Facility Study for Generation Interconnection Request GEN – 2006 – 047

SPP Tariff Studies
(#GEN-2006-047)

May 2008

Summary

Southwestern Public Service (d/b/a Xcel Energy) (SPS) performed the following study at the request of the Southwest Power Pool (SPP) for SPP Generation Interconnection request Gen-2006-047. The request for interconnection was placed with SPP in accordance with SPP's Open Access Transmission Tariff Attachment V, which covers new generation interconnections on SPP's transmission system.

If either prior queued project (GEN-2006-039, GEN-2006-047) goes on suspension or withdraws from the queue, a restudy will need to be performed.

The Customer will be required to install 48 Mvars of staged capacitor banks within the Customer's 230/34.5kV substation. These capacitors shall be staged as to be able to provide an acceptable voltage schedule at the point of interconnection regardless of the generation level of the Customer facility.

With the Customer capacitors requirements and the transmission system in the configuration as studied, the Customer will not be required to install a dynamic var device (STATCOM, SVC) to meet the low voltage ride through requirements of FERC Order #661A.

Facilities Study For
Southwest Power Pool (SPP)

240 MW Wind-Generated Energy Facility
Randall County, Texas
SPP #GEN-2006-047

April 28, 2008

Xcel Energy Services, Inc.
Transmission Planning

Executive Summary

[Omitted Text] in February 2008 ("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 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-2006-047) completed in January 2008. The interconnection request was studied using one hundred fifteen (115) Suzlon Wind Turbines Model S88 at 2.1 MW each for a total output of 240 MW. The study minimum requirement will consist of adding a 230 kV line terminal to the previously required new switching station for interconnection request GEN 2006-039 and GEN 2007-045. The Interconnection Customer is also required to add 48 MVARs of staged capacitor banks on the 34.5 kV side of their collector's 230/34.5 kV bus to maintain zero reactive flow at the interconnection point. The Interconnection Customer's expected commercial operation date is December 31, 2009 and the requested back-feed date is June 1, 2009.

The required line terminal for this request (#GEN-2006-047) will be a two-breaker terminal added as another branch to the new switching station as required by previous Interconnection request GEN-2006-039 and GEN-2006-045. It will include an eleven-breaker, seven terminals using breaker and a half arrangement and will be terminated to the existing 230 kV transmission lines between Potter Co Interchange to Plant X and Bushland Interchange to Deaf Smith Interchange. It will be referred to as Scenario 1.

If either of the two previous requests withdraw or suspend, the requirement will still consist of a nine-breaker, six terminals switching station tapping the existing Potter Co Interchange to Plant X 230 kV and Bushland Sub to Deaf Smith 230 kV transmission lines. However, if both previous requests suspend, then the minimum requirement will default to a three ring/terminal switching station that will be terminated to the Potter Co. to Plant X 230 kV transmission line only, and will be referred to as Scenario 2.

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 48 MVAR 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 understood that the construction of the new switching station required from previous requests GEN-2006-039 and GEN-2006-045 should be completed first, and will require filing of the Certificate of Convenience and Necessity (CCN) with the Texas Public Utility Commission and will take approximately 22 months to complete including, reviews, permits, engineering and construction. For Scenario 2, it does not require a CCN because the switching station can be constructed closer to the Potter Co. to Plant X (K-41) 230kV transmission lines.

As for this request (GEN-2006-047), it is anticipated that the entire process of adding the new 230 kV line terminal to the new switching station of Scenario 1 for the acceptance of the wind farm facility output, will require approximately 15 months to complete after an Interconnection Agreement is signed and an authorization to proceed is received.

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 of December 31, 2009 cannot be met by SPS.

