FEASIBILITY STUDY

250.7 MW WIND ENERGY FACILITY GENERATION INTERCONNECTION WYODAK-OSAGE 230 KV

BHBE – G9

FINAL
07/16/2010

PREPARED ON BEHALF OF THE COMMON USE SYSTEM BY
BASIN ELECTRIC POWER COOPERATIVE
TRANSMISSION SERVICES

Table of Contents

Executive Summary 4

1. Background 5
1.1 Tariff 5
1.2 Objective 5
1.3 Project Description 5

2. Base Case Development 6
2.1 Base Case Origin and Year 6
2.2 Planned Projects 6
2.3 Resource Assumptions 6
2.3.1 Network Resource 6
2.4 Area Load 6
2.4.1 2013 Heavy Summer 6
2.4.2 2014 Light Winter 6
2.5 Analytical Tools 7

3. Steady-State Analyses 7
3.1 Steady-State Analysis Methodology 7
3.1.1 Voltage Limits 7
3.1.2 Thermal Limits 7
3.1.3 Solution Parameters 7

4. Steady-State Analysis Results 8
4.1 Heavy Summer Pre-Wind Results 8
4.1.1 DC Tie Blocked 8
4.1.2 DC Tie 200 MW East to West 8
4.1.3 DC Tie 200 MW West to East 8
4.2 Heavy Summer Wind as Network Resource 8
4.2.1 DC Tie Blocked 8
4.2.2 DC Tie 200 MW East to West 8
4.2.3 DC Tie 200 MW West to East 9
4.3 Light Winter Pre-Wind Results 9
4.3.1 DC Tie Blocked 9
4.3.2 DC Tie 200 MW East to West 9
4.3.3 DC Tie 200 MW West to East 9
4.4 Light Winter Wind as Network Resource 9
4.4.1 DC Tie Blocked 9
4.4.2 DC Tie 200 MW East to West 9

4.4.3 DC Tie 200 MW West to East 9

5. Short-Circuit Analysis 10
5.1 Short-Circuit Study Methodology 10
5.2 Short-Circuit Results 10

6. Conclusions 11

Appendix A: Steady State N-1 Contingency List
Appendix B: 13HS RCDC E-W Results
Appendix C: 13HS RCDC OFF Results
Appendix D: 13HS RCDC W-E Results
Appendix E: 14LW RCDC E-W Results
Appendix F: 14LW RCDC OFF Results
Appendix G: 14LW RCDC W-E Results

Executive Summary

An Interconnection Feasibility Study (FS) was conducted by Basin Electric Power Cooperative under the guidance of the Common Use System (CUS) Open Access Transmission Tariff Large Generator Interconnection Procedures (LGIP) for the Interconnection Customer to interconnect a 250.7 MW wind generation facility. The proposed project consist of one hundred and nine (109) Siemens SWT-2.3-93 2.3 MW wind turbine generators and will interconnect to the CUS 230 kV transmission system with a Point of Interconnection (POI) on the Wyodak-Osage 230 kV line. The POI is approximately 6 miles northwest of the Osage power plant in Weston County, WY. The proposed interconnection in-service date is November 2012.

The goal of this study was to:

1) Evaluate the steady-state conditions for this project
2) Evaluate the short circuit conditions for this project
3) Determine necessary upgrades to the CUS to mitigate any impacts to the reliability caused by the proposed project

The project was simulated as a Network Resource with heavy summer loads and light winter loads.

Steady-State Analysis

Steady-state voltage and thermal ratings were examined without the proposed project to develop a baseline for comparison. The proposed project was then placed in-service and system performance was re-evaluated to determine any system impacts.

The power flow analysis found that the proposed interconnection increased the observed overload on the Wyodak-Osage 230 kV line for the Hughes-Lookout line outage. To mitigate the G9 POI to Osage overload this 6 mile section of line will require line upgrades.

Short-Circuit Analysis

Short-circuit analysis was performed as part of the FS to determine the fault currents caused by the addition of this project. The surrounding breakers were examined to determine if the currents were greater than the breaker's maximum fault rating. The interconnection of the proposed project did not significantly impact area short-circuit currents.

Conclusions

In order to interconnect the proposed facility the 6 mile section of line from the G9 POI to the Osage 230 kV substation will require line upgrades and a 230 kV POI substation with a three-position ring bus will need to be constructed. These facilities will be considered a Network Upgrade at an estimated cost of $ 4.8 million and an expected in-service date of eighteen (18) months from the date of a signed interconnection agreement.

