TRANSMISSION SERVICE REQUEST
20 MW POINT TO POINT
TRANSMISSION SERVICE STUDY

PREPARED ON BEHALF OF THE COMMON USE SYSTEM
BY
BLACK HILLS POWER
TRANSMISSION PLANNING

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1.0 Executive Summary

Black Hills Power, as the Tariff Administrator of the Joint Tariff, performed a System Impact Study for a 20 MW Point-to-Point request. The request was studied under both heavy summer and light winter conditions to assess the impacts, if any, this request may have on the power system. The study was performed with all previously queued transmission requests and resulting system upgrades included in the system model.

This System Impact Study shows that the 20 MW Point-to-Point (PTP) request can be accommodated by the Common Use System without the addition of any transmission lines or system upgrades beyond those required to accommodate higher queued transmission service requests.

2.0 Introduction

Black Hills Power ("Black Hills"), Basin Electric Power Cooperative ("Basin") and Powder River Energy Corporation ("PRECorp") own and operate 230 kV transmission facilities in Wyoming and South Dakota that are governed by a FERC approved Joint Open Access Transmission Tariff ("Joint Tariff"). The jointly owned facilities are commonly referred to as the Common Use System ("CUS"). Black Hills Power has been designated as the Tariff Administrator of the Joint Tariff and, as such, is responsible for evaluating and studying all transmission service requests made on the Joint Tariff.

The request in Table 1 was studied to determine the impacts the transfer might have on the CUS system. The detail of the 20 MW PTP request, which is the basis for this study, is shown in Table 2.

Table 1: 20 MW TSR Study Element

Request #	Capacity	Request Type	Point of Receipt	Point of Delivery
72052785	20 MW	PTP	Wyodak	Stegall

3.0 Base Case Development

2009 Heavy Summer

A heavy summer base case was prepared for the 2009 timeframe. The heavy summer base case was utilized to ensure that the requested transfers could be accommodated under current system configuration and loads.

The starting point for the 2009 heavy summer case was a 2008 operating case developed by Black Hills Power for outage planning and coordination. This case was modified to include projects which are expected to be completed by the end of 2008.

A light load case for 2009 was not considered as this is a less stressed condition from a power flow perspective for this timeframe.

2011 Heavy Summer/Light Winter

Base cases were prepared for the 2011 timeframe, both heavy summer and light winter. The heavy summer base case was utilized to ensure that the requested transfers could be accommodated under maximum load serving requirements. The light winter scenario was utilized to evaluate the system under maximum transfers.

The 2011 heavy summer base case was created by modifying the 2010 base case developed by WAPA for use in the Miracle Mile TOT3 Rated Path studies. The 2010 Western Area Power Administration ("WAPA") case was then updated with forecasted 2011 peak loads requested from WAPA, Black Hills, Basin and PacifiCorp.

The 2011 light winter base case was created from the 2010 Wyoming Joint Queue Study light winter base case. This case was updated with forecasted 2011 light winter loads requested from WAPA, Black Hills, Basin and PacifiCorp.

Both 2011 base cases were updated to include expected transmission system upgrades and generation additions. These included:

- 100 MVAR Rapid City Voltage Support
- Teckla Dynamic Voltage Support (+/- 32 MVAR)
- Miracle Mile Project
- DJ-Casper-Spence 230 kV loop-in

Present day system operating restrictions require a runback of the Rapid City DC Tie under the studied load and generation levels for a loss of the Wyodak generating unit. Additionally, there are additional operating restrictions at load and generation levels below those modeled in this study for single contingencies. The planned Rapid City Voltage Support may reduce or remove these single contingency restrictions.

Currently, the CUS network load and firm transfers are greater than the local generating resources. Therefore, power is currently imported into the CUS footprint. To eliminate any net positive system effects caused by combining these imports with the TSRs, additional unplanned local generating resources were added to the base case. This allowed the TSRs to be analyzed under a worst-case scenario of no imports into the CUS.