Table 1, Cost Summary[a]

	Scenario 1	Scenario 2
Stand-alone Network Upgrades:	$ 0	$3,060,363
Network Upgrades:	$90,376	$ 436,348
Interconnection Facilities [b]:	$1,258,595	$106,657
Total:	**$1,348,971**	**$3,603,370**

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

   1.1. **Location:** SPS will construct a new 230 kV line terminal (two-breaker) at the new switching station required in Scenario 1. Appendix A, Figure A- 2, shows a preliminary one-line of the new switching station, while Figure A- 3 shows the preliminary general arrangement plan view of the new switching station.

   1.2. **Bus Design:** The new two-breaker line terminal will be added to the proposed 230 kV switching station will be built to accommodate the output from the wind energy facility. The proposed switching station bus design 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.

   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:** The control house for the proposed switching station will be utilized to house the new metering, protective relaying and control devices, terminal cabinets, and any fiber-optic cable terminations, etc. for the new 230kV line breaker terminal.

   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 430' × 400', 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 230 kV two-breaker line terminal primary protections to the interconnection customer 230 kV transmission line will use line current differential relaying over optical fiber installed in the static on the new transmission line. Secondary relaying will use mirrored bit, directional comparison blocking over the optical fiber. An SEL 311L and an SEL 321-1 will be used as primary and secondary relays, respectively. An SEL 279H-2 relay will be installed; however no automatic re-closing scheme will be used. The SEL 279H-2 will be used for line/bus SCADA closing conditions for the 230 kV breaker. Also, a SEL 501-0 will be used for breaker failure.

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

An SEL DTA-2 will display the bus voltage, GCB amps, MW, MVAR, and fault location.

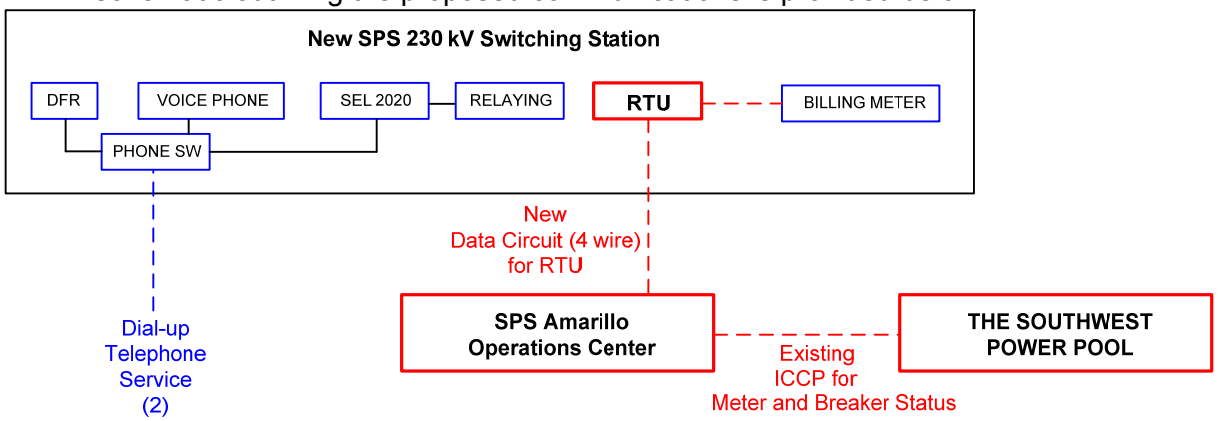
1.10. **Revenue Metering:** On the SPS new switching station 230 kV line terminal to the Interconnection Customer's substation, an individual billing meter will be installed along with an ION 8400 meter unit, ANSI C12.1 accuracy class 0.2 (3-PT's IEEE C57.13 accuracy class 0.3 and 3 CT's IEEE C57.13 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 synch 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:



The Interconnection Customer shall be responsible for providing fiber optic communication circuit installed in their overhead transmission line static wire for protective relaying from the customer substation to the new switching station indicated in Section 1.9.

