manage Bridger generation such that the amount of generator tripping required for different outages would remain the same and would not require any changes to the Bridger RAS. The Bridger generation would need to be backed down or curtailed at times of high production.

All of these options will require additional detailed analysis in order to determine the appropriate outage(s) and amount of generation tripping/curtailment, RAS modifications and/or implementation and to ensure that proper monitoring capabilities are in place.

5.1 Impacts to Populus West RAS & Borah West RAS

The flows west of Populus are also impacted due to the addition of the [redacted] project. PacifiCorp and Idaho Power Company would need to review the impacts on the Populus West RAS and Borah West RAS as well due to the addition of this wind farm.

Similar to the Bridger RAS, the Populus West RAS simulates the combination of the three 345 kV line outages that originate from Populus and issues a transfer trip to Jim Bridger generation unit(s) in order to alleviate reliability issues on the transmission system. These three lines are

(1) Populus – Borah # 1 345 kV line
(2) Populus – Borah # 2 345 kV line
(3) Populus – Kinport 345 kV line

The RAS not only simulates the single line outages but also a combination of the above mentioned outages in order to have reliable operation of the transmission system.

The Borah West RAS is owned and operated by Idaho Power Company. This RAS simulates single contingencies and combination of four 345 kV line segments and one 230 kV line out of Borah and issues a transfer trip to Jim Bridger unit/s in order to alleviate reliability issues on the transmission system.. These outages include

(1) Kinport – Mid Point 345 kV line
(2) Borah – Mid Point 345 kV line
(3) Borah – Adelaide 345 kV line
(4) Adelaide – Midpoint 345 kV line
(5) Borah – Hunt 230 kV line

A detailed review of the above mentioned RASs would be required before the Project could move forward with this Project.

5.2 Conclusion

The addition of [redacted] as a network resource would require modification to at least one and possibly three existing remedial actions schemes and additional studies to make these modifications would be necessary. No additional transmission lines or other capital improvements are anticipated at this time.