Interconnection Service in and of itself does not convey any right to deliver electricity to any specific customer or Point of Delivery

1. Background

1.1 Tariff

Black Hills Power (BHP), Basin Electric Power Cooperative (Basin), and Powder River Energy Corporation (PRECorp) own and operate 230 kV transmission facilities in Wyoming and South Dakota which are governed by a FERC approved Joint Open Access Transmission Tariff (Joint Tariff) and commonly referred to as the Common Use System (CUS). Black Hills Power acts as the Tariff Administrator of the Joint Tariff and, as such, is responsible for evaluating and studying all large generator interconnection requests made on the CUS.

1.2 Objective

Black Hills Power received a Large Generator Interconnection request from the Interconnection Customer to conduct a Feasibility Study to interconnect a 250.7 MW wind generation facility. The purpose of this Feasibility Study is to determine whether the proposed interconnection has any adverse impacts on the reliability or operating characteristics of the CUS. Steady-state and short-circuit conditions were analyzed in this study.

1.3 Project Description

The proposed Point of Interconnection is on the existing Wyodak to Osage 230 kV transmission line approximately 6 miles from the Osage substation. The wind generating facility was modeled with the following assumptions:

- 109 Siemens SWT-2.3-93 2.3 MW wind turbine generators operating at 690 V nominal, represented as one 250.7 MW lumped generator.
- 109 generator step-up transformers (690 V to 34.5 kV), modeled as one step-up transformer, 6.0% impedance on 283.4 MVA base, connected to a single collector bus.
- One substation transformer (34.5 kV to 230 kV), 10% impedance on 300 MVA base
- A connecting 230 kV substation with a 3-position ring bus that taps the Wyodak to Osage 230 kV line six miles from Osage.

2. Base Case Development

2.1 Base Case Origin and Year

The proposed interconnection is scheduled for the fourth quarter of 2012. The base cases utilized for this study, 12hs2ap and 13lw1sap, originated from the Western Electricity Coordinating Council (WECC). The base cases were updated for the 2013 Heavy Summer and 2013-14 Light Winter load scenarios. They were examined and updated for accuracy by area utilities.

2.2 Planned Projects

The cases were updated to include committed projects with in-service dates prior to the facility in-service date which were determined to have an impact on system performance, including:

- Rapid City Voltage Support Project
- Wygen II and III
- The Hughes Transmission Project
- Dry Fork Station
- Donkey Creek-Pumpkin Butte-Windstar 230 kV line
- Teckla Voltage Support Project

Should any one of the projects listed above not be complete prior to the proposed project in-service date, the interconnection project may be curtailed due to transmission prior outages or other emergency conditions. These curtailments and/or operating restrictions, if needed, will be developed and identified through operational studies as required.

The cases were also updated to include the higher queued generation interconnection requests that have been received by the CUS. These projects include a 200 MW wind project near Pumpkin Buttes, and a 50.6 MW wind project near Sturgis. Should any one of these projects be postponed or cancelled a re-study of the BHBE G9 generation interconnection request may be required.

2.3 Resource Assumptions

2.3.1 Network Resource

To dispatch the wind generation as a Network Resource, the generation at Dry Fork, Wygen I, Wygen II, and Wygen III was scaled down on a pro rata basis.

2.4 Area Load

2.4.1 2013 Heavy Summer

The 2013 heavy summer load case was created by updating BHP, CLF&P, and Basin Electric loads to their 2013 peak forecast values.

2.4.2 2014 Light Winter

The 2014 light winter load case was created by scaling the area load to 75% of 2014 peak winter forecast values.

2.5 Analytical Tools

Power flow simulations were performed using PSS/E simulation software, version 30.3.3.

3. Steady-State Analysis

3.1 Steady State Analysis Methodology

To determine if the proposed project caused any adverse impacts to the reliability and operating characteristics of the CUS transmission system, it was evaluated using 2013 peak summer and 2014 light winter load levels. A baseline for comparison was established by comparing the voltage and thermal performance of the CUS without and with the proposed project in-service. A sensitivity scenario was also analyzed to determine the impact of the new Teckla-Osage 230 kV line. This line is expected to be in-service in 2013 to serve native load.

3.1.1 Voltage Limits

Table 1 presents the voltage criteria used in the study area for the steady-state voltage assessment.

Voltage Class	Acceptable Voltage Range	
	Pre-Contingency	Post-Contingency
69 kV and Above	0.95 to 1.05 p.u.	0.90 to 1.10 p.u

Table 1: Steady-State Voltage Criteria

3.1.2 Thermal Limits

Normal thermal ratings shall not be violated under system intact conditions, and applicable emergency ratings shall not be exceeded under contingency conditions. Thermal loading on all transmission lines in the CUS are not allowed to exceed 100% of their normal rating. The CUS transmission lines do not have emergency ratings. Transformers are allowed to overload as outlined in Table 2.