It is important to understand that should the additional modeled resources not materialize, the impacts on the overall system of the TSRs will be reduced due to the netting effect any imports into the CUS would have on exports out of the CUS.

4.0 Study Approach

2009 Heavy Summer

Although this TSR is below higher queued requests, the higher queued requests have service start dates later than this request. Therefore, it was decided to determine if this request causes any negative impacts on the current system, only including projects known to be complete by the end of 2008 included.

This 20 MW PTP request was simulated with the POR in the Wyodak area and POD at Stegall.

2011 Heavy Summer/Light Winter

Because TSRs are studied sequentially based upon queue position, with each TSR evaluated along with any higher queued TSRs, the request in Table 1 was studied with all higher queued requests and associated network upgrades modeled.

The 20 MW PTP request was simulated with the POR in the Wyodak area and POD at Stegall.

Two sensitivity scenarios were simulated with the transfer:

- Replace the DJ-Casper-Spence 230 kV loop-in with the current system configuration
- Add a second Pumpkin Buttes-DJ 230 kV circuit

5.0 Steady State Evaluation Criteria

System Intact and Prior Outage (N-0 and N-1) Criteria

All bus voltages are within 0.95 and 1.05 p.u. and all transformer and transmission lines are below 100% of their continuous rating. Transformer taps and switched shunts were allowed to operate.

Forced Outages (N-1-1 and N-2) Criteria

All bus voltages are within 0.90 and 1.1 p.u. and all transformer and transmission lines are below 100% of their continuous or emergency rating. Most of PacifiCorp transmission lines in Eastern Wyoming have an emergency rating equal to 123% of their continuous rating. Other lines were allowed to load to their emergency ratings. All regulating devices in the study area with the exception of DC taps were locked.

6.0 Power Flow Results

2009 Heavy Summer

The results of the 2009 heavy summer base case analysis identified no negative impacts to the transmission system as a result of the 20 MW TSR. This is primarily due to the fact the the CUS is presently a net energy importing area. Therefore, prior to the addition of planned generating resources, this request will in effect net against the current imports.

2011 Heavy Summer

The results of the Heavy Summer base case analysis identified no negative impacts to the transmission system as a result of the 20 MW TSR. Following the loss of either the Dryfork-Carr Draw or the Dryfork-Hughes 230 kV line, thermal overloads were encountered on the remaining line. These Dry Fork-area post-contingent criteria violations were identified in the study results of previously queued requests, and are a generation outlet issue related to the unplanned generation modeled in the case. The violations will be mitigated through the generator interconnection process should these unplanned facilities materialize.

The differences in results between the base case and the sensitivity cases listed in 4.0 were negligible.

2011 Light Winter

The results of the Light Winter base case analysis identified no negative impacts to the transmission system as a result of the 20 MW TSR. All evaluated scenarios exhibited Dry Fork-area overloads similar to those found in the Heavy Summer analysis.

The differences in results between the base case and the sensitivity cases listed in 4.0 were negligible.

7.0 Conclusion

Based on the study analysis, the full 20 MW Transmission Service Request can be accommodated by the Common Use System without the addition of any transmission lines or system upgrades beyond those required to accommodate higher queued transmission service requests.

APPENDIX A
POWER FLOW RESULTS

2009 HEAVY SUMMER

BASE CONFIGURATION

NC;

STATUS	VIOLATED ELEMENT	PU

OUTAGES:

20MW PTP;

STATUS	VIOLATED ELEMENT	PU

OUTAGES:

2011 HEAVY SUMMER

BASE CONFIGURATION

NC;DJ-CSP UPGRADE;TEK-OSG;

STATUS	VIOLATED ELEMENT	PU

OUTAGES:

43_1A3 OUTAGE: CARR DRA 230 -DRYFORK 230	HUGHES 230-DRYFORK 230	100.2 % OF 460.0 MVA RATING
104_1A3 OUTAGE: HUGHES 230 -DRYFORK 230	CARR DRA 230-DRYFORK 230	101.0 % OF 460.0 MVA RATING