2. **Transmission Work:**

   2.1. The Interconnection Customer will construct, own, operate, and maintain any customer owned 230 kV transmission line from the Interconnection Customer's substation to the Interconnection Point at the new SPS switching station as shown in Appendix A, Figure A-1. ***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.***

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 a new 230 kV line terminal at the switching station is not required from the Public Utility Commission in the State of Texas. The interconnection customer will be responsible for any permitting and right of way of their substation and the 230 kV transmission line from their substation to the Interconnection Point.

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 Point of Interconnection Location[d]

Scenario 1: Short Circuit Information without contribution from Wind Farm Facilities [e]				
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 Point of Interconnection Location

Scenario 2: Short Circuit Information without contribution from Wind Farm Facility (GEN 2006-047 only)[f]				
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] Point of Interconnection Location is on K41, approximately Thirty Eight (38) transmissions miles from Potter Co. Sub
[e] Scenario 1 consists of nine breakers, seven terminals, breaker and a half scheme switching station with K41 and K11 termination as POI for Interconnection Request GEN 2006-047, GEN 2006-045 and GEN 2006-039.
[f] Scenario 2 consists of three breakers, three terminals, and ring bus scheme switching station with K41 termination as POI for Interconnection Request GEN 2006-047only.

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. Scenario 1 and Scenario 2 estimated cost includes previously requested GEN 2006-039 and GEN 2006-045 and without it respectively.

Table 4, Required Interconnection Projects[g]

		Estimated Cost	
Project	**Description**	**Scenario 1**	**Scenario 2**
	Stand Alone Network Upgrades		
1	New Switching Station Facility (3-terminal)	$ 0	$ 2,868,751
2	Control House	$ 0	$ 191,612
	Subtotal:	**$ 0**	**$3,060,363**
	Network Upgrades		
3	Relay Upgrades at remote terminals	$0	$ 85,973
4	Disturbance Monitoring Device	$74,376	$ 74,375
5	Transmission Line Work	$0	$ 265,000
6	Right-Of-Way [h]	$16,000	$ 11,000
	Subtotal:	**$90,376**	**$ 436,348**
	Interconnection Facilities (at the Interconnection Customer's expense)		
7	Communications [i]	*$ See footnote*	*$ See footnote*
8	230 kV Breaker Line Terminal	$1,151,938	$0
9	Remote Terminal Unit (RTU)	$ 21,250	$ 21,250
10	Revenue metering	$ 74,251	$ 74,251
11	230 kV Line arrestors	$ 11,156	$ 11,156
	Subtotal:	**$1,258,595**	**$106,657**
	Total Cost:	**$1,348,971**	**$3,603,370**

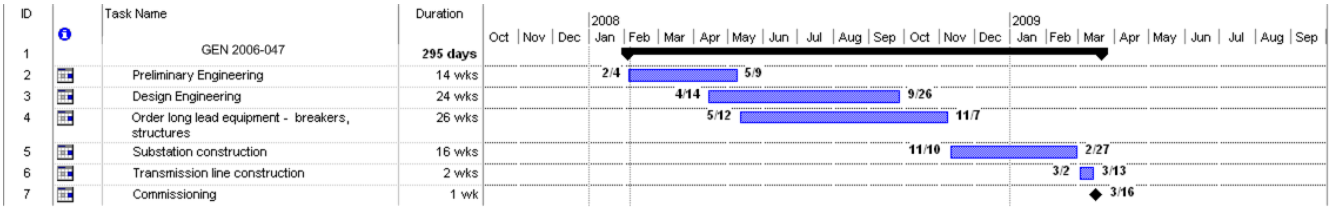
Engineering and Construction:

An engineering and construction schedule for the installation of the 230 kV line terminal is depicted below and is estimated at approximately 15 months and does not include construction schedule of the new switching station mentioned in Scenario 1. 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.

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

[h] 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.