Maximum Hours @ Overload	Allowable Transformer Overload
½ Hour	153%
1 Hour	135%
2 Hours	120%

Table 2: Transformer Overloads

3.1.3 Solution Parameters

Pre-contingency solution parameters allowed adjustment of load tap-changing (LTC) transformers, static VAR devices including switched shunt capacitors and reactors, and DC taps. Post-contingency solution parameters allowed for adjustment of DC taps and the Rapid City South capacitor only. Generator VAR limits were applied immediately and area interchange control was disabled for all

solutions. A fixed-slope decoupled Newton solution method was implemented for all cases. Table 3 lists all of the prior outages. Appendix A lists all N-1 contingencies.

Prior Outage List	
Wyodak-Hughes 230 kV	St.Onge-Lange 230 kV
Wyodak-Osage 230 kV	Lange-Rapid City South 230 kV
Wyodak-G9 Wind 230 kV	Rapid City South-Westhill 230 kV
G9 Wind-Osage 230 Kv	Westhill-Stegall 230 kV
Wyodak-Carr Draw 230 kV	Westhill-Minnekatah 230 kV
Wyodak-Donkey Creek 230 kV	Minnekatah-Osage 230 kV
Hughes-Lookout 230 kV	Osage-Yellow Creek 230 kV
Lookout-G8 Wind 230 kV	Yellow Crkee-Lookout 230 kV
G8 Wind-St.Onge 230 kV	

Table 3: Prior Outage List

4. Steady-State Analysis Results

4.1 Heavy Summer Pre-Wind Results

4.1.1 RCDC Tie Blocked

There were no criteria violations during this scenario when considering the established CUS operating guidelines.

4.1.2 RCDC Tie 200 MW East to West

There were no criteria violations during this scenario when considering the established CUS operating guidelines and RCDC RAS.

4.1.3 RCDC Tie 200 MW West to East

The baseline case indicated an overload of 105.8% of 421 MVA on the Wyodak-Osage 230 kV line for the N-1 outage of the Hughes-Lookout 230 kV line. This is with the established CUS operating guidelines for RC generation at Level 2 and a RCDC tie runback to 100 MW for this contingency.

4.2 Heavy Summer Wind as Network Resource

4.2.1 RCDC Tie Blocked

The interconnection of the proposed project caused no additional impacts to the CUS operating schemes or system reliability.

4.2.2 RCDC Tie 200 MW East to West

The interconnection of the proposed project caused no additional impacts to the CUS operating schemes or system reliability.

4.2.3 RCDC Tie 200 MW West to East

The interconnection of the proposed project increased the observed overload on the Wyodak-Osage 230 kV line. The flow on the G9 POI to Osage section increased by 45 MVA and overloaded this section of the line to 116.4% of its 421 MVA summer rating.

A sensitivity scenario with the new Teckla to Osage 230 kV was analyzed. This proposed line is expected to be in-service in 2013. The Teckla to Osage 230 kV line helped relieve the observed overload to 101.9% of its 421 MVA summer rating.

To mitigate the G9 POI to Osage overload this 6 mile section of line will require line upgrades.

The interconnection of the proposed project caused no additional impacts to the CUS operating schemes or system reliability.

4.3 Light Winter Pre-Wind Results

4.3.1 RCDC Tie Blocked

There were no criteria violations during this scenario when considering the established CUS operating guidelines.

4.3.2 RCDC Tie 200 MW East to West

There were no criteria violations during this scenario when considering the established CUS operating guidelines and RCDC RAS.

4.3.3 RCDC Tie 200 MW West to East

There were no criteria violations during this scenario when considering the established CUS operating guidelines and RCDC RAS.

4.4 Light Winter Wind as Network Resource

4.4.1 RCDC Tie Blocked

The interconnection of the proposed project caused no additional impacts to the CUS operating schemes or system reliability.

4.4.2 RCDC Tie 200 MW East to West

The interconnection of the proposed project caused no additional impacts to the CUS operating schemes or system reliability.

4.4.3 RCDC Tie 200 MW West to East

The interconnection of the proposed project caused no additional impacts to the CUS operating schemes or system reliability.

5. Short-Circuit Analysis

5.1 Short-Circuit Study Methodology

In the baseline case, the maximum fault currents were determined at the Wyodak, and Osage 230 kV substations. The proposed project was then modeled and the maximum fault currents were reanalyzed at the Wyodak, and Osage 230 kV substations. The results were compared to determine any significant impacts.

