



**DRAFT**

## **Interconnection Facilities Study Report**

### **Request # GI-2006-2**

Peetz Logan Interconnect, LLC.  
200 MW Expansion  
Facility Study

September 20, 2007

PSCo Transmission Planning – Denver, CO

## Executive Summary

This Interconnection Facilities Study Report summarizes the analysis performed by Public Service Company of Colorado (PSCo) to specify and estimate the cost of the equipment, engineering, procurement, and construction needed to interconnect a 200 MW wind generation expansion of the existing 400 MW<sup>1</sup> Peetz Logan Wind Facility (GI-2006-1(g)) for total interconnection amount of 600 MW. The Point of Interconnection (POI) will remain at the PSCo Pawnee Station in Morgan County, Colorado. The new wind generation facility would be located near Peetz, Colorado and would interconnect at Pawnee Station via the Customer's 78-mile 230 kV transmission line. The requested commercial in-service date is October 1, 2008 and a requested back feed date of April 1, 2008. This study indicates that the April 2008 back feed date is achievable to facilitate the commercial in-service date (CID) of October 2008.

PSCo will require testing of the full 600 MW of the facility. These tests will include but not limited to power factor capability and voltage control at the POI for various generation output levels (0 to 600 MW) of the Customer's wind generation facility. Appendix B provides a typical testing plan.

The recommended Network Upgrades for Interconnection at Pawnee Station only include minor wiring changes at PSCo's Lookout Center and relay setting changes at Pawnee Station. No other changes to the existing interconnection are required.

The total estimated cost for the facilities required for Interconnection and Delivery is approximately **\$96.39 million**<sup>2</sup> and includes:

- \$0.04 million for Customer Funded PSCo Interconnection Facilities
- \$0.0 for PSCo Network Upgrades for Interconnection
- \$96.35 million for PSCo Network Upgrades for Delivery

The estimated time required to engineer, permit, and construct the facilities described above is at least **3 months** from the date Customer meets all applicable Milestones as agreed to in any future LGIA. Assuming the LGIA is executed and the Customer Milestones completed in a timely manner, PSCo anticipates they can meet the back feed date of April 2008 for Interconnection only. It is not feasible to meet the requested CID due to the 60 month time frame needed to make the Network Upgrade Required for Delivery available to the PSCo system.

This wind project in the System Impact Study (SIS) was evaluated as an Energy Resource (ER)<sup>3</sup> and a Network Resource (NR)<sup>4</sup>, with power directed to PSCo customer loads. As an

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<sup>1</sup> The 400 MW is split 200 MW each between two separate entities each with their own Power Purchase Agreements (PPA's) with Xcel Energy Markets.

<sup>2</sup> Appropriation estimate for the Inteconnection only considered to have an accuracy of +/- 20%. The Network Upgrades For Delivery are Scoping Estimates and considered to have an accuracy of +/- 30%.

ER, the proposed project could deliver approximately 50 MW before any Network Upgrades are required. This is assuming planned upgrades of the two transmission lines in the Pawnee to Smoky Hill to Daniels Park Corridor are completed by Spring 2008. These upgrades raise the lines ratings from 340 MVA or 458 MVA to 637 MVA.

Transmission Studies for the NR evaluation show that the basic PSCo Network Upgrades for Delivery would consist of:

- Constructing a new 115-mile 345 kV line from Pawnee to Daniels Park Substation. The new transmission can be described in three sections:
  - The first section consists of 80-miles of new 345 kV single circuit steel structures in new right of way from Pawnee and then join the existing PSCo transmission corridor near Brick Center Substation
  - Replace 15-miles of an existing single circuit line between Brick Center and Smoky Hill (part of the Pawnee-Daniels Park 230 kV line) with double circuit 345 kV capable structures. One side will operate at 230 kV to maintain the existing circuit. The other side will operate at 345 kV and make up the second section.
  - The final (third) section consists of constructing 20 miles of new 345 kV double circuit transmission from Smoky Hill to Daniels Park.
- Two 345/230 kV autotransformers at Pawnee
- One new 345 kV line termination at Daniels Park

### Customer Voltage and Power Factor Issues

The System Impact Study showed that the Customer does not have any power factor or voltage control for power flows above 300 MW at the POI. For system reliability reasons, this Facilities Study, as per the Customer's request, has determined a solution for this problem. The solution is 200 MVAR of switched capacitor banks located near the POI. This 200 MVAR has been optimized into four individual 50 MVAR capacitor banks and would be switched on by the Customer's Operators at the request of the PSCo System Operations (Lookout Center) as the Customer's generation increases on their line. The cost of these capacitor banks and associated control equipment has not been estimated because these capacitors are part of the Customer's transmission system.

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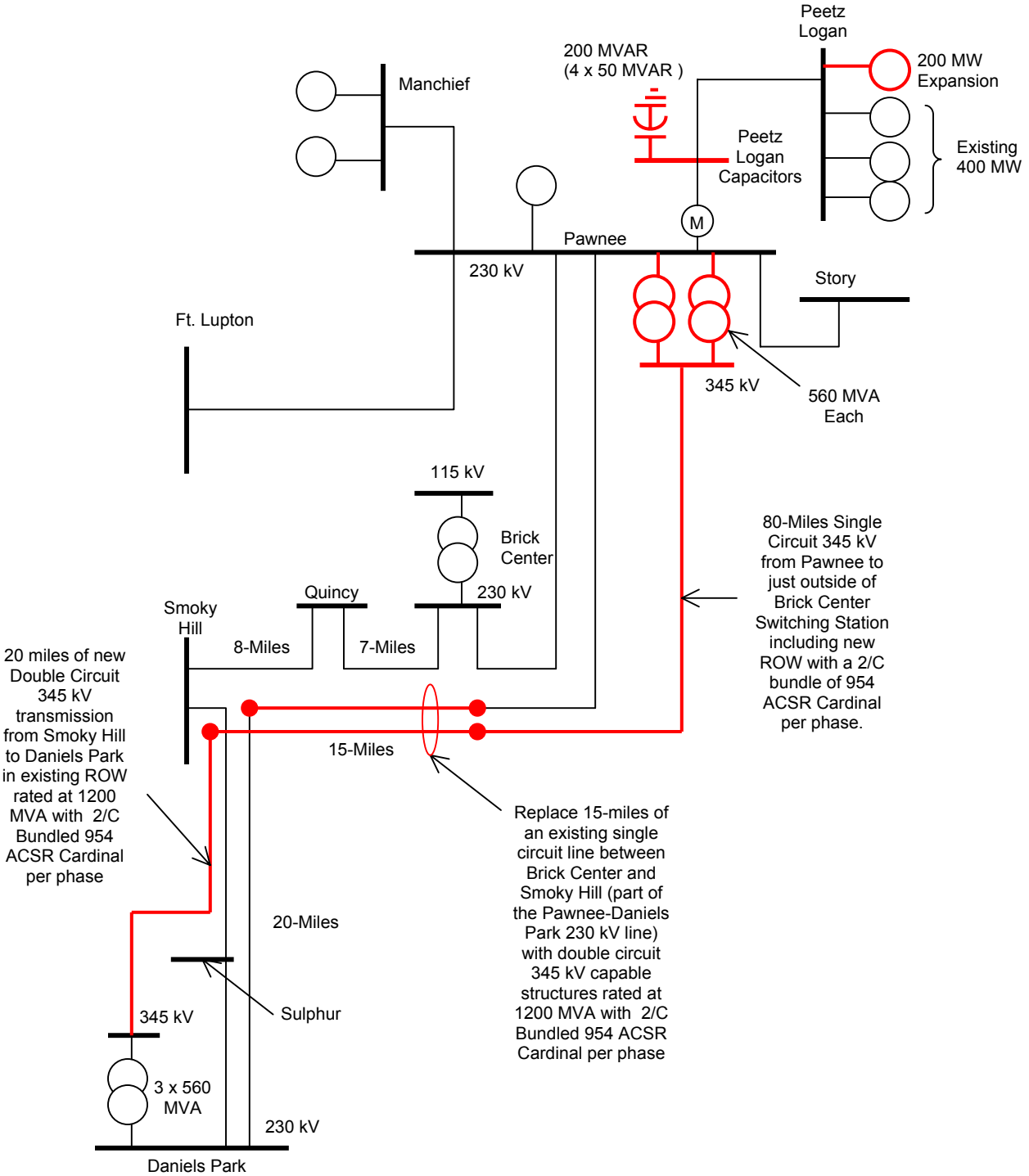
<sup>3</sup> **Energy Resource Interconnection Service (ER Interconnection Service)** shall mean an Interconnection Service that allows the Interconnection Customer to connect its Generating Facility to the Transmission Provider's Transmission System to be eligible to deliver the Generating Facility's electric output using the existing firm or nonfirm capacity of the Transmission Provider's Transmission System on an as available basis. Energy Resource Interconnection Service in and of itself does not convey transmission service.

