Southwest Power Pool

Impact Study For Generation Interconnection Request GEN-2006-040

SPP Tariff Studies

(#GEN-2006-040)

November 2008

Summary

Pursuant to the tariff and at the request of the Southwest Power Pool (SPP), Power Technologies Inc. (PTI) conducted the following Impact Study to satisfy the Impact Study Agreement executed by the requesting customer and SPP for SPP Generation Interconnection request GEN-2006-040. The request for interconnection was placed with SPP in accordance SPP's Open Access Transmission Tariff, which covers new generation interconnections on SPP's transmission system.

Facilities

The Impact Study determined that no SVC or STATCOM device was necessary for the requested generation using the Acciona 1.5MW wind turbines using the manufacturer's package for low voltage ride through. It was determined that the wind farm will need to be able to meet a unity power factor at the point of interconnection to maintain transmission system reliability. The Customer will need to assure that unity power factor can be maintained at the point of interconnection.

R104-08

Generator Interconnection Impact Study Stability Analysis for GEN-2006-040 108 MW Wind Farm Project in Thomas County, Kansas

Prepared for

Southwest Power Pool, Inc.

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Report Review 1: October 2, 2008
Draft Report: September 17, 2008

Siemens PTI project number: P/21-113293

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Executive Summary

The purpose of this report is to present the results of the transient stability analysis performed to evaluate the stability impact of the proposed interconnection of the GEN-2006-040 wind generation project (“the Project”) on the Southwest Power Pool system (SPP).

Project GEN-2006-040 will be a 108 MW wind generating facility located in Thomas County, Kansas. It will be connected to the existing Mingo 115 kV substation, which is owned by Sunflower Electric Cooperative.

The transient stability analysis was performed using the data package provided by SPP. It contains the latest stability database in PSS™E version 30.2.1. Previously queued projects were also modeled in the power flow cases considered in this study.

In order to assess the new project’s impact on the stability of the SPP system, twenty (20) relevant contingencies in the study area were tested. Summer peak and winter peak power flow cases with 2008 load levels were considered. The Project was evaluated at its full power output of 108 MW.

Generators, voltages and frequencies were monitored in the following control areas:

- Area 534 (SUNC). Project is located in this area
- Area 531 (MIDW)
- Area 536 (WERE)
- Area 539 (WEPL)
- Area 640 (NPPD)

Load flow analysis shows that there is no need for additional shunt capacitors at the main 34.5 kV collector bus to maintain an adequate power factor at the POI, even for the worst contingency.

The stability results show that during the simulations:

- The project wind turbines did not trip during any of the contingencies tested. Similarly, none of the higher queued projects listed in this report has tripped off.
- All other generators in the monitored areas were stable and remained in synchronism during all contingencies and the system conditions considered.
- Acceptable damping and voltage recovery was observed, within applicable standards.

The results show that the Project, modeled at its maximum power output, does not have an adverse impact on the stability of the SPP power system, for the contingencies and system conditions tested.

Section 1

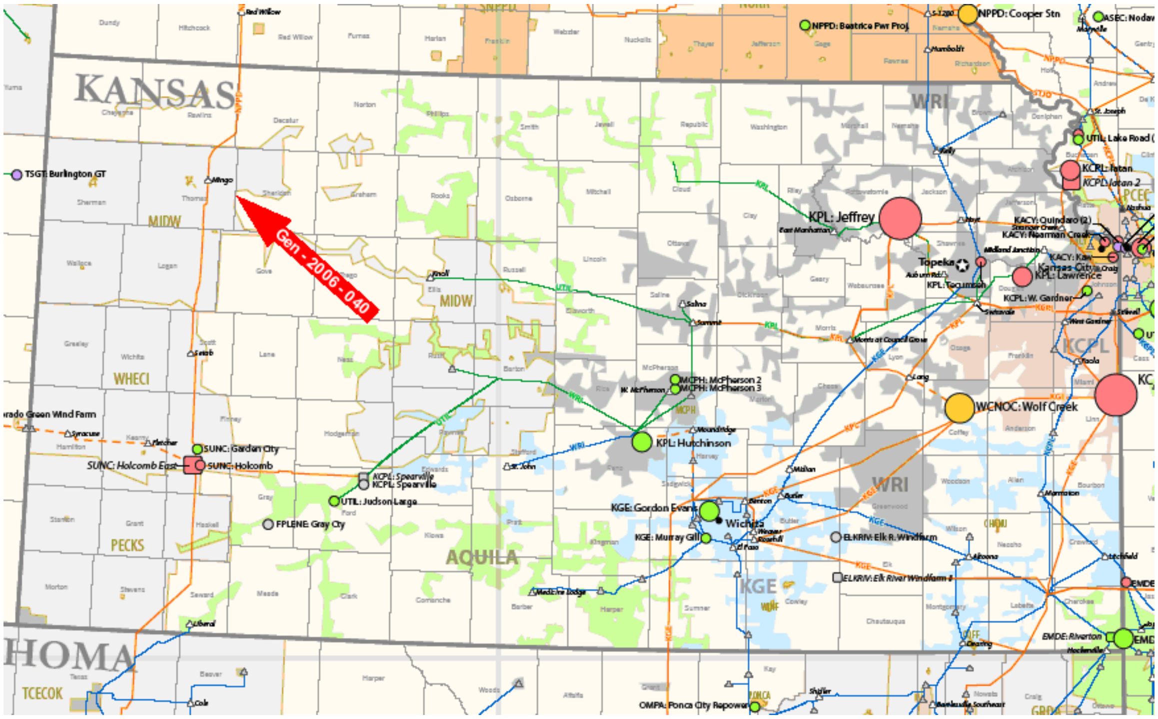
Introduction

1.1 Background

The purpose of this report is to present the results of the transient stability analysis performed to evaluate the impact of the proposed interconnection of the GEN-2006-040 wind generation project ("the Project") on the Southwest Power Pool system (SPP).

Project GEN-2006-040 is a 108 MW wind generating facility located in Thomas County, Kansas. It will be connected to the system by adding a new 115 kV line terminal into the existing Mingo 115 kV substation, which is owned by Sunflower Electric Power Corporation (SUNC). Figure 1-1 illustrates the approximate geographical location of the Project.