5.2 Short-Circuit Results

Short Circuit Analysis			
Substation	**Fault**	**Baseline**	**G9 Project**
Wyodak 230 kV	3-Phase	14,690 Amps	15,410 Amps
	SLG	16,720 Amps	17,680 Amps
Osage 230 kV	3-Phase	5,030 Amps	5,100 Amps
	SLG	4,220 Amps	4,280 Amps
G9 POI 230 kV	3-Phase		11,210 Amps
	SLG		11,900 Amps

Table 4: Short Circuit Analysis

The short circuit analysis results are summarized in Table 4. The interconnection of the G9 project did not significantly increase area short-circuit currents. The typical minimum circuit breaker rating of 230 kV buses is 40 kA. None of the short-circuit currents produced with the proposed project in place reached this threshold.

6. Conclusions

This report describes the power flow and short-circuit studies performed to determine the impacts of interconnecting a new 250.7 MW wind generation facility on the existing Wyodak to Osage 230 kV transmission line. The interconnecting project as studied consists of one hundred and nine (109) Siemens SWT-2.3-93 2.3 MW wind turbine generators.

The power flow analysis found that the proposed interconnection increased the observed overload on the Wyodak-Osage 230 kV line for the N-1 outage of the Hughes-Lookout line. To mitigate the G9 POI to Osage overload this 6 mile section of line will require line upgrades.

The total estimated cost and in-service time frame of the required Network Upgrades is listed in Table 5 below. This also includes the construction of a new 230 POI substation (3 position ring bus) to interconnect with the CUS on the Wyodak-Osage 230 kV line.

Customer Funded Network Upgrades	
Estimated Total Cost	$ 4.8 Million
Estimated Time Frame	18 months

Table 5: POI Estimated Cost

Interconnection Service in and of itself does not convey any right to deliver electricity to any specific customer or Point of Delivery.