<sup>4</sup> **Network Resource Interconnection Service** shall mean an Interconnection Service that allows the Interconnection Customer to integrate its Large Generating Facility with the Transmission Provider's Transmission System (1) in a manner comparable to that in which the Transmission Provider integrates its generating facilities to serve native load customers; or (2) in an RTO or ISO with market based congestion management, in the same manner as all other Network Resources. Network Resource Interconnection Service in and of itself does not convey transmission service.

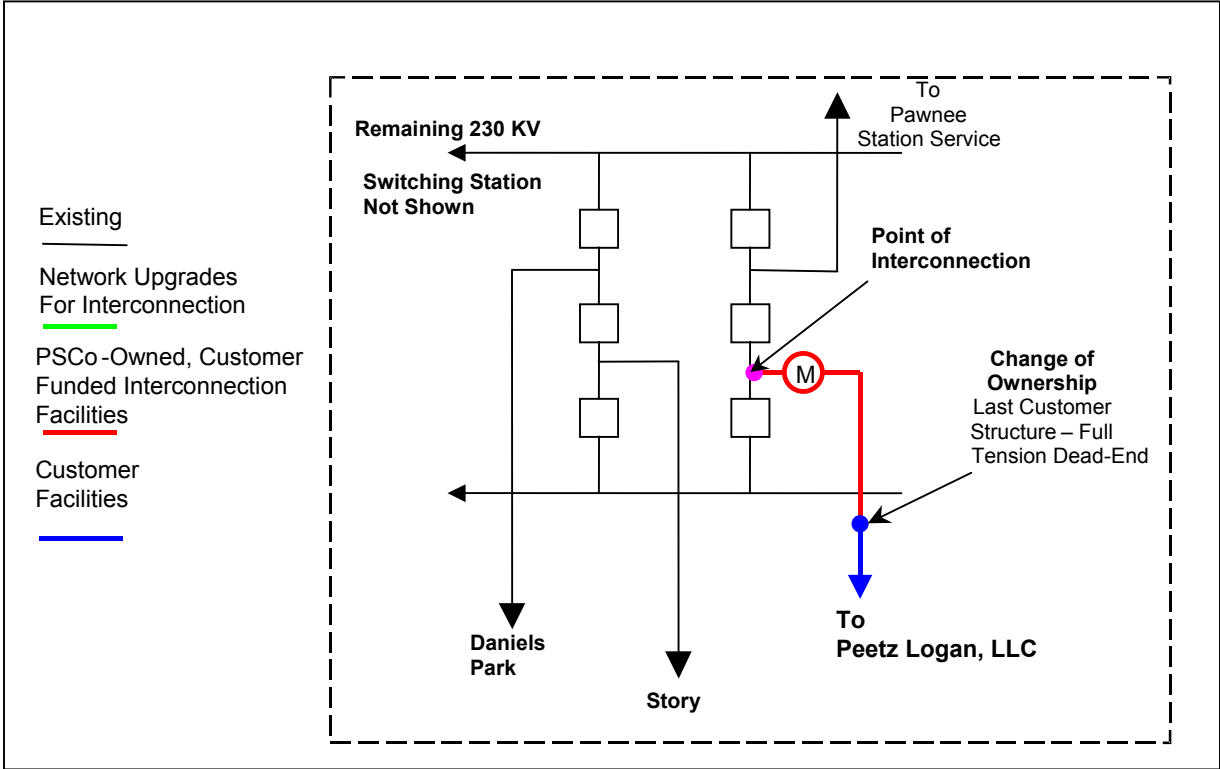
The Customer should also be aware that when all their generation is off-line that high voltages of 1.05 pu (242 kV) or greater will occur on their system. This is due to the charging capacitance of their 78-mile 230 kV line and the Customer will be required to compensate for this effect. The Customer should be well aware of this issue through their own due diligence studies and design of their system beyond their 230 kV switching station. Because of this, PSCo can not recommend a solution.

A simple diagram of the regional transmission system with Network Upgrades for Delivery for this request is depicted in Figure 1, and a simple one-line diagram of the existing interconnection facilities shown in Figure 2.

Figure 1: PSCo's Regional 230 kV Transmission System One-Line Diagram



**Figure 2: Interconnection One-Line Diagram**



## I. Introduction

PSCo Transmission received a request to conduct a Facilities Study that would evaluate a potential wind powered resource. The Peetz Logan Interconnect Project is requesting a 200 MW expansion. The System Impact Study report was issued and posted on the Westrans OASIS web site on May 4, 2007. An Interconnection Facilities Study Agreement was executed with the Customer on June 15, 2007.

## II. General Interconnection Facilities Description

### 1. Project Purpose & Scope

The purpose of this project is to interconnect an additional 200MW of wind generation from the Peetz-Logan site into PSCo's existing Pawnee 230 kV Substation. The customer proposes to bring the additional 200 MW into Pawnee over the existing transmission line between Pawnee and customer's substation site. There will be no additional equipment at Pawnee due to the customer's additional generation. See the Figure 6 for the one-line drawing for the existing interconnection details.

### 2. Background

Pawnee substation is a 5 bay breaker and half transmission switching station, which sits adjacent to the Pawnee Generating Station. Presently the Pawnee Generating Station and other nearby generators inject over 1400 MW into the Pawnee Bus and the Beaver Creek area. The additional injection of 200 MW into Pawnee from the customer's wind site expansion requires upgrading and/or replacing various facilities throughout PSCo's Denver Metro region.

### 3. Other Considerations

The desired backfeed date for the customer is April of 2008, with a commercial in-service date (CID) of October 2008. However the additional 200 MW injected into Pawnee substation requires significant network upgrades that will not be complete by the CID. The Network Upgrades for Delivery will be at least 60 months after the requested CID.

### 4. Interconnection & Network Upgrades for Interconnection

Requirements for interconnection can be found in the Interconnection Guidelines for Transmission Interconnected Producer-Owned Generation Greater Than 20 MW – Version 3.0<sup>5</sup>, last revised in December 2006. Xcel Energy requires the Interconnection Customer to construct the Interconnection Facilities in compliance

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<sup>5</sup> Guidelines can be found at [www.xcelenergy.com](http://www.xcelenergy.com)

with this document. This document describes the technical and protection requirements for connecting new generation to the Xcel Energy operating company transmission system and also includes commissioning, operation, and maintenance guidelines. Xcel Energy also requires that the Interconnection Customer be in compliance with all applicable criteria, guidelines, standards, requirements, regulations, and procedures issues by the North American Electric Reliability Council, Western Electricity Coordinating Council, and Federal Energy Regulatory Commission or their successor organizations.

a) Removals and Relocations

None

b) Fault Current

Existing 3 phase and SLG fault currents are 19,675A and 22,524A respectively at the Pawnee 230 kV bus. The anticipated fault current at the Pawnee 230 kV bus after the additional 200 MW and network upgrades are installed is approximately 22,556A and 25,578A respectively.

c) Right of Way

Nothing required

d) High Voltage Electrical Installations

No additional equipment is required at Pawnee substation. Customer plans to use the existing transmission line to interconnect. All (metering) instrument transformers and metering are rated to handle the additional 200 MW.

At Lookout control center minor wiring and programming changes will be installed to reflect the additional wind turbines added to the customers site.

The step-up transformers at the customer facility shall be designed to meet the interconnection guidelines mentioned above. The configuration shall be grounded-wye on the 230 kV primary side, wye on the 34.5 kV secondary side, and delta on the tertiary. The Customer must specify their transformer(s) to meet PSCo's requirements for an effectively grounded system.



e) AC & DC Systems

Existing AC and DC panels are adequate in the Electrical Enclosure Equipment (EEE).

f) Control Building

All new equipment will fit into existing building.

g) Grounding

No new grounding is required.

h) Lightning Protection

No new lightning protection is required.

i) Grading & Fencing

No new grading or fencing are required.

j) Foundations & Structural

No new foundations or steel are required.

k) Removals & Relocations

No removals or relocations are required.

m) Control & Protection - Electrical Installations

No new transmission line relaying is required, however the protective relay settings need to be checked, and may need to be adjusted to accommodate the additional 200 MW.

Additional interconnection requirements will need to be satisfied as stated in PSCo's Interconnection Guidelines For Transmission Interconnected Producer-Owned Generation Greater Than 20 MW.

Existing RTU at Lookout control center has space to add the additional SCADA points for the additional wind turbines.

n) Outages

No substation outages will be necessary at Pawnee, however the customer's transmission line may experience periodic outages for their expansion of the wind site.

o) Project and Operating Concerns

None at Pawnee.

p) Related Substation & Transmission Projects

See Network Upgrades for Delivery.

q) Assumptions for Customer's Site

Customer will provide power factor correction equipment to meet voltage tolerances at point of interconnection.

Customer will engineer, procure, and construct all equipment up to the Pawnee 230 kV dead-end structure. This includes transmission line relay equipment at customer's site.

The customer will need to arrange for station service power through the local utility/service provider, as customer's site may not be in PSCO service territory<sup>6</sup>.

PSCo needs approximately 4-6 weeks to test requirements of Interconnection Guidelines For Transmission Interconnected Producer-Owned Generation Greater Than 20 MW. Much of the testing can be performed in parallel with the construction schedule. A typical testing and commissioning procedure can be found in Appendix B.

Customer will comply with FERC Order 661-A<sup>7</sup> and guidelines for Low Voltage Ride Through (LVRT) capability. PSCo modeled the GE 1.5 SLE turbines with LVRT of 0.0 per unit voltage as provided by the Customer. **Any change in turbines will requires a re-study of the System Impact Study.**

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<sup>6</sup> Currently the Customer gets station power via High West Energy REA a Tri-State Generation and Transmission, Inc, (TSGT) member. TSGT has designated Pawnee Station a Network Transmission Delivery Point. Being so makes the Customer an in-direct PSCo Customer subject to PSCo's Interconnection Guidelines for Transmission Interconnected Loads Version 1.0 dated 9/30/2006. These guidelines can be found at [www.xcelenergy.com](http://www.xcelenergy.com).

<sup>7</sup> This can be found at [www.ferc.gov](http://www.ferc.gov).

Customer will provide reactive support equipment to meet voltage tolerances and power factor at the point of interconnection as required by Xcel Energy and FERC interconnection guidelines.

The Customer will arrange for station service power through the local utility/service provider, as Customer's site is not in PSCo service territory.

r) Assumptions for Pawnee

No work is required at Pawnee Substation other than verifying and possibly re-configuring SCADA points for the additional 200 MW.

s) Communications

A new RTU<sup>8</sup> for LF/AGC (Load Frequency Control/Automatic Generator Control) will not be required at the Customer's substation, it is assumed that the existing equipment will provide information to the existing RTU to be installed at the PSCo Control Center. Customer will supply all necessary AC and DC station service and space for the required equipment. Customer will need to supply a communication circuit for the RTU located at the Customer's facility and to the PSCo Control Center. Typical data required, *subject to change*, will be:

- Breaker Status for all breakers in the Customer's substation.
- MW and MVAR information for all lines coming into or leaving the Customer's substation.
- Voltage values for each phase.
- Weather data such as Wind Speed

The Customer will need to supply two-communication circuits; One from the RTU located at their substation to PSCo Control Center. The second circuit will need to go from the RTU located at their substation to the PSCo Pawnee substation.

Customer will need to supply protective relaying communication circuits going from their substation to the PSCo Pawnee substation.

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<sup>8</sup> Xcel Energy's Policy on Load Frequency Control for Wind Powered Generation is currently under review and subject to change.

## 5. Network Upgrades for Delivery

In general the network upgrades for delivery shall mean the additions, modifications, and upgrades to the transmission provider's transmission system (PSCo) required at or beyond the point at which the interconnection facilities connect to the transmission provider's transmission system to accommodate the interconnection of the large generating facility (customer) to the transmission provider's transmission system. See FERC 2003-A definitions for further explanation.

### PAWNEE

(In addition to the network upgrades for interconnection)

A new 345 kV yard will be built to the east of the existing 230 kV yard. The two (2) yards will be connected through two (2) 345-230-13 kV 336/448/560 MVA auto-transformers. One of the auto-transformers will connect to the 230 kV yard into an existing bay position, however the second auto-transformer will connect into a new bay in the 230 kV yard. The new 345 kV yard will initially be built and operated as a three (3) breaker ring bus, with the ability to be easily converted into a breaker-and-a-half bus configuration in the future. In addition a new 345 kV transmission line will be built from Pawnee to Daniels Park substation. Major equipment will include two (2) 345-230-13 kV 336/448/560 MVA auto-transformers, three (3) 345 kV circuit breakers, eight (8) 345 kV gang operate switches, nine (9) 345 kV CCVT's, three (3) 230 kV circuit breakers, six (6) 230 kV gang operated switches, two (2) 230 kV CCVT's, and two (2) 230 kV underground bus tie circuits.

### DANIELS PARK

(See comments above about new 345 kV transmission line)

The 345 kV yard at Daniels Park will not be ready for this new transmission line until the end of 2008, or early 2009. It is assumed this new line will be installed after the new 345 kV yard is constructed at Daniels Park. The new 345 kV transmission line will connect into an existing bay position. The major equipment needed to complete the transmission line installation are three (3) 345 kV circuit breakers, three (3) 345 kV gang operated switches, one (1) 345 kV CCVT, and one high profile steel transmission line deadend.

### Assumptions

Timeframe to complete all of the necessary network upgrades for delivery is substantially longer than customer's requested COD.

The construction of the network upgrades for delivery will have to be carefully planned. Not all of the work can be performed at the same time due to transmission capacity restraints.

The construction of the 15-mile line from Brick Center to Smoky Hill will require lengthy outages that may require reduction in generation in the Pawnee Station Area. This generation includes the coal fired Pawnee Station generation, gas fired Manchief generation, gas fired Brush/Beaver Creek generation, and Peetz Logan wind generation. Imports from TOT 3 may also be restricted.

PSCo will engineer, procure, construct, own, and maintain all facilities associated with the network upgrades for delivery.

**III. Costs Estimates and Assumptions**

The estimated total cost for the required upgrades is **\$96,390,000.00**

The estimated costs shown are (+/-30%) estimates in 2007 dollars and are based upon typical construction costs for previously performed similar construction. These estimated costs include all applicable labor and overheads associated with the engineering, design, and construction of these new PSCo facilities. This estimate did not include the cost for any other Customer owned equipment and associated design and engineering.

The following tables list the improvements required to accommodate the interconnection and the delivery of the Project. The cost responsibilities associated with these facilities shall be handled as per current FERC guidelines. System improvements are subject to change upon more detailed analysis.

Since this project intends to use the interconnection from the 400 MW Wind Facility GI-2006-1(g) and GI-2006-2 at Pawnee Station, there will be only minimal costs of \$40,000 associated with the interconnection required for this 200 MW expansion project GI-2006-2.

**Table 1: Transmission Provider Interconnection Facilities (Customer Funded)**

	Description	Cost Millions
<b>Pawnee 230kV Switchyard</b>	Interconnect Customer’s 230kV line to the existing Pawnee Switchyard. The major work required includes: <ul style="list-style-type: none"> <li>• Engineering and design</li> <li>• Transmission line relaying and testing</li> </ul>	<b>\$0.02</b>
<b>Lookout Operations Center</b>	Add additional status/weather monitoring points for the Customer’s generation at Lookout Operations Center. The major work required includes: <ul style="list-style-type: none"> <li>• Programming and wiring changes</li> </ul>	<b>\$0.02</b>
	<b>Total Estimated Cost for PSCo Interconnection Facilities</b>	<b>\$0.04</b>
<b>Time Frame</b>		<b>3 Months</b>

**Table 2: PSCo Network Upgrades for Delivery**

Element	Description	Cost Millions
<b>Pawnee Switchyard</b>	Upgrades and modifications required at Pawnee Switchyard for adding a 345kV yard. The major equipment required includes: <ul style="list-style-type: none"> <li>• Three 345kV, 2000 amp, 40 kA circuit breakers</li> <li>• Eight 345kV, 2000 amp gang switches</li> <li>• Nine 345kV transformer CCVT's</li> <li>• Two 345/230kV 560 MVA autotransformers</li> <li>• Three 230kV 40 kA, 3000 amp circuit breakers</li> <li>• Six 230kV, 3000 amp gang switches</li> <li>• Two 230kV transformer CCVT's</li> <li>• Associated foundations, structures, bus and electric equipment/material</li> <li>• Transmission line relaying, communication equipment and testing</li> <li>• 230kV underground (bus tie)</li> <li>• Site and yard work</li> </ul>	<b>\$14.25</b>
<b>Daniels Park Substation</b>	345 kV Line Termination equipment that includes: <ul style="list-style-type: none"> <li>• Three 345kV, 2000 amp, 40 kA circuit breakers</li> <li>• Three 345kV, 2000 amp gang switches</li> <li>• Associated foundations, structures, bus and electric equipment/material</li> <li>• Transmission line relaying, communication equipment and testing</li> </ul>	<b>\$1.50</b>
<b>Pawnee – Daniels Park 345 kV line</b>	Add a new single circuit 345 kV line from Pawnee -Daniels Park. This includes: <ul style="list-style-type: none"> <li>• Single Circuit 345 kV from Pawnee to just outside of Brick Center Switching Station including new ROW (80-miles).</li> <li>• Rebuild existing Pawnee-Daniels Park single circuit 230 kV line from Brick Center to outside of Smoky Hill (15-miles) to double circuit 345 kV line One side operated at 345 and the other operated at 230 kV for the Pawnee-Daniels Park line.</li> <li>• Construct new double circuit 345 kV line from just outside of Smoky Hill to Daniels Park utilizing existing ROW (20-miles). String both sides of double circuit tower.</li> </ul>	<b>\$74.12</b>
<b>Pawnee-Daniels Park 230 kV Line</b>	Removal of Brick Center to Smoky Hill Section (15 miles)	<b>\$1.01</b>
<b>Siting and Land Rights</b>	Land acquisition & permitting for all above	<b>\$5.47</b>
	<b>Total Estimated Cost for PSCo Delivery Infrastructure Upgrades</b>	<b>\$96.35</b>

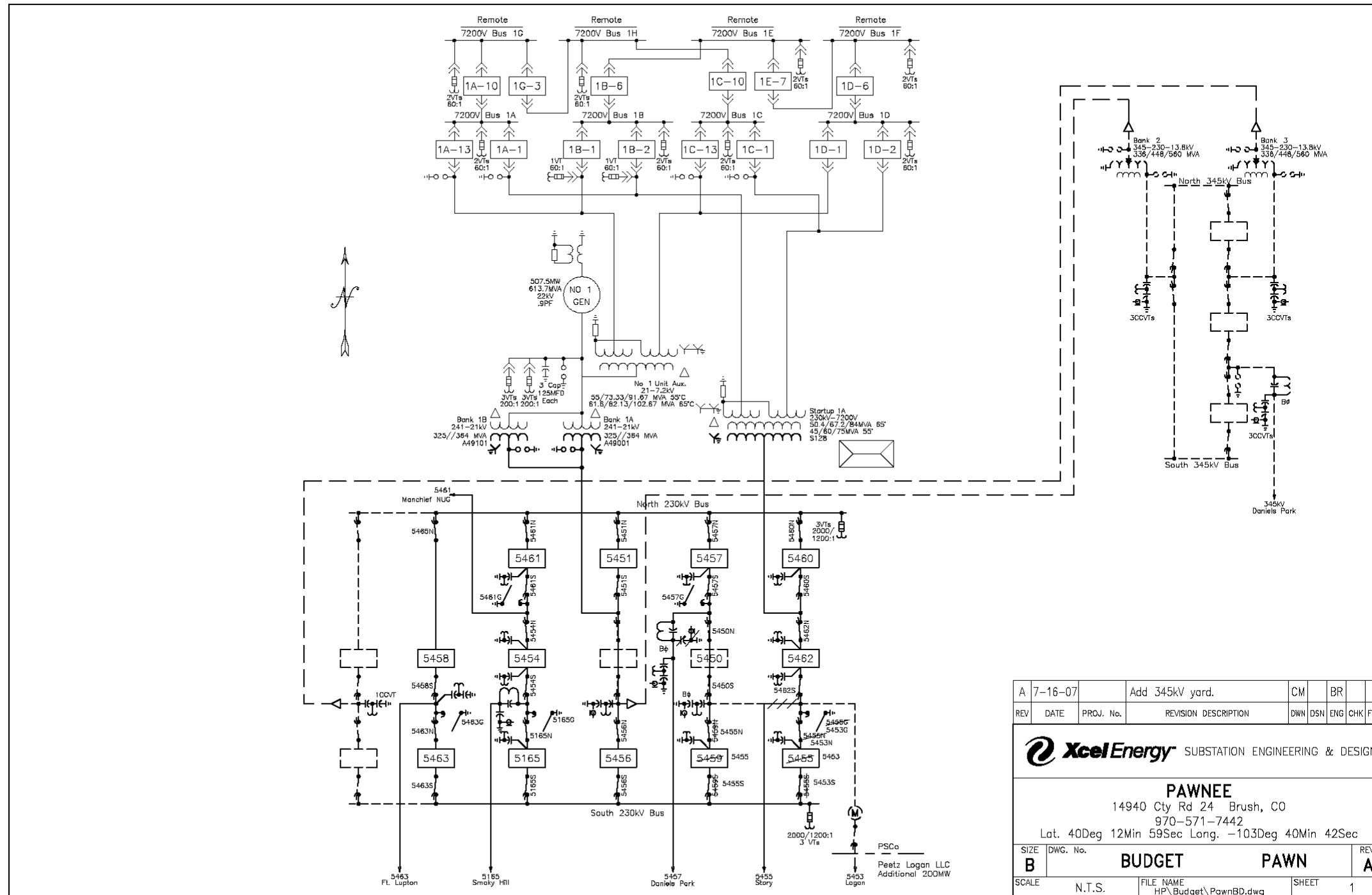
Element	Description	Cost Millions
Time Frame		60 Months
	<b>TOTAL PROJECT COST</b>	<b>\$96.39</b>

**Assumptions**

- The estimated costs provided are with an accuracy of +/- 30%.
- All applicable overheads are included. AFUDC has not been included.
- There is no contingency added to the estimates.
- Estimates have not been escalated. All estimates are in 2007 dollars.
- Labor is estimated for straight time only – no overtime included.
- Customer will be expanding their 3-breaker ring bus to a 4-breaker ring bus.
- No additional metering will be required.
- The Generator is not in PSCo’s retail service territory. Therefore no costs for retail load metering are included in these estimates.
- PSCo (or its Contractor) crews will perform all work associated with PSCo owned and maintained equipment.
- All required transmission outages necessary to support construction will be obtained as needed that may also require restrictions in Pawnee Area generation.
- This additional wind generation will utilize the existing/planned Peetz Logan Interconnect 230 kV transmission line.
- New 345 kV line requires new ROW from Pawnee to Near Brick Center
- Extensive public involvement anticipated. Assume a minimum 28-month process for Permitting and Land Rights issues.



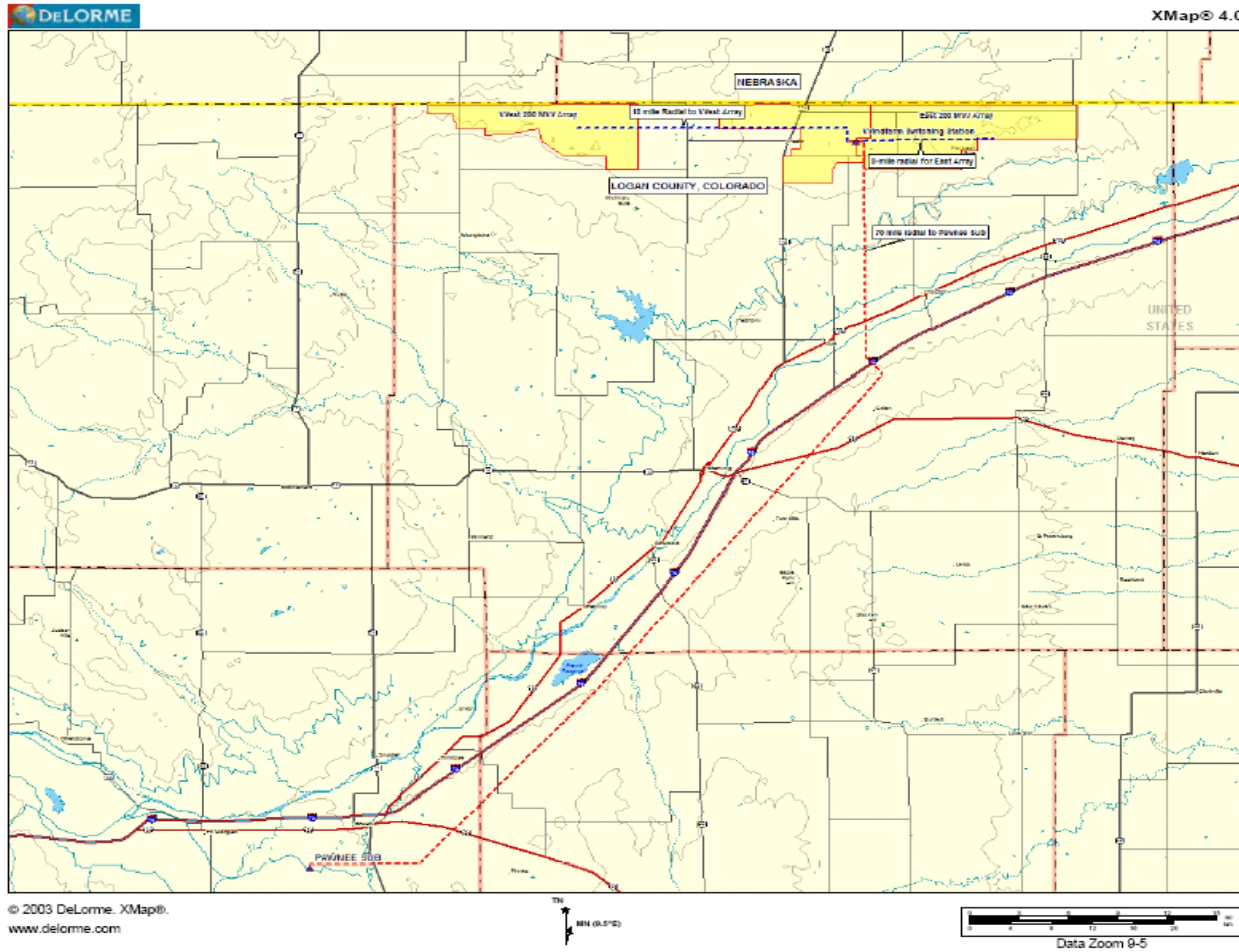
Figure 3: Pawnee Substation: One-Line Diagram



A	7-16-07	Add 345kV yard.	CM	BR	
REV	DATE	PROJ. No.	REVISION DESCRIPTION	DWN	DSN
SUBSTATION ENGINEERING & DESIGN					
<b>PAWNEE</b> 14940 Cty Rd 24 Brush, CO 970-571-7442 Lat. 40Deg 12Min 59Sec Long. -103Deg 40Min 42Sec					
SIZE	DWG. No.		REV.		
B	BUDGET PAWN		A		
SCALE	FILE NAME		SHEET		
N.T.S.	HP\Budget\PawnBD.dwg		1		

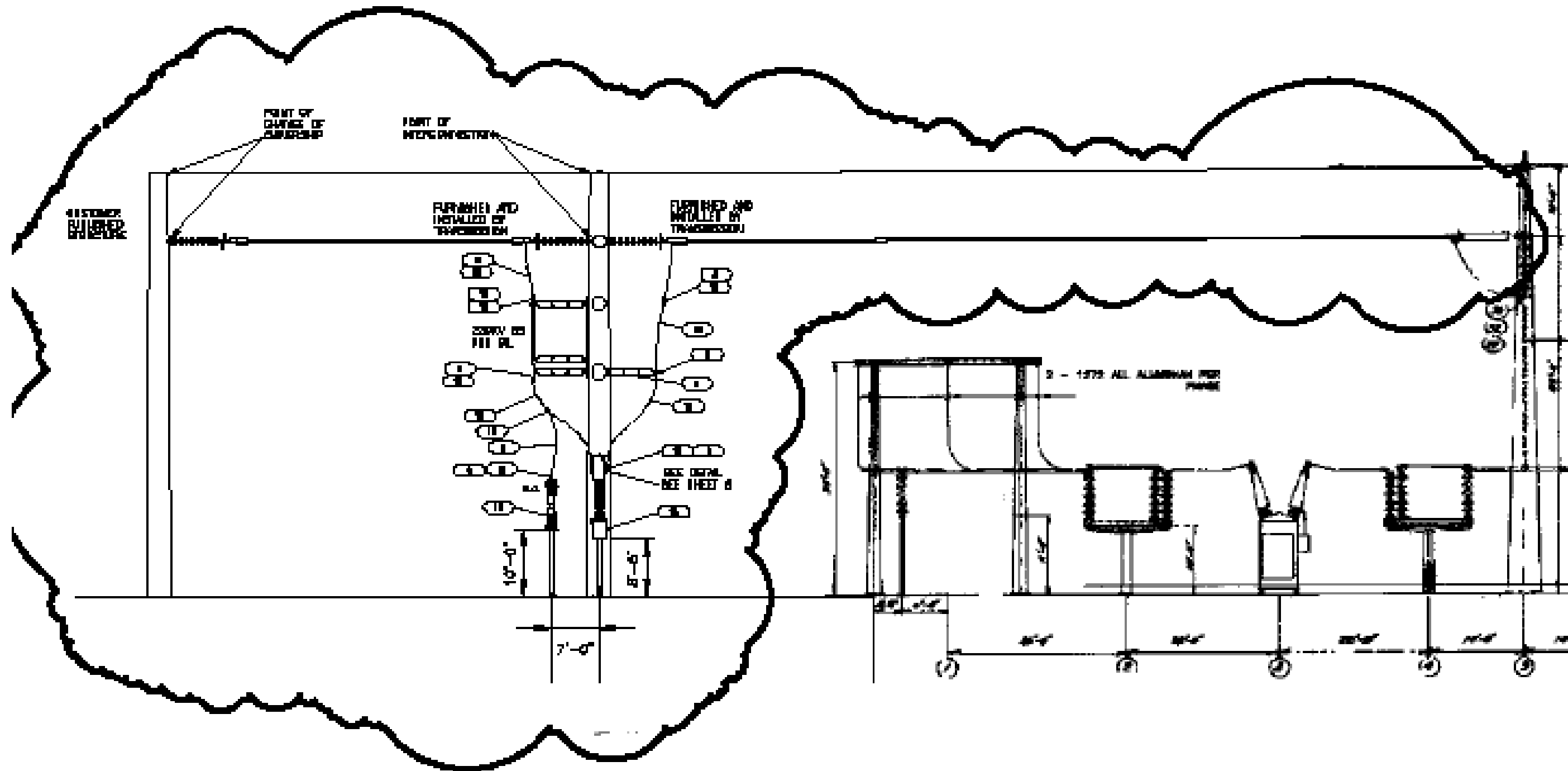
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Figure 4: General Location Overview



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Figure 5: Section View of Interconnection at Pawnee



# Appendix A

## Load Flow Plots

**Figure 6: Load Flow Before Peetz Logan Shunt Capacitors Showing Maximum VAR Output From Pawnee**

Figure 1

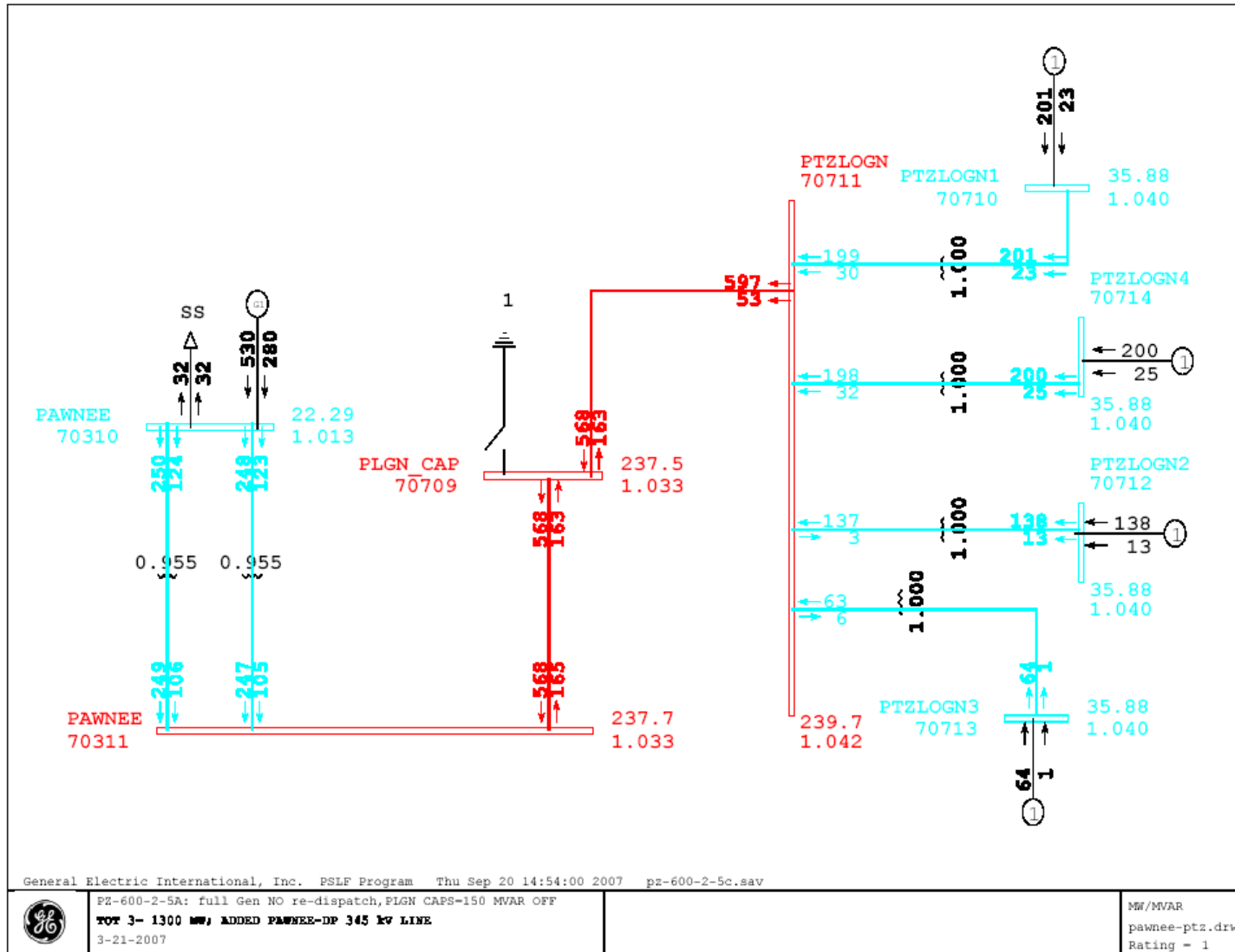
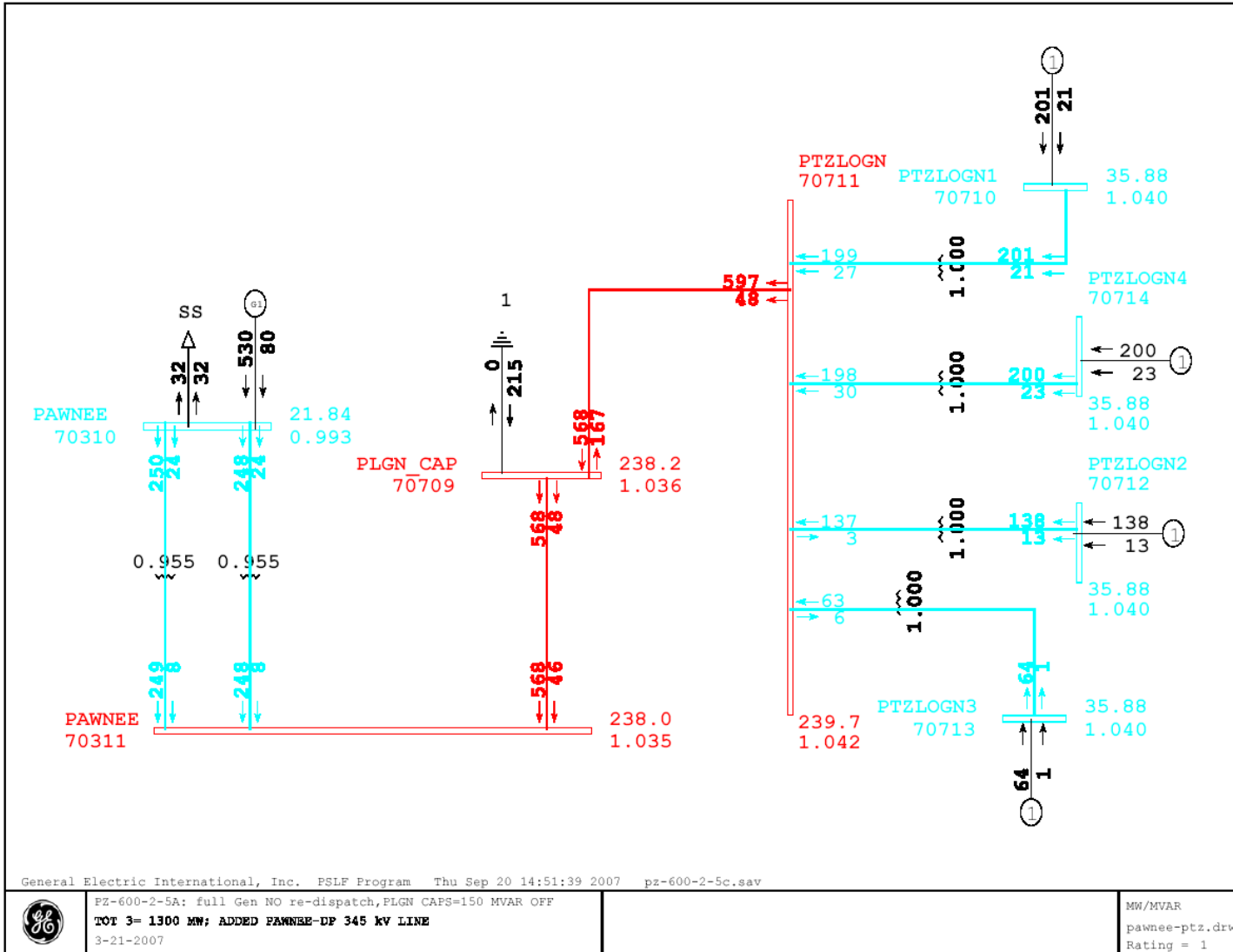
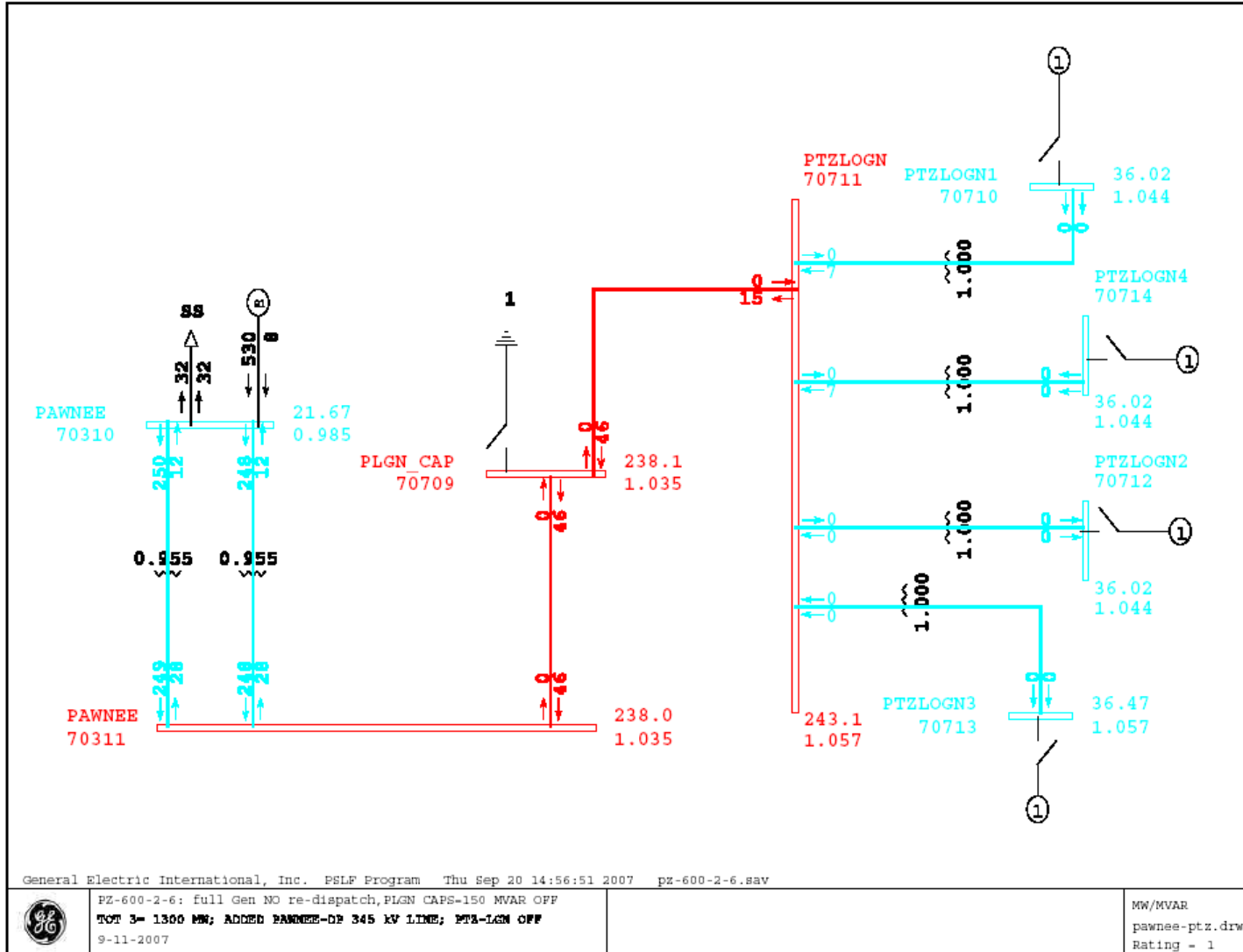


Figure 7: Peetz Logan Line With Shunt Capacitors



**Figure 8: Peetz Logan Line with Any Generation Showing High Voltage at Customer's Bus (PTZ-LOGN)**



## APPENDIX B

### Typical Commercial Testing Document



## Peetz-Logan Wind Project, 600 MW

Test Sheet DRAFT-Based on Power Factor Control as Primary Operating Mode (we may decide on voltage control as primary). We understand that the plant is capable of either.

**NOTE\*\* Performance test period begins upon 1) successful commissioning of all turbines and other major electrical equipment to be connected to the Peetz-Logan Interconnect and 2) SCADA in place, with all points available and active, including Lookout to Wind Plant and Wind Plant to FPL Remote Operations**

Requirement	Specific Req.	Test	Pass	Conditions			
1	Power Factor control at Point of Interconnection (POI)	Maintain unity p.f.	Set to 1.00 p.f.	Variability recorded and noted	0-P(rated): 0--->400-->0 twice, not curtailed to achieve zero.	Demonstrates normal plant operation over full range using normal reactive power control	
2		Fully compensated (demonstrate full reactive power compensation for line/collector capacitance)	Set to 1.00 p.f.	Mvar <=0, report reactive shunts in use, or other source(s) of reactive compensation	0 MW output, all turbines off, 2+ hours, not curtailed to achieve zero.	Demonstrates compliance with TICL II.I (ref. LGIG III.F), requiring plant to not have leading power factor at less than 50% load levels. Lead/Lag 0.98 p.f. required at 50+% customer load.	
3		Lead/Lag 0.95 limits	Set to 0.950 p.f. Lead	Capability measured and recorded	>92.5% P(rated)=370 MW	Demonstrates plant reactive power capability at high output (ref. NERC Standard TOP-002 R13)	
4			Set to 0.950 p.f. Lag	Capability measured and recorded	>92.5% P(rated)=370 MW		
5		Lead/Lag setpoints	Set to 0.990 p.f. Lead	Measured and recorded	>50% P(rated)=200 MW	Demonstrate plant reactive control at lower output levels (ref. NERC Standard TOP-002 R13)	
6			Set to 0.970 p.f. Lead	Measured and recorded	>50% P(rated)=200 MW		
7			Set to 0.990 p.f. Lag	Measured and recorded	>50% P(rated)=200 MW		
8			Set to 0.970 p.f. Lag	Measured and recorded	>50% P(rated)=200MW		
9	Voltage control at POI	Raise/lower setpoint	Series selected at time of test, e.g., "raise 2 kV"	right direction, e.g., raise not lower, as requested, subject to p.f. limits	>50% P(rated)=200 MW	Demonstrate voltage control functionality (ref. NERC Standard TOP-002 R13)	
10				Volt raise 2, as above	right direction, e.g., raise not lower, as requested, subject to p.f. limits		>50% P(rated)=200 MW
11				Volt lower 1, as above	right direction, e.g., raise not lower, as requested, subject to p.f. limits		>50% P(rated)=200 MW
12				Volt lower 2, as above	right direction, e.g., raise not lower, as requested, subject to p.f. limits		>50% P(rated)=200 MW
13				Hold voltage setpoint	Setpoint selected at time of test, e.g., 1.01 p.u.		voltage held within +/- 1% as plant is capable, variability recorded and noted
14	Communication	Responsiveness	Series of reasonable requests, e.g., "switch to voltage control mode", "report # turbines online", "report status of shunt caps & reactors"	Professional, prompt (within one minute) response, accurate and complete. 100% compliance for one week.	0-P(rated)=0-400 MW, full range at least once during test period.	Demonstrates responsiveness of operator and ability to view and control plant. (ref. LGIG VI.J)	
15		Physical link	documented dedicated circuit, Lookout-wind op center	documentation submitted prior to operational testing.	no operational requirement		
16			site visit to observe wind operations center (most likely RTP or Op engineer or manager)	Written summary of how control center works, and first-hand validation.	no operational requirement	Demonstrate compliance with operator requirements (ref. LGIG VI.J)	