Figure 1-1: Location of Project GEN-2006-040



Note: Map was taken from "Platts U.S. Electric Power System – 2007/2008 Edition" (www.platts.com)

The transient stability analysis was performed using a data package provide by SPP. The power flow and dynamic stability data was provided in PSS™E version 30.2.1 format. The following previously queued projects were included in the data:

- GEN-2006-031; 75 MW combustion turbine project at Knoll 115 kV substation
- GEN-2006-032; 201 MW wind farm project at the South Hays 230 kV substation
- GEN-2006-034; 81 MW wind farm project on the Ruleton-Tribune 115 kV line
- GEN-2001-039M; 100 MW wind farm project on the Tribune to Setab 115 kV line
- GEN-2007-011; 135 MW wind farm project at Syracuse 115 kV substation

SPP provided the modeling data for the project GEN-2007-011 separately. Siemens PTI added this project to the power flow cases and the dynamic database.

The stability simulations considered both single line to ground and three phase faults. The fault clearing was three-phase tripping with reclosing. Twenty contingencies provided by SPP were tested in this study. Clearing times were provided as part of the contingency definitions.

1.2 Purpose

The stability study was carried out to:

(a) Determine the ability of the proposed generation facility to remain in synchronism and within applicable planning standards following system faults with normal and delayed clearing;

(b) Determine the amount of capacitance banks to be added at the wind farm facilities;

(c) Evaluate the maximum generation level of the GEN-2006-040 Project in order to avoid stability problems.

Section
2

Model Development

2.1 Power Flow Data

2.1.1 Benchmark Cases (Cases without GEN-2006-040 Project)

The transient stability analysis was performed considering base cases for the year 2008 as follows:

- 2008 – winter peak
- 2008 – summer peak

Figures 2.1 and 2.2 present the power flow diagrams for the year 2008 benchmark cases considered in the study. The diagrams show the power flows and voltages in the area near the Project.

Figure 2-1: Power Flows and Voltages – 2008 Summer Peak without GEN-2006-040

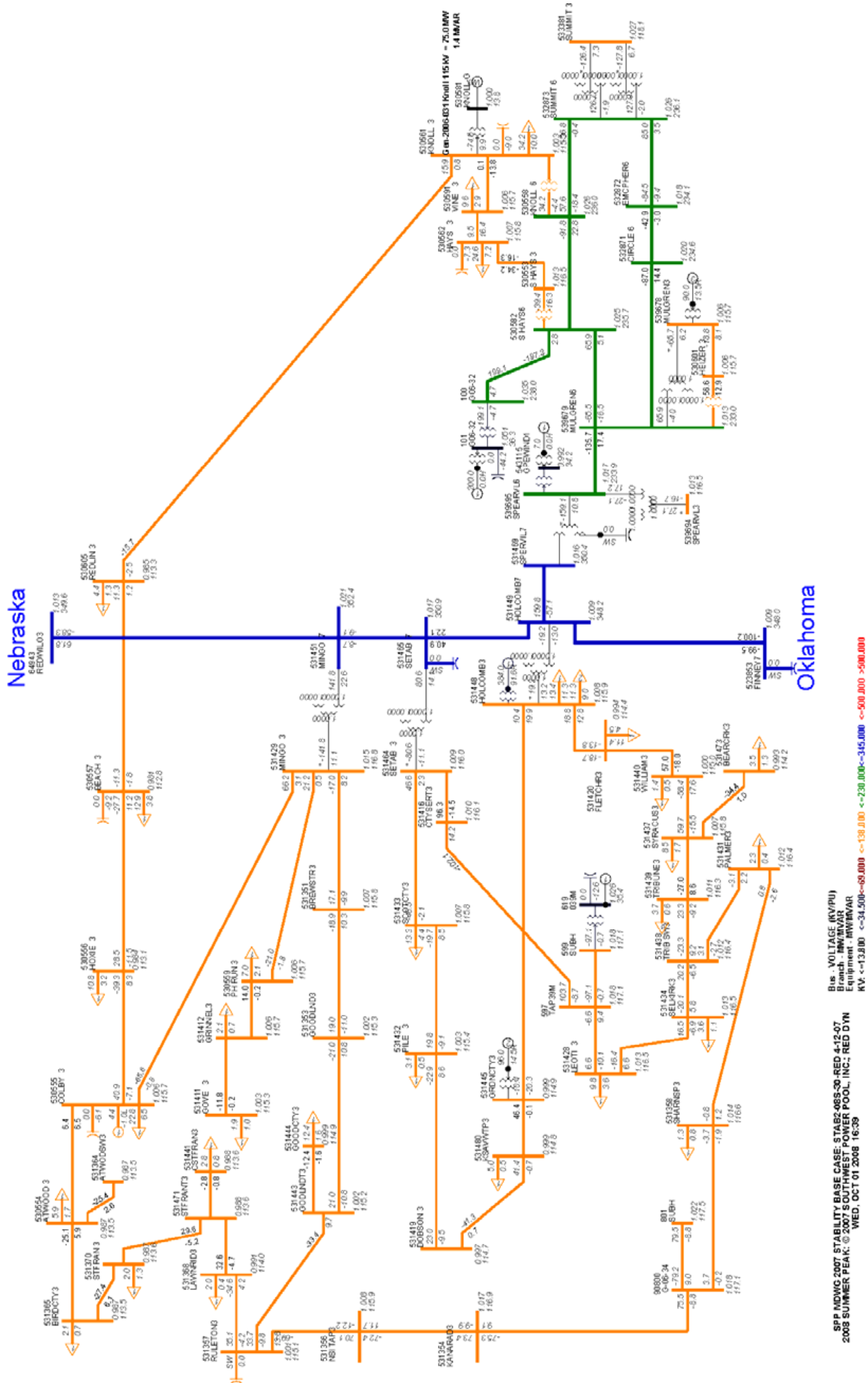
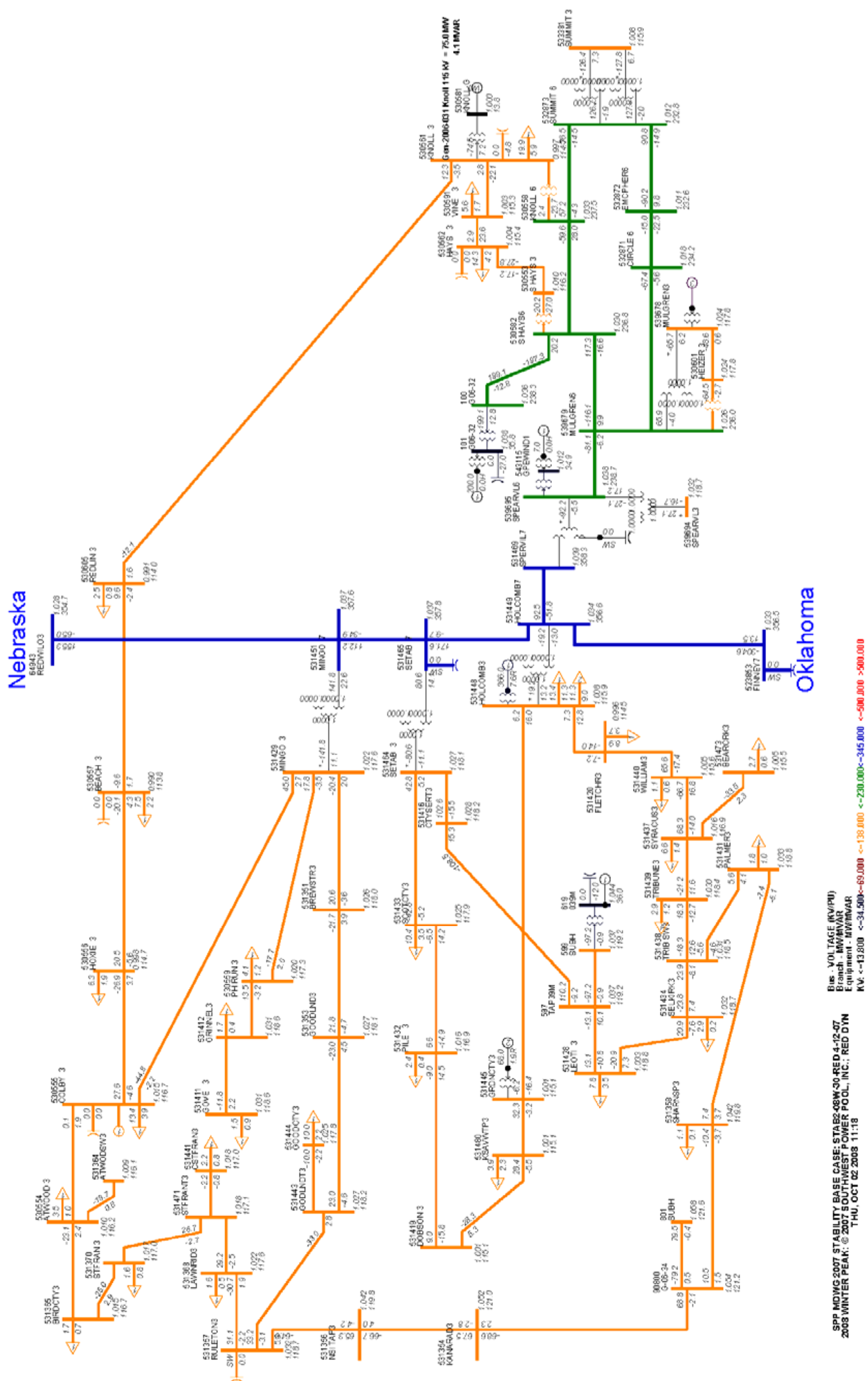


Figure 2-2: Power Flows and Voltages – 2008 Winter Peak without GEN-2006-040



2.1.2 Cases with GEN-2006-040 Project

The Project was modeled as a 108 MW wind generating facility connected to the existing Mingo 115 kV substation, in Thomas County, Kansas.

2.1.2.1 Base Case Setup

The Project is comprised of 72 wind turbines, each with an output of 1.5 MW. The project developer provided the impedance data for a 34.5 kV collector system that accommodates ten (10) turbines. The impedance data for this collector system with ten (10) turbines is included in Appendix A.

The 72 wind units need seven (7) such collector systems to be connected to the system, five of them with 10 turbines, and two collector systems with 11 turbines. An extra feeder was added to the 11-turbine collector systems in order to include the additional wind turbines. All seven collector systems terminate in the main 34.5-kV collector bus.

For the stability study, the wind farm project was represented by seven equivalent wind turbines, each connected to an equivalent collector system. Each of five equivalent systems represents 10 turbines and their associated feeders, and each of the two remaining equivalent collector systems represents 11 turbines and their associated feeders.

The capacitance of the collector system cables was included in the equivalent models.

Figures 2.3 and 2.4 present the power flow diagrams for the year 2008 cases including the GEN-2006-040 wind farm. The diagrams show the power flows and voltages in the area near the Project.

Figure 2-3: 2008 Summer Peak Power Flows and Voltages – with GEN-2006-040 in Service

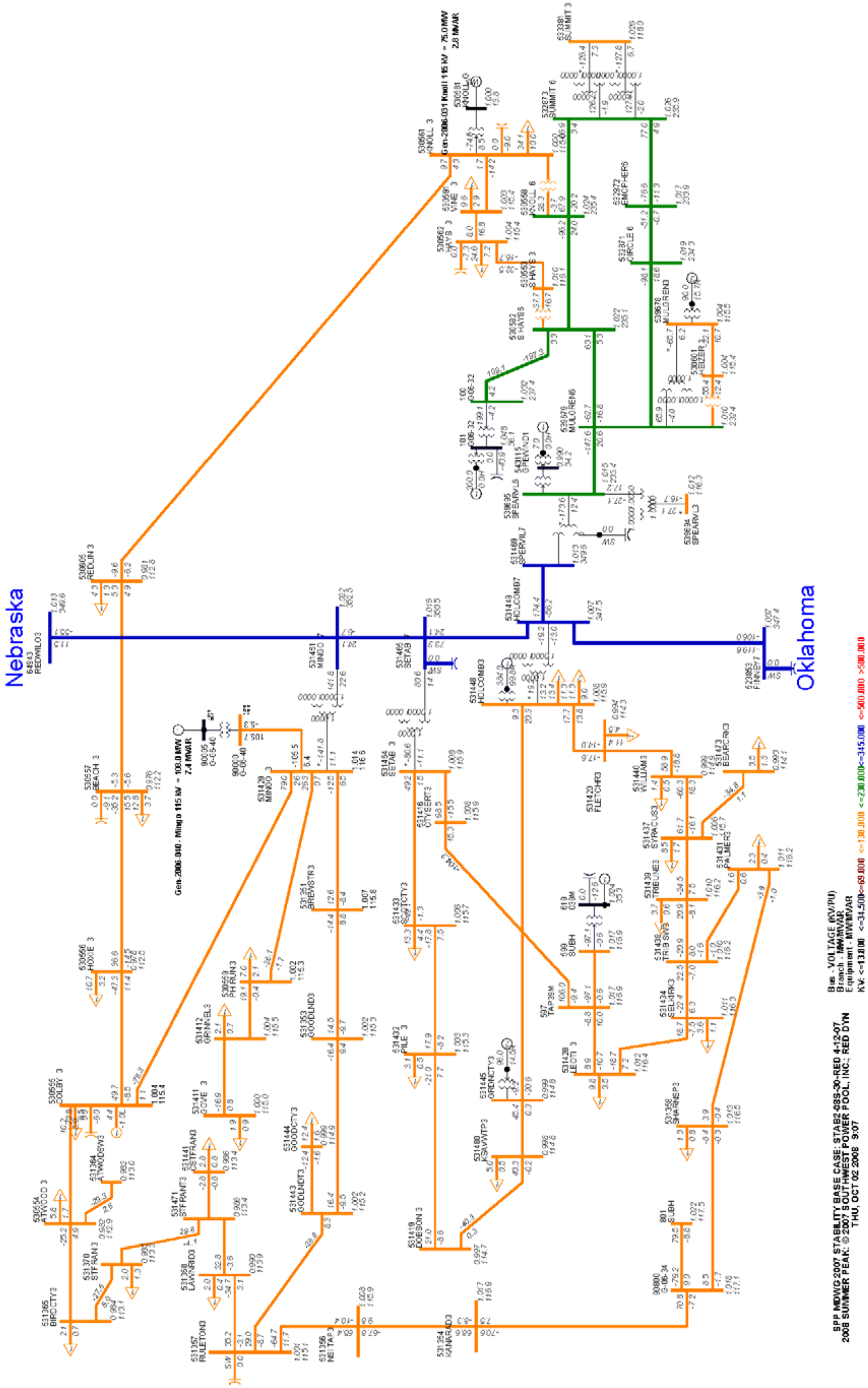


Figure 2-4: 2008 Winter Peak Power Flows and Voltages – with GEN-2006-040 in Service

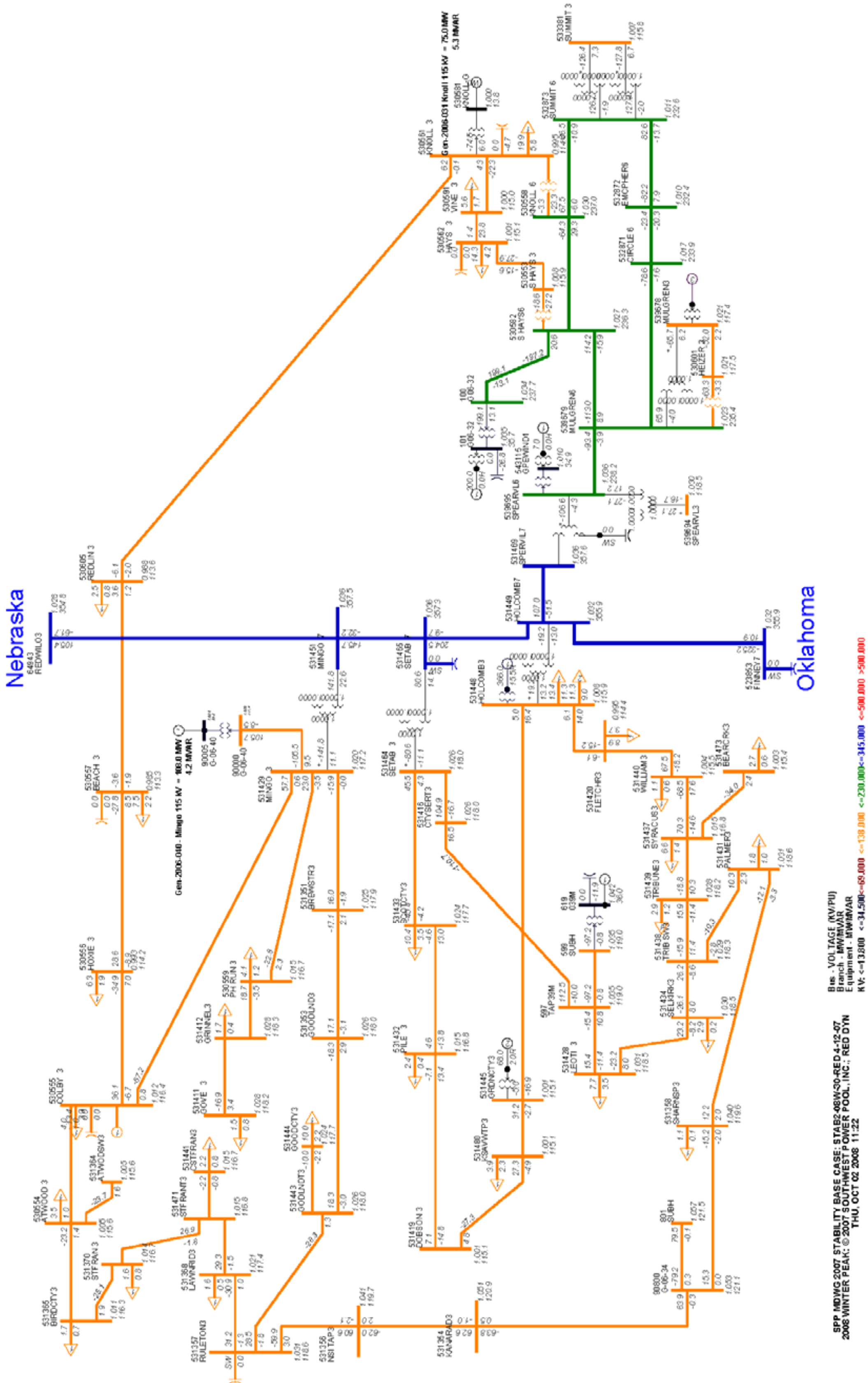
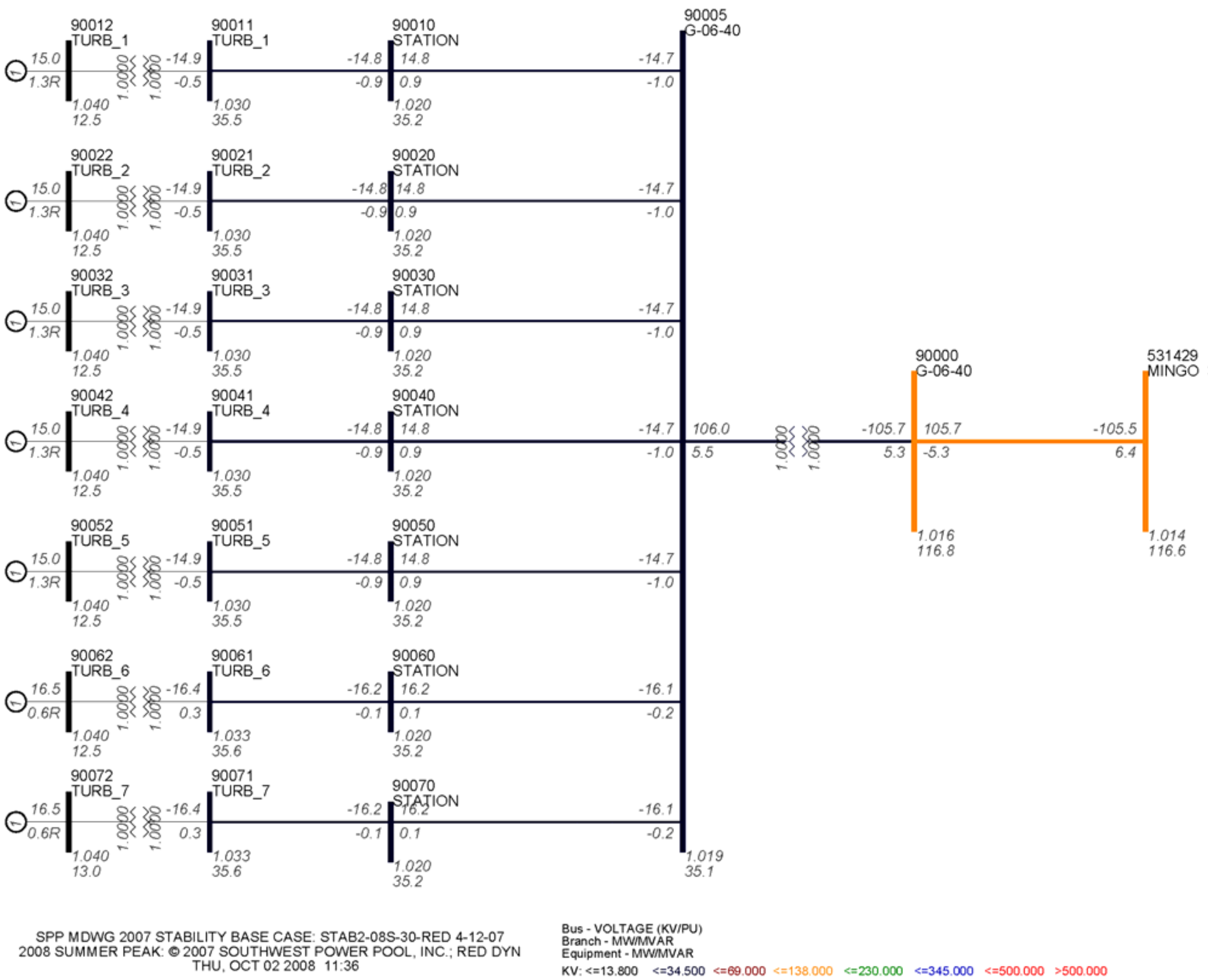


Figure 2.5 present the wind farm power flow diagram, showing the seven wind turbine equivalents, generator step up transformers and feeders. The wind farm generators are represented by 5 x 15 MW wind turbines and 2 x 16.5 MW wind turbine generators, for a total output of 108 MW. All seven feeders terminate in the main collector 34.5-kV bus, which is connected to the 115-kV point of interconnection (POI) via the main 80/100/120 MVA wind farm transformer. The high side of this transformer is connected to the existing Mingo 115-kV substation through a 3.2-mile overhead 115-kV transmission line.

Figure 2-5: GEN-2006-040 Project Power Flow Model



2.2 Power Factor Analysis

A power factor analysis was conducted to determine if any additional VAR support was needed. The analysis was performed on the summer peak case. Following the methodology outlined by SPP, a fictitious VAR generator was modeled at the Project 115 kV bus. The VAR generator was set to hold a voltage of 1.015 per unit, which is the voltage at the Project Interconnection Point (POI) in the case that SPP provided. All contingencies were run in power flow. The results are presented in Table 2-1. The contingency definitions are shown in Table 3-2.

Table 2-1 Power Factor Analysis

Contingency ID	VAR Generator MVAR
FLT1	-11.6
FLT3	-9.5
FLT5	-8.7
FLT7	-8.3
FLT9	-11.1
FLT11	-3.6
FLT13	-3.6
FLT15	+5.0
FLT17	-6.9
FLT19	-5.5

The voltage at the POI in the power flow case with the Project is about 1.02 per unit. Due to the VAR support provided by the Project, the voltage at the POI with the Project is higher than the voltage at the POI in the case without the Project, which is 1.015 per unit, as indicated above.

As shown in the Table 2-1 above, contingency #15 is the worst one. In this contingency, the Holcomb to Spearville 345 kV line is lost. However, only 5 Mvar would be needed to maintain the scheduled voltage.

Without additional reactive support, the post-contingency voltage at the POI following contingency #15 is adequate. The resulting power factor at the POI is 0.998.

Therefore, it is concluded that there is no need for capacitor banks at the main 34.5 kV collector bus to maintain unity power factor at the POI.

2.3 Stability Database

The transient stability analysis was performed using the data provided by SPP. Stability models for the GEN-2005-012 project were added to the dynamic database, based on data documentation given.

2.3.1 GEN-2006-040 Stability Modeling Data

The Acciona Windpower AW1500 wind turbine model package provided by SPP was used to represent the GEN-2006-040 wind turbine units. The default parameters recommended by the manufacturer were used. The wind turbine generators were modeled controlling the voltage of their own buses.

The default voltage protection model set points recommended by the manufacturer were used. The wind units were modeled with their built-in voltage ride through capability. Also, the default frequency protection model set points recommended by the manufacturer were used. The protection settings are summarized in the document "Modeling the Acciona Windpower AW1500 Wind Turbine for Power Flow and Stability Studies with PSS/E (version 29.4 pt 30.0)" issued by Acciona WindPower BEW Engineering, 19-Jan-2008. This document was provided by SPP.

The dynamic data package of the Acciona AW1500 units includes a voltage regulator model. As described by the manufacturer in the document cited above, "this system is used to simulate the operation of the SCADA based wind plant voltage regulator, and is it is used to dynamically control the reactive power output of the individual wind turbines within the wind plant to regulate a remote bus voltage". In the present stability study, the controlled bus was the high side of the collector substation transformer.

The PSS/E data output documenting the model parameters is shown below for one of the wind turbines modeled for this stability study. The other six turbines have similar parameters.

```
PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS/E      TUE, SEP 16 2008  15:54
SPP MDWG 2007 STABILITY BASE CASE: STAB2-08S-30-RED 4-12-07
2008 SUMMER PEAK: ¬ 2007 SOUTHWEST POWER POOL, INC.; RED DYN

PLANT MODELS
REPORT FOR PLANT MODELS                    BUS 90012 [TURB_1      12.000] MODELS

** WTG_AW **    BUS     NAME      BASE kV    MC    C O N S      S T A T E S     V A R S     I C O N S
            90012TURB_1          12.000     1  117574-117594  43047-43047   16220-16324    8282

   DYNAMICS MODEL DATA:
   --------------------
   Max_Fnet         Min_Fnet         Tmax_Freq           MaxVnet1             MaxVnet2
    63.00            57.00             5.00                1.10                 1.20

   TmaxVnet1        TmaxVnet2        MinVnet1            MinVnet2             MinVnet3
     5.00             0.10             0.15                0.80                 0.85

   Min_Vnet4        TminVne0         TminVne1            TminVne2             TminVne3
     0.90             0.25             0.75                2.00                15.00

   TminVne4          Vv_nom        CONTROL_DYN_Q      EQUIPO_POTENCIA_Q    Time_PriorQ_Swell
   210.00            15.00             1.00                0.00                 3.00

   Time_PriorQ_Dip
     3.00
    ** AWVREG **  BUS      C O N S      S T A T E S      V A R S      I C O N S
               90000    *****-*****    43054-43055    16955-16958     8289- 8297
                   KP      KI      VTTAU   SCDEL  MAXANG  MINANG
                 1.00   10.00    0.10    0.10    0.32   -0.32

                         GENERATORS ASSOCIATED WITH THIS REGULATOR
                 90012   90022   90032   90042   90052   90062   90072       0
```

Section 3

Study Assumptions

The stability study was carried out using the PSS™E Version 30.2.1.

The study considered the winter peak and summer peak 2008 power flow cases provided by SPP. The base case contains all the significant proposed generation projects ahead in the interconnection queue:

- GEN-2006-031; 75 MW combustion turbine project at Knoll 115 kV substation
- GEN-2006-032; 201 MW wind farm project at the South Hays 230 kV substation
- GEN-2006-034; 81 MW wind farm project on the Ruleton-Tribune 115 kV line
- GEN-2001-039M; 100 MW wind farm project on the Tribune to Setab 115 kV line
- GEN-2007-011; 135 MW wind farm project at Syracuse 115 kV substation

Table 3-1 shows the control areas monitored for this study:

Table 3-1 – Monitored Control Areas

Area Number	Area Name
534	SUNC
531	MIDW
536	WERE
539	WEPL
640	NPPD

3.1 Contingencies for Stability Analysis

The stability simulations included three-phase (3PH) faults and single line-to-ground (1PH) faults. The fault clearing was three-phase tripping with re-closing. The disturbances studied are described in Table 3-2. The disturbance descriptions and clearing times were provided by SPP.

Table 3-2: Contingencies

#	Fault Location	Fault Type	Fault Clearing
FLT1	Fault on the Mingo to Brewster 115 kV line, near Mingo	3PH	• Clear Fault after 5 cycles by removing the line from the Mingo – Brewster • Wait 20 cycles, and then re-close the line in (b) back into the fault. • Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT2	Same as FLT1 above	1PH	Same as FLT1 above
FLT3	Fault on the Mingo to Colby 115 kV line, near Mingo	3PH	• Clear Fault after 5 cycles by removing the line from the Mingo - Colby • Wait 20 cycles, and then re-close the line in (b) back into the fault. • Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT4	Same as FLT3 above	1PH	Same as FLT3 above
FLT5	Fault on the Mingo to Pheasant Run (530559) 115 kV line, near Mingo	3PH	• Clear Fault after 5 cycles by removing the line from the Mingo – Pheasant Run • Wait 20 cycles, and then re-close the line in (b) back into the fault. • Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT6	Same as FLT5 above	1PH	Same as FLT5 above
FLT7	Fault on the Mingo Autotransformer on the 345kV bus	3PH	• Apply Fault at Mingo (531451). • Clear Fault after 5 cycles by removing the auto from service
FLT8	Same as FLT7 above	1PH	Same as FLT7 above
FLT9	Fault on the Mingo – Setab 345kV line near Mingo	3PH	• Clear Fault after 5 cycles by removing the line from Mingo - Setab • Wait 20 cycles, and then re-close the line in (b) back into the fault. • Leave fault on for 5 cycles, then trip the line in (b) and remove fault
FLT10	Same as FLT9 above	1PH	Same as FLT9 above

#	Fault Location	Fault Type	Fault Clearing
FLT11	Fault on the Mingo (531451) – Red Willow (64943) 345kV line near Mingo	3PH	• Clear Fault after 5 cycles by removing the line from Mingo – Red Willow • Wait 20 cycles, and then re-close the line in (b) back into the fault. • Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT12	Same as FLT11 above	1PH	Same as FLT11 above
FLT13	Fault on the Colby o Hoxie 115 kV line, near Hoxie	3PH	• Clear Fault after 5 cycles by removing the line from Colby - Hoxie • Wait 20 cycles, and then re-close the line in (b) back into the fault. • Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT14	Same as FLT13 above	1PH	Same as FLT13 above
FLT15	Fault on the Holcomb to Spearville 345 kV line, near Spearville	3PH	• Clear Fault after 5 cycles by removing the line Holcomb to Spearville • Wait 20 cycles, and then re-close the line in (b) back into the fault. • Leave fault on for 5 cycles, then trip the line in (b) and remove fault
FLT 16	Same as FLT15 above	1PH	Same as FLT15 above
FLT17	Fault on the Tribune Switch to Selkirk 115 kV line, near Tribune Switch	3PH	• Clear Fault after 5 cycles by removing the line from Tribune Switch - Selkirk • Wait 20 cycles, and then re-close the line in (b) back into the fault. • Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT18	Same as FLT17 above	1PH	Same as FLT17 above
FLT19	Fault on the Colby to Atwood 115 kV line, near Atwood	3PH	• Clear Fault after 5 cycles by removing the line from Colby-Atwood • Wait 20 cycles, and then re-close the line in (b) back into the fault. • Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT20	Same as FLT19 above	1PH	Same as FLT19 above

In order to simulate a single line to ground fault at a certain bus, an equivalent admittance was connected to that bus. The equivalent admittance was sized so that the instantaneous post-fault positive sequence voltage was about 0.6 times the pre-fault voltage. Table 3-3 shows the equivalent admittances used in the study. The admittances were calculated using the summer peak and winter peak cases provided by SPP.

Table 3-3: Equivalent Admittance – Single Line to Ground Modeling

Substation / kV	***Equivalent Admittance (MVA)***	
	Summer 2008	***Winter 2008***
Mingo 115 kV	139-j1164	141-j1112
Mingo 345 kV	225-j1918	251-j1825
Hoxie 115 kV	134-j322	125-j312
Spearville 345 kV	159-j1639	209-j1549
Tribune Switch 115 kV	132-j476	128-j467
Atwood 115 kV	130-j333	120-j319

Section

4

Stability Analysis

The objective of this analysis is to determine the impact of the GEN-2006-040 on the system stability performance and to verify the ability of the proposed generation facility to remain online during the disturbances considered in the study.

The summer peak and winter peak cases were tested with the Project in service at full power output. If stability problems were observed, the corresponding case and problematic contingencies were tested without the Project to determine if the Project was causing the stability problem or if the problem was pre-existing. If the Project was the cause of the problem, this study would determine the maximum power output at which the Project could operate without causing stability problems.

4.1 Steady State Performance

The base cases used in the study were checked for thermal and voltage violations in the monitored control areas. The pre-contingency thermal loadings in all transmission facilities were checked against the corresponding normal ratings. Any loading greater than 100% of the normal rating was reported. Also, pre-contingency voltages were checked. Voltages outside the normal range (0.95 to 1.05 per unit) were reported. The results are summarized below.

4.1.1 Summer Peak Case

No thermal violations were found.

The following voltage violations were found:

BUSES WITH VOLTAGE LESS THAN 0.9500:

BUS#	X-- NAME --X	BASKV	AREA	V(PU)	V(KV)	BUS#	X-- NAME --X	BASKV	AREA	V(PU)	V(KV)
64759	C.CREEK4	230.00	640	0.9347	214.98	64765	CANADAY4	230.00	640	0.9361	215.31
64948	RIVERDL4	230.00	640	0.9326	214.50	530617	EDWARDS3	115.00	531	0.9415	108.27
530619	KINSLEY3	115.00	531	0.9355	107.58	530621	PAWNEE 3	115.00	531	0.9337	107.38
530622	PAWN-ED3	115.00	531	0.9395	108.04	539687	PRATT 3	115.00	539	0.9478	108.99
533485	WATHENA2	69.000	536	0.9454	65.230						

None of the low voltages reported above are in the Project control area.

4.1.2 Winter Peak Case

No thermal or voltage violations were found.

4.2 Stability Analysis Results

In order to assess the stability impact of the Project each of the contingencies described in Table 3-2 was simulated during 20 seconds. The following variables (channels) were monitored and plotted during the simulations (28 plots in total) :

1. Project active power for each equivalent wind turbine (two plots)
2. Project reactive power for each equivalent wind turbine (two plots)
3. Project total active power and total reactive power
4. Terminal voltage for each project wind turbine unit (two plots)
5. Voltage at Project POI
6. Total P and Q for GEN-2001-39M project
7. Voltage at POI of GEN-2001-39M project
8. Total P and Q for GEN-2007-011 project
9. Voltage at POI of GEN-2007-011 project
10. Total P and Q for GEN-2006-034 project
11. Voltage at POI of GEN-2006-034 project
12. Total P and Q for GEN-2006-032 project
13. Voltage at POI of GEN-2006-032 project
14. Machine angles for GEN-2006-035 project
15. Voltage at POI of GEN-2006-035 project
16. SUNC Control Area Machine Angles
17. WERE Control Area Machine Angles (two plots)
18. WEPL Control Area Machine Angles
19. NPPD Control Area Machine Angles (two plots)
20. 115 kV voltages (two plots)
21. 345 kV voltages
22. Bus Frequencies

The results show that during the simulations:

- The Project wind turbines did not trip during any of the simulations and any of the power flow cases tested. Similarly, none of the higher queued projects listed in this report tripped off.

- All other generators in the monitored areas were stable and remained in synchronism during all contingencies and the system conditions considered.

- Acceptable damping and voltage recovery was observed, within applicable standards.

Table 4-1 describes the contingencies tested and the results obtained.

The plots of the selected system variables are included in Appendices B and C for the Summer Peak and Winter Peak 2008 cases, respectively.

Table 4-1: Stability Analysis Results with the Project in Service at 108 MW (Full Output)

#	Contingency ID	Contingency Description	2008 Summer Peak	2008 Winter Peak
1	FLT1-3PH	Fault on the Mingo to Brewster 115 kV line, near Mingo	**Stable**	**Stable**
2	FLT2-1PH	Same as FLT1 above	**Stable**	**Stable**
3	FLT3-3PH	Fault on the Mingo to Colby 115 kV line, near Mingo	**Stable**	**Stable**
4	FLT4-1PH	Same as FLT3 above	**Stable**	**Stable**
5	FLT5-3PH	Fault on the Mingo to Pheasant Run (530559) 115 kV line, near Mingo	**Stable**	**Stable**
6	FLT6-1PH	Same as FLT5 above	**Stable**	**Stable**
7	FLT7-3PH	Fault on the Mingo Autotransformer on the 345kV bus	**Stable**	**Stable**
8	FLT8-1PH	Same as FLT7 above	**Stable**	**Stable**
9	FLT9-3PH	Fault on the Mingo – Setab 345kV line near Mingo	**Stable**	**Stable**
10	FLT10-1PH	Same as FLT9 above	**Stable**	**Stable**
11	FLT11-3PH	Fault on the Mingo (531451) – Red Willow (64943) 345kV line near Mingo	**Stable**	**Stable**
12	FLT12-1PH	Same as FLT11 above	**Stable**	**Stable**
13	FLT13-3PH	Fault on the Colby o Hoxie 115 kV line, near Hoxie	**Stable**	**Stable**
14	FLT14-1PH	Same as FLT13 above	**Stable**	**Stable**
15	FLT15-3PH	Fault on the Holcomb to Spearville 345 kV line, near Spearville	**Stable**	**Stable**
16	FLT16-1PH	Same as FLT15 above	**Stable**	**Stable**
17	FLT17-3PH	Fault on the Tribune Switch to Selkirk 115 kV line, near Tribune Switch	**Stable**	**Stable**
18	FLT18-1PH	Same as FLT17 above	**Stable**	**Stable**
19	FLT19-3PH	Fault on the Colby to Atwood 115 kV line, near Atwood	**Stable**	**Stable**
20	FLT20-1PH	Same as FLT19 above	**Stable**	**Stable**

Section

5

Conclusion

The proposed GEN-2006-040 - 108 MW wind farm project has been evaluated to determine the stability impact of the project on the SPP system.

Load flow analysis shows that, there is no need for capacitor banks at the main 34.5 kV collector bus to maintain unity power factor at the POI, even for the worst contingency.

The stability results show that during the simulations:

- The Project wind turbines did not trip during any of the contingencies tested. Similarly, none of the higher queued projects listed in this report tripped off.
- All other generators in the monitored areas were stable and remained in synchronism during all contingencies and the system conditions considered.
- Acceptable damping and voltage recovery was observed, within applicable standards.

The results show that the Project, modeled at its maximum power output, does not have an adverse impact on the stability of the SPP power system, for the contingencies and system conditions tested.

Appendix

A

Case Setup

A.1 Collector System Data for GEN-2006-040

			Ohms/1000ft				µF/1000ft			Ohms				µF
Terminal	**wire - size**	**wire - type**	**R1**	**X1**	**R0**	**X0**	**C**	**sec_mi**	**sec_ft**	**R1**	**X1**	**R0**	**X0**	**C**
FEEDER														
Turbine 10	AWG 1/0	Aluminium - U/G	0.212	0.053	0.751	0.034	0.0391	0.2324	1227.0	0.2601	0.0650	0.9215	0.0417	0.0480
Turbine 9	AWG 1/0	Aluminium - U/G	0.212	0.053	0.751	0.034	0.0391	0.2641	1394.4	0.2956	0.0739	1.0472	0.0474	0.0545
Turbine 8	AWG 4/0	Aluminium - U/G	0.106	0.047	0.401	0.029	0.0486	0.6817	3599.1	0.3815	0.1692	1.4432	0.1044	0.1749
Turbine 7	AWG 4/0	Aluminium - U/G	0.106	0.047	0.401	0.029	0.0486	0.3076	1624.0	0.1721	0.0763	0.6512	0.0471	0.0789
Turbine 6	AWG 4/0	Aluminium - U/G	0.106	0.047	0.401	0.029	0.0486	0.1709	902.2	0.0956	0.0424	0.3618	0.0262	0.0438
Turbine 5	500 kCMIL	Aluminium - U/G	0.048	0.042	0.173	0.024	0.0662	0.2305	1217.2	0.0584	0.0511	0.2106	0.0292	0.0806
Turbine 4	500 kCMIL	Aluminium - U/G	0.048	0.042	0.173	0.024	0.0662	0.2635	1391.1	0.0668	0.0584	0.2407	0.0334	0.0921
Turbine 3	500 kCMIL	Aluminium - U/G	0.048	0.042	0.173	0.024	0.0662	0.3660	1932.4	0.0928	0.0812	0.3343	0.0464	0.1279
Turbine 2	1000 kCMIL	Aluminium - U/G	0.028	0.037	0.088	0.020	0.0865	0.1901	1003.9	0.0281	0.0371	0.0883	0.0201	0.0868
Turbine 1	1000 kCMIL	Aluminium - U/G	0.028	0.037	0.088	0.020	0.0865	0.2262	1194.2	0.0334	0.0442	0.1051	0.0239	0.1033
ST	1000 kCMIL	Aluminium - U/G	0.028	0.037	0.088	0.020	0.0865	0.7724	4078.1	0.1142	0.1509	0.3589	0.0816	0.3528

Appendix

B

Stability Plots for the Summer Peak Case

The plots of the contingencies for the 2008 Summer Peak case are shown in this Appendix.

Appendix

C

Stability Plots for the Winter Peak Case

The plots of the contingencies for the 2008 Winter Peak case are shown in this Appendix.