Appendix A: Steady State N-1 Contingency List

Q0220 POI 230.-WINDSTAR 230. #1 LINE
G9 WIND 230.-WYODAK 230. #1 LINE
G9 WIND 230.-OSAGE 230. #1 LINE
ANT MINE 230.-YELLOWCK 230. #1 LINE
ANT MINE 230.-TEKLA 230. #1 LINE
BADWATER 230.-SPENCE 230. #1 LINE
BADWATER 230.-THERMOPL 230. #1 LINE
BUFFALO 230.-CARR DRA 230. #1 LINE
BUFFALO 230.-KAYCEE 230. #1 LINE
BUFFALO 230.-SHERIDAN 230. #1 LINE
CARR DRA 230.-WYODAK 230. #1 LINE
CARR DRA 230.-BARBERCK 230. #1 LINE
CARR DRA 230.-DRYFORK 230. #1 LINE
CASPERPP 230.-DAVEJOHN 230. #1 LINE
CASPERPP 230.-MIDWEST 230. #1 LINE
CASPERPP 230.-RIVERTON 230. #1 LINE
CASPERPP 230.-SPENCE 230. #1 LINE
CASPERPP 230.-CLAIMJPR 230. #1 LINE
CASPERPP 230.-WINDSTAR 230. #1 LINE
CASPERPP 230.-LATIGO 230. #1 LINE
CASPERPP 115.-CENTERST 115. #1 LINE
CASPERPP 115.-CASPERLM 115. #1 LINE
CASPERPP 115.-REFNRYTP 115. #1 LINE
DAVEJO&1 230.-DAVEJOHN 230. #1 LINE
DAVEJO&1 230.-SPENCE 230. #1 LINE
DAVEJOHN 230.-DIFICULT 230. #1 LINE
DAVEJOHN 230.-YELLOWCK 230. #1 LINE
DAVEJOHN 230.-WINDSTAR 230. #1 LINE
DAVEJOHN 230.-WINDSTAR 230. #2 LINE
DAVEJOHN 230.-LAR.RIVR 230. #1 LINE
DAVEJOHN 230.-STEGALL 230. #1 LINE
DAVEJOHN 115.-DAVEJTPN 115. #1 LINE
DAVEJOHN 115.-DAVEJTPS 115. #1 LINE
FRANNIE 230.-GARLAND 230. #1 LINE
FRANNIE 230.-YELOWTLP 230. #1 LINE
GARLAND 230.-OREBASIN 230. #1 LINE
GOOSE CK 230.-SHERIDAN 230. #1 LINE
GOOSE CK 230.-YELOWTLP 230. #1 LINE
GRASS CK 230.-OREBASIN 230. #1 LINE
GRASS CK 230.-THERMOPL 230. #1 LINE
KAYCEE 230.-MIDWEST 230. #1 LINE
MIDWEST 230.-CLAIMJPR 230. #1 LINE
MUSTANG 230.-SPENCE 230. #1 LINE
RIVERTON 230.-THERMOPL 230. #1 LINE
RIVERTON 230.-WYOPO 230. #1 LINE
SHERIDAN 230.-TONGRIV 230. #1 LINE
THERPACE 115.-WORLAND 115. #1 LINE
THERPACE 115.-THERMOPL 115. #1 LINE
THERPACE 115.-THERMOPL 115. #2 LINE
WHTEWOOD 69.0-STURGBEC 69.0 #1 LINE
WNDYFLAT 69.0-PLUMA TP 69.0 #1 LINE
WYODAK 69.0-HUGHES 69.0 #1 LINE
WYODAK 69.0-NSS2 69.0 #1 LINE
WYODAK 69.0-CLOVSJPR 69.0 #1 LINE
WYODAK 69.0-PWDRS PR 69.0 #1 LINE
YELOWCRK 69.0-PLUMA TP 69.0 #1 LINE
HUGHES 230.-DRYFORK 230. #1 LINE
HUGHES 69.0-ADON PR 69.0 #1 LINE
NSS2 69.0-GILLETTS 69.0 #1 LINE
NSS2 69.0-PWDRN PR 69.0 #1 LINE
CENTRYRD 69.0-MALL 69.0 #1 LINE
MALL 69.0-NLOOP TP 69.0 #1 LINE
NLOOP TP 69.0-LANGE TP 69.0 #1 LINE
LANGE TP 69.0-CROSS ST 69.0 #1 LINE
ROBINSDL 69.0-ROBNS TP 69.0 #1 LINE
5THST TP 69.0-RCSOUTH2 69.0 #1 LINE
RADIO_DR 69.0-44TH ST 69.0 #1 LINE
RADIO_DR 69.0-RCSOUTH2 69.0 #1 LINE
AMCOLOID 69.0-COLONY 69.0 #1 LINE
BELLECRK 69.0-BUTTEPMP 69.0 #1 LINE
COLONY 69.0-BUTTEPMP 69.0 #1 LINE
NEWCSTLE 69.0-WY REFIN 69.0 #1 LINE
NEWCSTLE 69.0-NWCL TAP 69.0 #1 LINE
DEGS-ST.ONGE 230.00 #1 (RCDC 150 RAS)
STURGIS 69.0-PEDMNT 69.0 #1 LINE
WY REFIN 69.0-S.CRK TP 69.0 #1 LINE
88 OIL 69.0-S.CRK TP 69.0 #1 LINE
NWCL TAP 69.0-SCRK TP2 69.0 #1 LINE
OSAG CTY 69.0-BENTON 69.0 #1 LINE
BENTON 69.0-UPTON_C 69.0 #1 LINE
UPTON_C 69.0-UPTON TP 69.0 #1 LINE
CLOVIS 69.0-CLOVSJPR 69.0 #1 LINE
RCSOUTH1 230.-RCDC W 230. #1 LINE
DONKYCRK 230.-WG1 230. #1 LINE
DONKYCRK 230.-WG2 230. #1 LINE
DONKYCRK 230.-WG3 230. #1 LINE
DONKYCRK 230.-HARTZOG 230. #1 LINE
ST.ONGE 69.0-STURGBEC 69.0 #1 LINE
PBWIND 230.-HARTZOG 230. #1 LINE
OSAGE PR 69.0-EFIDLRPR 69.0 #1 LINE
OSAGE PR 69.0-SUNDANPR 69.0 #1 LINE
EFIDLRPR 69.0-WFIDLRPR 69.0 #1 LINE
PWDRN PR 69.0-PWDRS PR 69.0 #1 LINE
TONGRIV 230.-ARVADA 230. #1 LINE
TONGRIV 230.-DECKER 230. #1 LINE
DRYFORK 230.-ARVADA 230. #1 LINE
DECKER 230.-WYOMONT 230. #1 LINE
DEGS2 230.-DEGSCB 34.5 #1 XFMR

WORLAND 115.-WORLANTP 115. #1 LINE
WYODAK 230.-OSAGE 230. #1 LINE
WYODAK 230.-HUGHES 230. #1 LINE
WYODAK 230.-DONKYCRK 230. #1 LINE
WYODAK 230.-DONKYCRK 230. #2 LINE
YELLOWCK 230.-WINDSTAR 230. #1 LINE
YELOWTLP 230.-YELLOWBR 230. #1 LINE
WINDSTAR 230.-GLENROCK 230. #1 LINE
WINDSTAR 230.-TOPOFWLD 230. #1 LINE
WINDSTAR 230.-LATIGO 230. #1 LINE
WINDSTAR 230.-HARTZOG 230. #1 LINE
CENTERST 115.-BRYAN 115. #1 LINE
BRYAN 115.-REFNRYPP 115. #1 LINE
THREEBUT 230.-LATIGO 230. #1 LINE
WESTHILL 230.-STEGALL 230. #1 LINE
WESTHILL-RCSOUTH1 230.00 #1 (RCDC 150 RAS)
WESTHILL-MINNKHAT 230.00 #1 (WO 69 RAS)
WESTHILL-MINNKHAT 230.00 #1 (W 69 RAS)
OSAGE 230.-LANGE 230. #1 LINE
OSAGE 230.-TEKLA 230. #1 LINE
OSAGE 230.-YELOWCRK 230. #1 LINE
OSAGE 230.-MINNKHAT 230. #1 LINE
LANGE 230.-RCSOUTH1 230. #1 LINE
LANGE-ST.ONGE 230.00 #1 (RCDC 150 RAS)
RENO 230.-TEKLA 230. #1 LINE
RENO 230.-DONKYCRK 230. #1 LINE
LOOKOUT1 230.-YELOWCRK 230. #1 LINE
LOOKOUT1 230.-HUGHES 230. #1 LINE
LOOKOUT1-DEGS 230.00 #1 (RCDC 150 RAS)
38TH ST 69.0-CEMETERY 69.0 #1 LINE
38TH ST 69.0-WTRPLANT 69.0 #1 LINE
4THST TP 69.0-WESTBLVD 69.0 #1 LINE
4THST TP 69.0-ANAMOSA 69.0 #1 LINE
4THST TP 69.0-4TH ST 69.0 #1 LINE
4THST TP 69.0-EASTNRTH 69.0 #1 LINE
ANGOSTUR 69.0-EDGEMONT 69.0 #1 LINE
ANGOSTUR 69.0-WESTHILL 69.0 #1 LINE
ARGYLE 69.0-PRINGLE 69.0 #1 LINE
ARGYLE 69.0-MINNKHAT 69.0 #1 LINE
BENFRNCH 69.0-BIG BEN 69.0 #1 LINE
BENFRNCH 69.0-PLSNTVLY 69.0 #1 LINE
BENFRNCH 69.0-LANGE 69.0 #1 LINE
BENFRNCH 69.0-LANGE 69.0 #2 LINE
BENFRNCH 69.0-LANGE 69.0 #3 LINE
BENFRNCH 69.0-WTRPLANT 69.0 #1 LINE
BENFRNCH 69.0-BFRNCH26 69.0 #1 LINE
BENFRNCH 69.0-CMNTPLNT 69.0 #1 LINE
BENFRNCH 69.0-CROSS ST 69.0 #1 LINE
BIG BEN 69.0-PACTOLA 69.0 #1 LINE
CAMBELL 69.0-LANGE 69.0 #1 LINE
CAMBELL 69.0-EASTNRTH 69.0 #1 LINE
CAMBELL 69.0-CENTRYRD 69.0 #1 LINE
G9 WIND 230.-G9 CLTR 34.5 #1 XFMR
CASPERPP 230.-CASPERPP 115. #1 XFMR
CASPERPP 115.-CASPERPP 69.0 #1 XFMR
CASPERPP 115.-CASPERPP 69.0 #2 XFMR
DAVEJOHN 230.-DAVEJOHN 115. #1 XFMR
DAVEJOHN 230.-DAVEJON3 13.8 #1 XFMR
DAVEJOHN 230.-DAVEJON4 22.0 #1 XFMR
DAVEJOHN 115.-DAVEJOHN 69.0 #1 XFMR
DAVEJOHN 115.-DAVEJON1 13.8 #1 XFMR
DAVEJOHN 115.-DAVEJON2 13.8 #1 XFMR
FRANNIE 230.-FRANNIE 34.5 #1 XFMR
FRANNIE 230.-FRANNIE 34.5 #2 XFMR
GARLAND 230.-GARLAND 34.5 #1 XFMR
GARLAND 230.-GARLAND 34.5 #2 XFMR
GRASS CK 230.-GRASS CK 34.5 #1 XFMR
MIDWEST 230.-MIDWEST 69.0 #1 XFMR
MIDWEST 230.-MIDWEST 69.0 #2 XFMR
OREBASIN 230.-OREBASIN 34.5 #1 XFMR
OREBASIN 230.-OREBASIN 34.5 #2 XFMR
OREBASIN 230.-OREBASIN 34.5 #3 XFMR
OREBASIN 230.-OREBASIN 69.0 #1 XFMR
RIVERTON 230.-RIVERTON 115. #1 XFMR
SHERIDAN 230.-SHERIDAN 34.5 #1 XFMR
SHERIDAN 230.-SHERIDAN 34.5 #2 XFMR
THERMOPL 230.-THERPACE 115. #1 XFMR
THERMOPL 230.-THERPACE 115. #2 XFMR
WYODAK 230.-WYODAK 1 22.0 #1 XFMR
WYODAK 230.-WYODAK 69.0 #1 XFMR
WYODAK 230.-WYODAK 69.0 #2 XFMR
YELOWTLP 230.-YELOWTLP 161. #1 XFMR
GLENROCK 230.-GLENRK 1 34.5 #1 XFMR
GLENROCK 230.-GLENRK 3 34.5 #1 XFMR
TOPOFWLD 230.-TOPW_CL 34.5 #1 XFMR
WESTHILL 230.-WESTHILL 69.0 #1 XFMR
OSAGE 230.-OSAGE 69.0 #1 XFMR
LANGE 230.-LANGE 69.0 #1 XFMR
LANGE 230.-LANGE 69.0 #2 XFMR
LOOKOUT1 230.-LOOKOUT 69.0 #1 XFMR
BENFRNCH 69.0-BENFRNCH 13.8 #1 XFMR
BENFRNCH 69.0-RCCT1 13.8 #1 XFMR
BENFRNCH 69.0-RCCT2 13.8 #1 XFMR
BENFRNCH 69.0-RCCT3 13.8 #1 XFMR
BENFRNCH 69.0-RCCT4 13.8 #1 XFMR
BENFRNCH 69.0-BFDIESEL 4.16 #1 XFMR
CAMBELL 69.0-CAMBELL 115. #1 XFMR
CAMBELL 69.0-CAMBELL 115. #2 XFMR
NSS1 69.0-NSS1 13.8 #1 XFMR
OSAGE 69.0-OSAGE1 11.5 #1 XFMR
OSAGE 69.0-OSAGE2 11.5 #1 XFMR
OSAGE 69.0-OSAGE3 11.5 #1 XFMR
LANGE 69.0-LNG_CT1 13.8 #1 XFMR
YELOWCRK 230.-YELOWCRK 69.0 #1 XFMR

CAMBELL 69.0-ROBNS TP 69.0 #1 LINE
CEMETERY 69.0-5THST TP 69.0 #1 LINE
CLINTON 69.0-PACTOLA 69.0 #1 LINE
CUSTER 69.0-HILLCITY 69.0 #1 LINE
CUSTER 69.0-WESTHILL 69.0 #1 LINE
CUSTER 69.0-JWL CAVE 69.0 #1 LINE
CUSTER 69.0-PRINGLE 69.0 #1 LINE
DUMONT 69.0-YELOWCRK 69.0 #1 LINE
EDGEMONT 69.0-MINNKHAT 69.0 #1 LINE
HILLCITY 69.0-PACTOLA 69.0 #1 LINE
HILLSVW 69.0-POPE&TAL 69.0 #1 LINE
HILLSVW 69.0-SPFSHBEC 69.0 #1 LINE
KIRK 69.0-YELOWCRK 69.0 #1 LINE
KIRK 69.0-YELOWCRK 69.0 #2 LINE
KIRK 69.0-MTNVIEW 69.0 #1 LINE
MERILLAT 69.0-ROBNS TP 69.0 #1 LINE
MERILLAT 69.0-RCSOUTH2 69.0 #1 LINE
MCFT PR 69.0-HUGHES 69.0 #1 LINE
MCFT PR 69.0-UPTON TP 69.0 #1 LINE
NSS1 69.0-WYODAK 69.0 #1 LINE
NSS1 69.0-NSS2 69.0 #1 LINE
NSS1 69.0-GILLETTE 69.0 #1 LINE
OSAGE 69.0-88 OIL 69.0 #1 LINE
OSAGE 69.0-NWCL TAP 69.0 #1 LINE
OSAGE 69.0-OSAG CTY 69.0 #1 LINE
OSAGE 69.0-UPTON TP 69.0 #1 LINE
OSAGE 69.0-OSAGE PR 69.0 #1 LINE
PACTOLA 69.0-WNDYFLAT 69.0 #1 LINE
PLSNTVLY 69.0-44TH ST 69.0 #1 LINE
PLUMA 69.0-YELOWCRK 69.0 #1 LINE
PLUMA 69.0-PLUMA TP 69.0 #1 LINE
PLUMA 69.0-SPRUCEGL 69.0 #1 LINE
POPE&TAL 69.0-SPFSHCIT 69.0 #1 LINE
LANGE 69.0-NLOOP TP 69.0 #1 LINE
LANGE 69.0-PEDMNT 69.0 #1 LINE
RICHMHIL 69.0-SPFSHCIT 69.0 #1 LINE
RICHMHIL 69.0-TROJAN 69.0 #1 LINE
5TH ST 69.0-ROBINSDL 69.0 #1 LINE
5TH ST 69.0-5THST TP 69.0 #1 LINE
SALT CRK 69.0-S.CRK TP 69.0 #1 LINE
SALT CRK 69.0-SCRK TP2 69.0 #1 LINE
SPFSHBEC 69.0-LOOKOUT 69.0 #1 LINE
LOOKOUT 69.0-SUNDHILL 69.0 #1 LINE
LOOKOUT 69.0-SUNDHILL 69.0 #2 LINE
LOOKOUT 69.0-MTNVIEW 69.0 #1 LINE
STURG_CI 69.0-WHTEWOOD 69.0 #1 LINE
STURG_CI 69.0-STURGIS 69.0 #1 LINE
SUNDHILL 69.0-AMCOLOID 69.0 #1 LINE
SUNDHILL 69.0-ST.ONGE 69.0 #1 LINE
TEKLA 230.-HARTZOG 230. #1 LINE
HUGHES 230.-HUGHES 69.0 #1 XFMR
NSS2 13.8-NSS2 69.0 #1 XFMR
NSS2 69.0-NSS_CT1 13.8 #1 XFMR
NSS2 69.0-NSS_CT2 13.8 #1 XFMR
WYGEN 13.8-WG1 230. #1 XFMR
WYGEN2 13.8-WG2 230. #1 XFMR
WYGEN3 13.8-WG3 230. #1 XFMR
RCSOUTH1 230.-RCSOUTH2 69.0 #1 XFMR
DONKYCRK 230.-BHPLPLAN 13.8 #1 XFMR
MINNKHAT 69.0-MINNKHAT 230. #1 XFMR
ST.ONGE 230.-ST.ONGE 69.0 #1 XFMR
PBWIND 230.-PBCTR1 34.5 #1 XFMR
ARVADA1 13.8-ARVADA 230. #1 XFMR
ARVADA2 13.8-ARVADA 230. #1 XFMR
ARVADA3 13.8-ARVADA 230. #1 XFMR
BARBERC1 13.8-BARBERCK 230. #1 XFMR
BARBERC2 13.8-BARBERCK 230. #1 XFMR
BARBERC3 13.8-BARBERCK 230. #1 XFMR
HARTZOG1 13.8-HARTZOG 230. #1 XFMR
HARTZOG2 13.8-HARTZOG 230. #1 XFMR
HARTZOG3 13.8-HARTZOG 230. #1 XFMR
DRYFORK 230.-DRYFRK1 19.0 #1 XFMR
TEKLA1 69.0-TEKLA 230. #1 XFMR
TEKLA2 69.0-TEKLA 230. #2 XFMR
DEGSFB1 0.69 #1 GEN
GLENRKG1 0.57 #1 GEN
GLENRKG2 0.57 #1 GEN
TOPW_G 0.57 #1 GEN
BENFRNCH 13.8 #1 GEN
NSS1 13.8 #1 GEN
RCCT1 13.8 #1 GEN
RCCT2 13.8 #2 GEN
RCCT3 13.8 #3 GEN
RCCT4 13.8 #4 GEN
OSAGE1 11.5 #1 GEN
OSAGE2 11.5 #2 GEN
OSAGE3 11.5 #3 GEN
NSS2 13.8 #2 GEN
BFDIESEL 4.16 #1 GEN
BFDIESEL 4.16 #5 GEN
NSS_CT1 13.8 #1 GEN
NSS_CT2 13.8 #1 GEN
WYGEN 13.8 #1 GEN
WYGEN2 13.8 #1 GEN
WYGEN3 13.8 #1 GEN
LNG_CT1 13.8 #1 GEN
BHPLPLAN 13.8 #1 GEN
PBGEN1 0.57 #1 GEN
DRYFRK1 19.0 #1 GEN