20MW PTP;DJ-CSP UPGRADE;TEK-OSG;

STATUS	VIOLATED ELEMENT	PU

OUTAGES:

43_2A3 OUTAGE: CARR DRA 230 -DRYFORK 230	HUGHES 230-DRYFORK 230	101.1 % OF 460.0 MVA RATING
104_2A3 OUTAGE: HUGHES 230 -DRYFORK 230	CARR DRA 230-DRYFORK 230	101.7 % OF 460.0 MVA RATING

NO DAVE JOHNSTON-CASPER UPGRADES

NC;DJ-CSP CURRENT;TEK-OSG;

STATUS	VIOLATED ELEMENT	PU

OUTAGES:

43_1B3 OUTAGE: CARR DRA 230 -DRYFORK 230	HUGHES 230-DRYFORK 230	100.2 % OF 460.0 MVA RATING
104_1B3 OUTAGE: HUGHES 230 -DRYFORK 230	CARR DRA 230-DRYFORK 230	101.0 % OF 460.0 MVA RATING

20MW PTP;DJ-CSP CURRENT;TEK-OSG;

STATUS	VIOLATED ELEMENT	PU
OUTAGES:		
43_2B3 OUTAGE: CARR DRA 230 -DRYFORK 230	HUGHES 230-DRYFORK 230	101.1 % OF 460.0 MVA RATING
104_2B3 OUTAGE: HUGHES 230 -DRYFORK 230	CARR DRA 230-DRYFORK 230	101.8 % OF 460.0 MVA RATING

PUMPKIN BUTTES-DAVE JOHNSTON DOUBLE CIRCUIT

NC;DJ-CSP UPGRADE;PB-DJ DOUBLE;TEK-OSG;

STATUS	VIOLATED ELEMENT	PU
OUTAGES:		
43_1A4 OUTAGE: CARR DRA 230 -DRYFORK 230	HUGHES 230-DRYFORK 230	101.4 % OF 460.0 MVA RATING
104_1A4 OUTAGE: HUGHES 230 -DRYFORK 230	CARR DRA 230-DRYFORK 230	102.3 % OF 460.0 MVA RATING

20MW PTP;DJ-CSP UPGRADE;PB-DJ DOUBLE;TEK-OSG;

STATUS	VIOLATED ELEMENT	PU
OUTAGES:		
43_2A4 OUTAGE: CARR DRA 230 -DRYFORK 230	HUGHES 230-DRYFORK 230	102.2 % OF 460.0 MVA RATING
104_2A4 OUTAGE: HUGHES 230 -DRYFORK 230	CARR DRA 230-DRYFORK 230	102.9 % OF 460.0 MVA RATING

2011 LIGHT WINTER

BASE CONFIGURATION

NC;DJ-CSP UPGRADE;TEK-OSG;

STATUS	VIOLATED ELEMENT	PU
OUTAGES:		

20MW PTP;DJ-CSP UPGRADE;TEK-OSG;

STATUS	VIOLATED ELEMENT	PU
OUTAGES:		

NO DAVE JOHNSTON-CASPER UPGRADES

NC;DJ-CSP CURRENT;TEK-OSG;

STATUS	VIOLATED ELEMENT	PU
OUTAGES:		

20MW PTP;DJ-CSP CURRENT;TEK-OSG;

STATUS	VIOLATED ELEMENT	PU

OUTAGES:

PUMPKIN BUTTES-DAVE JOHNSTON DOUBLE CIRCUIT

NC;DJ-CSP UPGRADE;PB-DJ DOUBLE;TEK-OSG;

STATUS	VIOLATED ELEMENT	PU

OUTAGES:

20MW PTP;DJ-CSP UPGRADE;PB-DJ DOUBLE;TEK-OSG;

STATUS	VIOLATED ELEMENT	PU

OUTAGES: