SPP Southwest Power Pool

Facility Study For Generation Interconnection Request GEN-2006-045

SPP Tariff Studies

(#GEN-2006-045)

February 2008

Summary

Pursuant to the tariff and at the request of the Southwest Power Pool (SPP), Xcel Energy performed the following Facility Study to satisfy the Facility Study Agreement executed by the requesting customer and SPP for SPP Generation Interconnection request Gen-2006-045. 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.

Additional Items

In addition to the facilities specified in the attached Facility Study, the Interconnection Customer is required to install a minimum of 60 Mvars of 34.5kV capacitors. These capacitors need to be installed in at least two stages of 30Mvar each in multiple banks. A single 34.5kV bank will not be acceptable as it would prevent the wind farm from operating at unity power factor during periods of low wind. These banks should be sized and staged as to not cause voltage excursions on the 230kV transmission system.

The Customer requested Suzlon S88 2.1MW wind turbines will meet FERC Order 661A with the capacitor banks and the configuration #1 listed in the study. If GEN-2006-039 withdraws from the queue, a restudy will need to be conducted.

Facilities Study For
Southwest Power Pool (SPP)

240 MW Wind-Generated Energy Facility
Randall County, Texas
SPP #GEN-2006-045

February 15, 2008

Xcel Energy Services, Inc.
Transmission Planning

Executive Summary

[Omitted Text] in December 2007 ("Interconnection Customer") requested the interconnection of a wind energy facility located in Randall County, Texas to the Southwestern Public Service Company (SPS), a New Mexico Corporation and wholly owned subsidiary of Xcel Energy Inc. 230 kV transmission network. This facility has a net capacity of 240 MW. The Interconnection Customer's facility will connect to a new SPS 230 kV switching station located adjacent to SPS's Potter Co. to Plant X (K-41) 230kV transmission line circuit approximately 8 miles southwest of Canyon, Texas.

The Southwest Power Pool (SPP) evaluated the request to interconnect the wind farm facility to the SPS transmission system in a System Impact Study (SIS) (GEN-2006-045) completed in October 2007.
The interconnection request was studied using one hundred fourteen (114) Suzlon Wind Turbines Model S88 at 2.1 MW each for a total output of 240 MW. The study minimum requirement will consist of building a nine-breaker, six terminal switching station using breaker and a half scheme and interconnection to the existing Potter Co Interchange to Plant X and Bushland Interchange to Deaf Smith Interchange 230 kV transmission lines, referred to as Case 1. The Interconnection Customer is also required to install 60 MVARs of capacitors in multiple banks on the 34.5 kV side of their collector's 230/34.5 kV bus.

The new switching station will provide one terminal each for this request (#GEN-2006-045) and the previous request (#GEN-2006-039) wind farm facilities. The minimum requirement is contingent upon previous request GEN-2006-039 staying in the queue. If GEN-2006-039 withdraws or suspends, then the requirement will consist of a three (3) breaker, three terminal ring bus switching station and interconnection to the existing Potter Co Interchange to Plant X 230 kV transmission line, referred to as Case 2. The Interconnection Customer's expected commercial operation date and back-feed date is December 31, 2008 and June 1, 2008, respectively.

SPS requires that all construction for this request be in compliance with the latest revision of the Xcel Energy Interconnection Guidelines for Transmission Interconnection Producer-Owned Generation Greater than 20 MW, Version 3.0 dated Dec 31, 2006, and is available at (http://www.xcelenergy.com/XLWEB/CDA/0,3080,1-1-1_16699_24407-1428-0_0_0-0,00.html). This document describes the requirements for connecting new generation to the Xcel Energy transmission systems including technical, protection, commissioning, operation, and maintenance. SPS will also require that the Interconnection Customer be in compliance with all applicable criteria, guidelines, standards, requirements, regulations, and procedures issued by the North American Electric Reliability Corporation (NERC), Southwest Power Pool (SPP), and the Federal Energy Regulatory Commission (FERC) or their successor organizations.

The Interconnection Customer is responsible for the cost of the Interconnection Facilities, installation of the 60 MVARs of cap banks and any Direct Assigned Interconnection Facilities; inclusive of all construction required for the 230 kV transmission line from the Interconnection Customer's substation to the new SPS switching station.

It is anticipated that the entire process of constructing the new Interconnection Facility for the acceptance of the wind farm facility output, will require approximately 21 months to complete to include filing of the Certificate of Convenience and Necessity (CCN) with the Texas Public Utility Commission (Case 1 only), reviews, permits, engineering and construction. Case 2 does not require the CCN because the switching station can be constructed closer to the Potter Co. to Plant X (K-41) 230kV transmission line. The cost of these upgrades, inclusive of the Interconnection Customer's cost for the interconnection of this wind farm facility, is shown below in Table 1, with the detailed description of the cost shown in Table 4. The requested in-service date cannot be met by SPS for both Case 1 and Case 2.

Table 1, Cost Summary[a]

	Case 1	Case 2
Stand-alone Network Upgrades:	$5,633,214	$3,134,738
Network Upgrades:	$3,985,946	$ 361,973
Interconnection Facilities [b]:	$ 106,657	$ 104,532
Total:	**$9,725,818**	**$3,601,245**

[a] The cost estimates are 2008 dollars with an accuracy level of ±20%.
[b] This is a direct assigned cost to the Interconnection Customer.

General Description of SPS[c] Facilities

1. **Construction a new Switching Station:** See Appendix A, Figure A- 1 for general vicinity location map.

   1.1. **Location:** SPS will construct a new switching station adjacent to Potter Co. to Plant X (K-41) 230kV transmission line within a mile on the west side. Appendix A, Figure A- 2, shows a one-line of the new switching station, while Figure A- 3 shows a plan view of the new switching station.

   1.2. **Bus Design:** The new 230 kV switching station will be built to accommodate the outputs from the two wind energy facilities. The bus design for this new switching station will be "breaker and a half" configuration with nine (9) 230kV breakers and six (6) terminals with provisions for expansion to maximum of five branches. It is assumed the previous interconnection request Gen-2006-039 stays in the queue. Otherwise, the bus construction will default to a three (3)-breaker ring to accommodate three line terminals, with future expansion capability for the five-branch breaker and a half design.

   1.3. **Line Terminals:** The 230kV lines and static wire terminals will be designed to accommodate 2,000 pounds per phase conductor at maximum tension, with a maximum 15-degree pull off from normal.

   1.4. **Control House:** A control house approximately 20 feet by 30 feet will be installed to contain the metering, protection and control devices, terminal cabinets, and any fiber-optic cable terminations, etc.

   1.5. Security Fence: The switching station will have a 7-foot chain-link fence with steel posts set in concrete, with 1-foot of barbed wire on the top in a "V" configuration. The enclosed area will be approximately 400' × 300', with a rock yard surface.

   1.6. **Ground Grid**: A complete ground-grid will be installed per ANSI/IEEE STD 80-1986, with our standard 4/0 copper ground mesh on 40-foot centers with ground rods and 20-foot centers in corners and loop outside of fence.

   1.7. **Site Grading**: Company contractor, per company specifications, will perform initial site grading and erosion control of the new switching station. Soil compaction shall be not less that 95% of laboratory density as determined by ASTM-D-698.

   1.8. **Station Power**: A 133 kV/120-240 volt transformer tapped off of the 230 kV bus will provide station power. A backup station power source will be taken from local distribution if it is available or a generator will be installed if none is available. A flip-flop to automatically transfer the station power will be installed.

   1.9. **Relay and Protection Scheme**: The new switching station to the 230 kV lines to Potter Co. and Plant X will utilize directional comparison blocking (DCB) over power line carrier with a Pulsar TC10B. A SEL 421-1 (DCB) and a SEL 311-C (step distance) will be used as primary and secondary relaying respectively. A SEL 279H-2 relay will be used for re-closing and a

[c] All modifications to SPS facilities will be owned, maintained and operated by SPS.

SEL 501-0 will be used for breaker failure. The REL 302 primary relaying at Potter Co. end shall be replaced with a SEL 421-1 and keep the existing SEL 321 as secondary relaying.

The new switching station to the 230 kV lines to Bushland Sub and Deaf Smith Co. will utilize directional comparison blocking (DCB) over power line carrier with a Pulsar TC10B. A SEL 421-1 (DCB) and a SEL 311-C (step distance) will be used as primary and secondary relaying respectively. A SEL 279H-2 relay will be used for re-closing and a SEL 501-0 will be used for breaker failure.

The new switching station to the Interconnection Customer's line relaying will also use CCS and step distance relaying utilizing an SEL 311-L as primary protection. An SEL 321-1 relay with directional comparison blocking scheme through mirrored bits over fiber optics installed by the customer will be use as backup relaying. A SEL 279H-2 relay will be installed; however **there will not be any automatic re-closing**. The SEL 279H-2 will be used for line/bus conditions and sync check along with supervisory closing of the breaker. A SEL 501-0 will be used for breaker failure.

The bus voltage and GCB amps will be the SATEC PM type meters that shows all three phases eliminating the need for a switch and transducers. The batteries will be a set of 440 AH Varta batteries with a 75 amp charger.

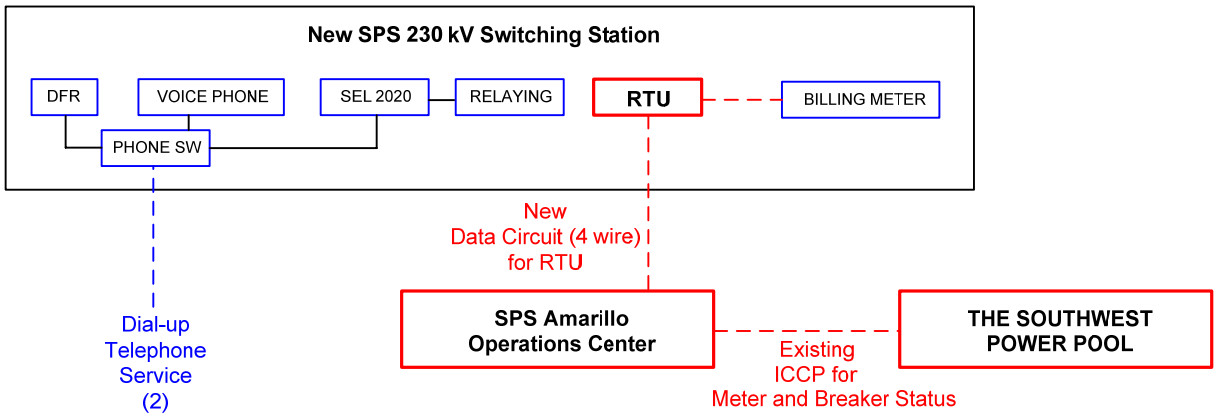
1.10. **Revenue Metering:** On the SPS switching station 230 kV line to the Interconnection Customer's substation, an individual billing meter will be installed along with an ION 8400 meter unit, ANSI C12.1 accuracy class 0.2 (3-PT's IEEE C57.13 accuracy class 0.3 and 3 CT's IEEE C57.13 accuracy class 0.15) for full 3 phase 4-wire metering. Also installed for the metering units will be 3-PT's and 3-CT's for full 3-phase 4-wire metering. There will be two meters per line terminal: one will be primary and the other will be back up, each will have full 4 quadrant metering. Pulses out of the primary billing meter will be sent via SCADA to the Transmission Owner's Control Center in Amarillo, Texas.

1.11. **Disturbance Monitoring Device:** Disturbance-monitoring equipment (DFR), capable of recording faults, swings, and long term trending, will be installed to monitor and record conditions in the substation and on the transmission lines. The disturbance equipment shall also be equipped with a GPS time synching clock. This equipment will have communication capability with a dedicated communication circuit. The disturbance equipment will have its own dedicated dial-up communications telephone circuit.

1.12. **Remote Terminal Unit (RTU):** A new RTU will be utilized with communications for the new switching station. An SEL 2020 will be installed for relay communications and other functions as required. SPS will provide and install an RTU for metering and telemetry at the Interconnection Customer's facility as required by the latest Xcel Energy Interconnection Guidelines. The direct cost will be charged to the Interconnection Customer.

1.13. **Communications:** Communications from the new switching station to the Amarillo Control Center will consist of a telephone and data circuit. ***It is the Interconnection Customer's responsibility to make arrangements with the local phone company to provide both the four-wire data circuit and both telephone circuits to the new switching station and the new wind farm facility. Prior to any construction the Interconnection Customer is required to contact the SPS substation-engineering department for all details.***

A schematic outlining the proposed communications is provided below:



2. **Transmission Work:**

The Interconnection Customer will construct, own, operate, and maintain any customer owned 230 kV transmission line from the Interconnection Customer's substation to the new SPS switching station. This line is shown in Appendix A, Figure A- 1 and is estimated to be 7.5 miles. ***The SPS transmission design group prior to any construction by the Interconnection Customer or its contractor on any customer 230 kV transmission lines, or doing work in close proximity to any SPS transmission line, will require an engineering review of the customer's design. It is the Interconnection Customer's responsibility to initiate the design review in a timely manner before construction of any transmission line begins. If the review has not been made or the design at any of the aforementioned locations is deemed inadequate, the crossing(s) and or termination into the new switching station will be delayed until the matters are resolved. SPS will not be held responsible for these delays.***

2.1. **Circuit K-41:** SPS will re-route and terminate the existing 230 kV transmission circuit from Potter Co Interchange to Plant X (K-41) to the new SPS switching station. For the transmission work, tap the line in and out of new switching station adjacent to the transmission line and install 2 H-frame steel corner structures and run a span of wire into and out of the new switching station. The conductor would be 795 kcmil ACSR (Drake) and the static would be 3/8" EHS steel.

2.2. **Circuit K-11:** SPS will re-route and terminate the existing 230 kV transmission circuit from Bushland Sub to Deaf Smith Co Interchange (K11) to the new SPS switching station. The work will consist of installing 2 H-frame steel corner structures to tap in and out of the line. Build approximately 9.5 miles of 230 kV line construction on wood, 2-pole tangent structures and terminate on two 2-pole steel termination structures. The conductor would be 795 kcmil ACSR (Drake) and the static would be 3/8" EHS steel.

3. **Right-Of-Way:**

3.1. **Switching Station Real Estate:** SPS will provide Interconnection Customer with easement detailing the metes and bounds description for the required switching station real estate. The Interconnection Customer will obtain all necessary signatures from landowner(s) for the easement needed on the land where the new SPS switching station will be built.

3.2. **Permitting**: Permitting for the construction of this new switching station and the re-routing of the transmission lines is required from the Texas Public Utility Commission (TPUC). A Certificate of Convenience and Necessity (CCN) will be required from the TPUC for the re-routing of the Bushland Sub-Deaf Smith Sub 230 kV transmission line to the new switching station.

4. **Construction Power and Distribution Service:** It is the sole responsibility of the Interconnection Customer to make arrangements for both construction and station power, which may be required for the Interconnection Customer's wind farm facility. **Additionally, if the Interconnection Customer's substation(s) and/or construction site(s) are located outside of the SPS service area, SPS cannot provide station power (retail distribution service) and the Interconnection Customer needs to make arrangements for distribution service from the local retail provider.**

5. **Project and Operating Concerns:** Close work between the Transmission group, the Interconnection Customer's personnel and local operating groups will be imperative in order to meet any in-service date that has been established.

6. **Fault Current Study:** The available fault current at the interconnection location, without any contribution from the wind farm facilities, is shown in Table 2 and Table 3.

Table 2, - Available fault current at interconnection location

Case 1: Short Circuit Information without contribution from Wind Farm Facilities (GEN 2006-045 & GEN 2006-039)[d]				
Fault Location	Fault Current (Amps)		Impedance (Ω)	
	Line-to-Ground	3–Phase	Z^+	Z^0
230 kV Bus	7,625	9,200	1.857 + j14.315	5.994 + j22.673

Table 3, - Available fault current at interconnection location

Case 2: Short Circuit Information without contribution from Wind Farm Facility (GEN 2006-045 only)[e]				
Fault Location	Fault Current (Amps)		Impedance (Ω)	
	Line-to-Ground	3–Phase	Z^+	Z^0
230 kV Bus	3,625	5,525	3.126 + j23.786	14.808 + j59.919

[d] Case 1 consists of nine breaker, six terminals, breaker and a half scheme switching station with K41 and K11 termination.
[e] Case 2 consists of three breakers, three terminals, and ring bus scheme switching station with K41 termination only.

Estimated Construction Costs

The projects required for the interconnection of this 240 MW Wind Farm facility consist of the projects summarized in the table below. Case 1 and Case 2 estimated cost includes previously requested Gen2006-039 and without it respectively.

Table 4, Required Interconnection Projects[f]

		Estimated Cost	
Project	**Description**	**Case 1**	**Case 2**
	Stand-alone Network Upgrades		
1	New Switching Station Facility (6 or 3-terminal)	$ 5,347,977	$ 2,868,751
2	Control House	$ 210,862	$ 191,612
3	Disturbance Monitoring Device	$ 74,375	$ 74,375
	Subtotal:	**$5,633,214**	**$3,134,738**
	Network Upgrades		
4	Relay Upgrades at remote terminals	$ 171,946	$ 85,973
5	Transmission Line Work	$3,797,000	$ 265,000
6	Right-Of-Way [g]	$ 17,000	$ 11,000
	Subtotal:	**$3,985,946**	**$ 361,973**
	Interconnection Facilities (at the Interconnection Customer's expense)		
8	Communications [h]	*$ See footnote*	*$ See footnote*
9	Remote Terminal Unit (RTU)	$ 21,250	$ 19,125
10	Revenue metering	$ 74,251	$ 74,251
11	230 kV Line arrestors	$ 11,156	$ 11,156
	Subtotal:	**$ 106,657**	**$ 104,532**
	Total Cost:	**$9,725,818**	**$3,601,245**

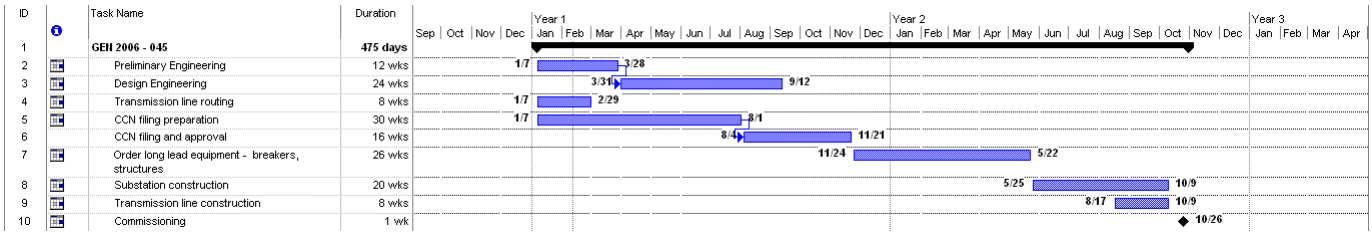
Engineering and Construction:

An engineering and construction schedule for this project is depicted below and is estimated at approximately 21 months. The schedule is shown for project duration purposes only and other factors associated with clearances, equipment delays and work schedules could cause additional delays. The schedule below is applicable after all required agreements are signed and internal approvals are granted.

[f] The cost estimates are 2008 dollars with an accuracy level of ±20%.

[g] Surveying cost; Interconnection Customer will acquire the SPS easement needed for the land upon which the new switching station will be built, see Section 3.1.

[h] It is the Requester's responsibility to provide both the data circuit and both dial-up telephone circuits, see Section 1.13.



All additional cost for work not identified in this study is the sole responsibility of the Interconnection Customer unless other arrangements are made.

Appendix A

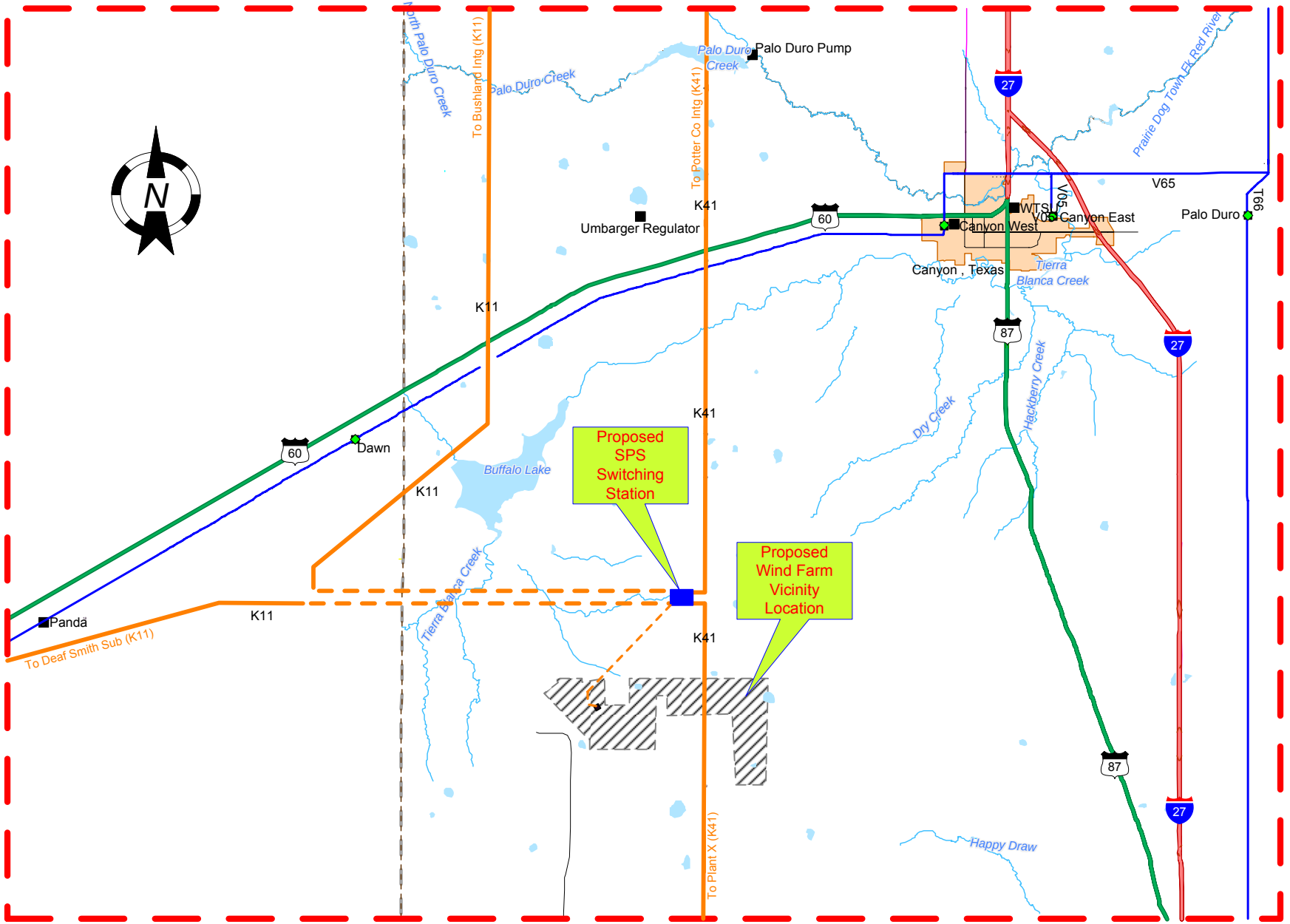


Figure A- 1 Approximate location of proposed switching station

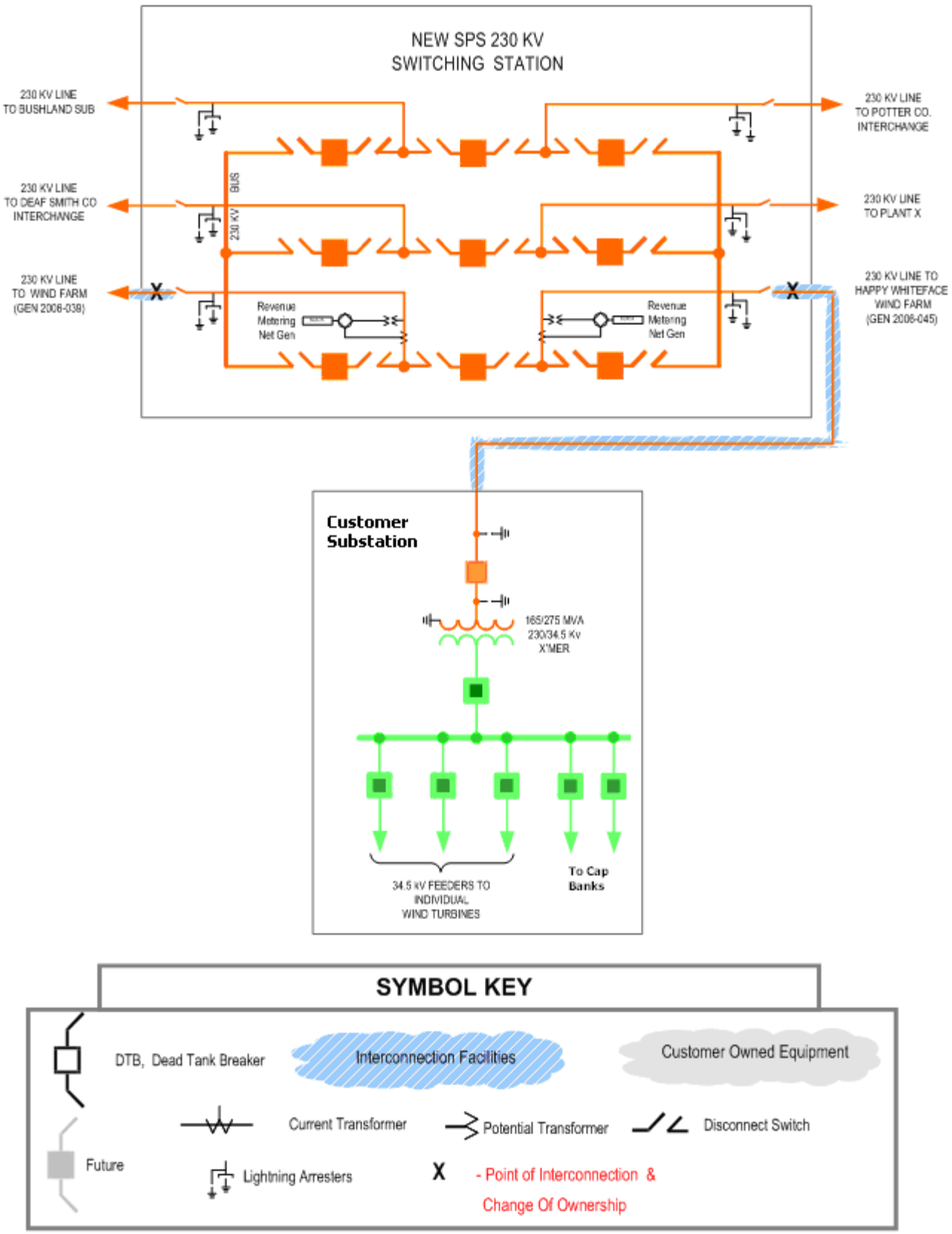


Figure A- 2 One-line Diagram of New Switching Station

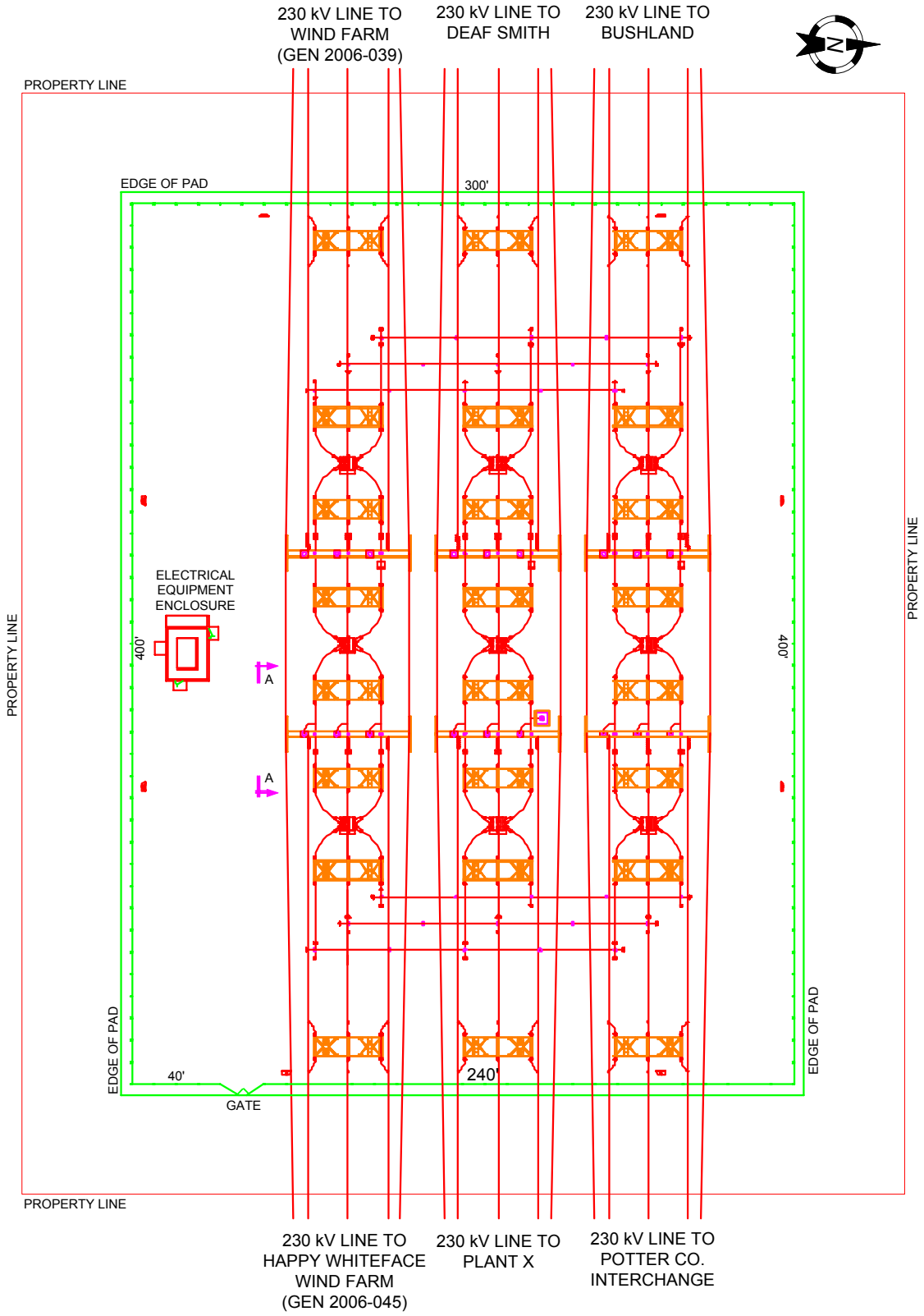


Figure A- 3 New SPS Switching Station Interconnection Facility Plan View

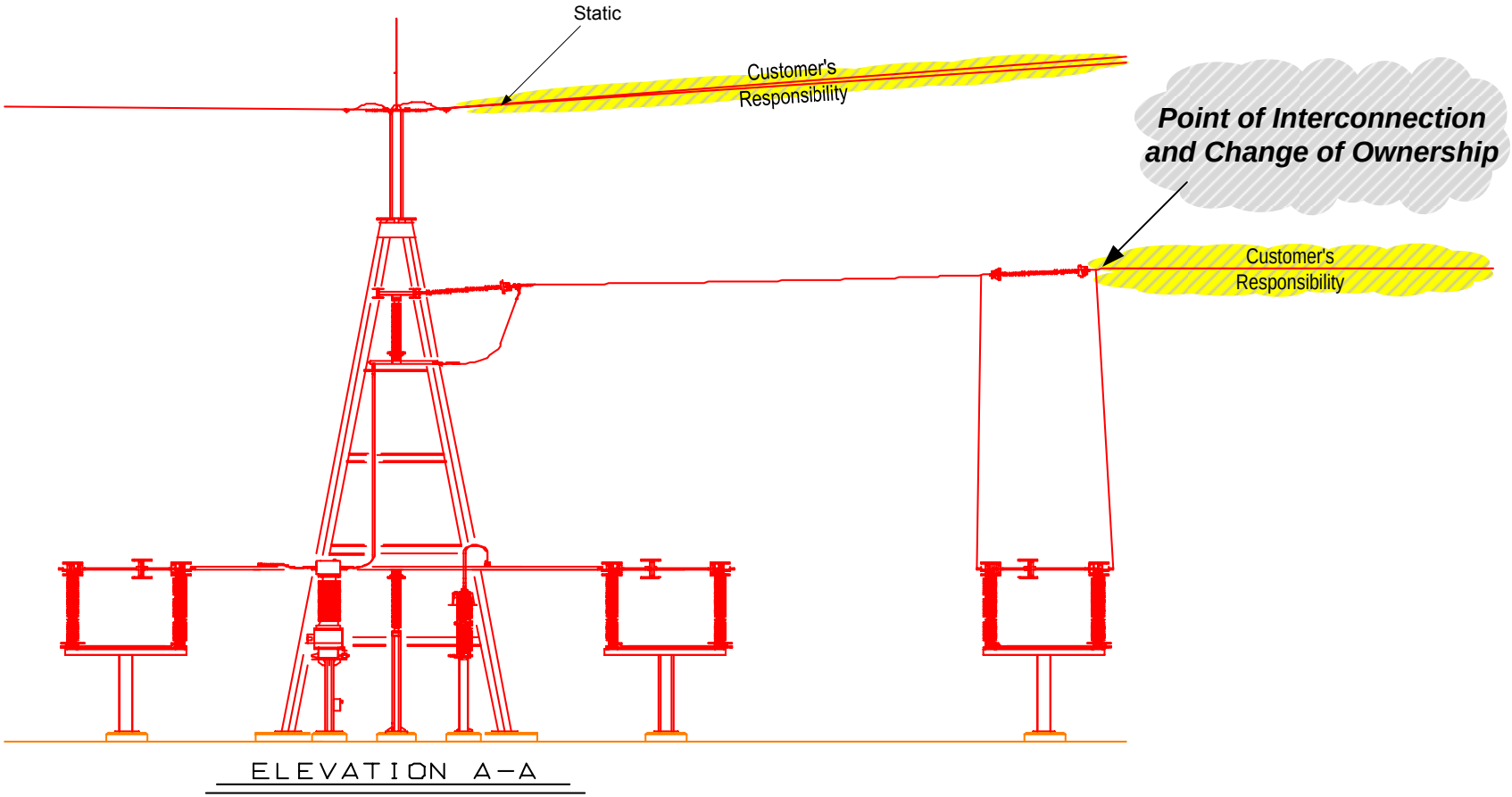


Figure A- 4 Point of Interconnection & Change of Ownership (Typical)

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