[i] 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

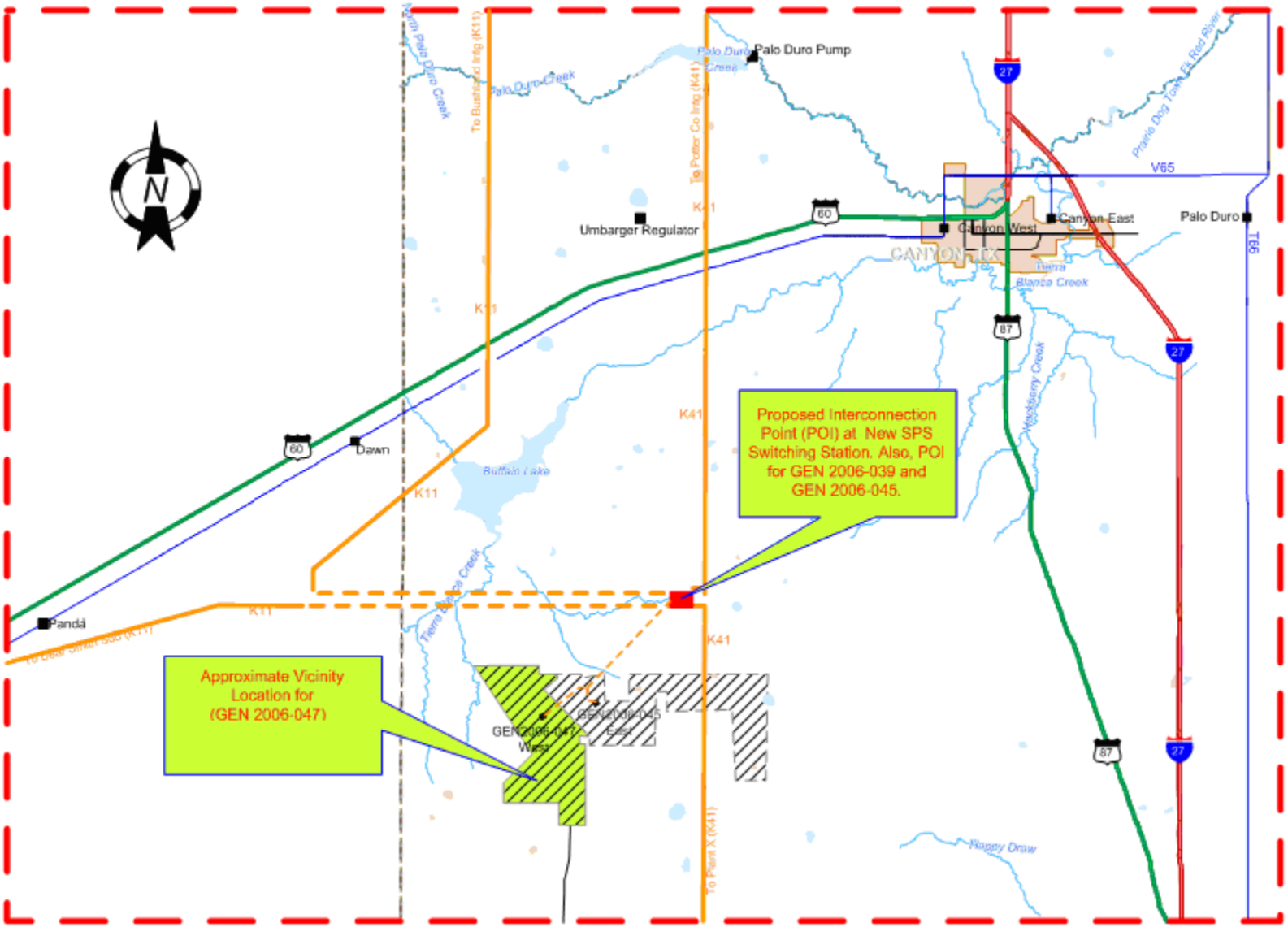


Figure A- 1 Approximate location of proposed switching station

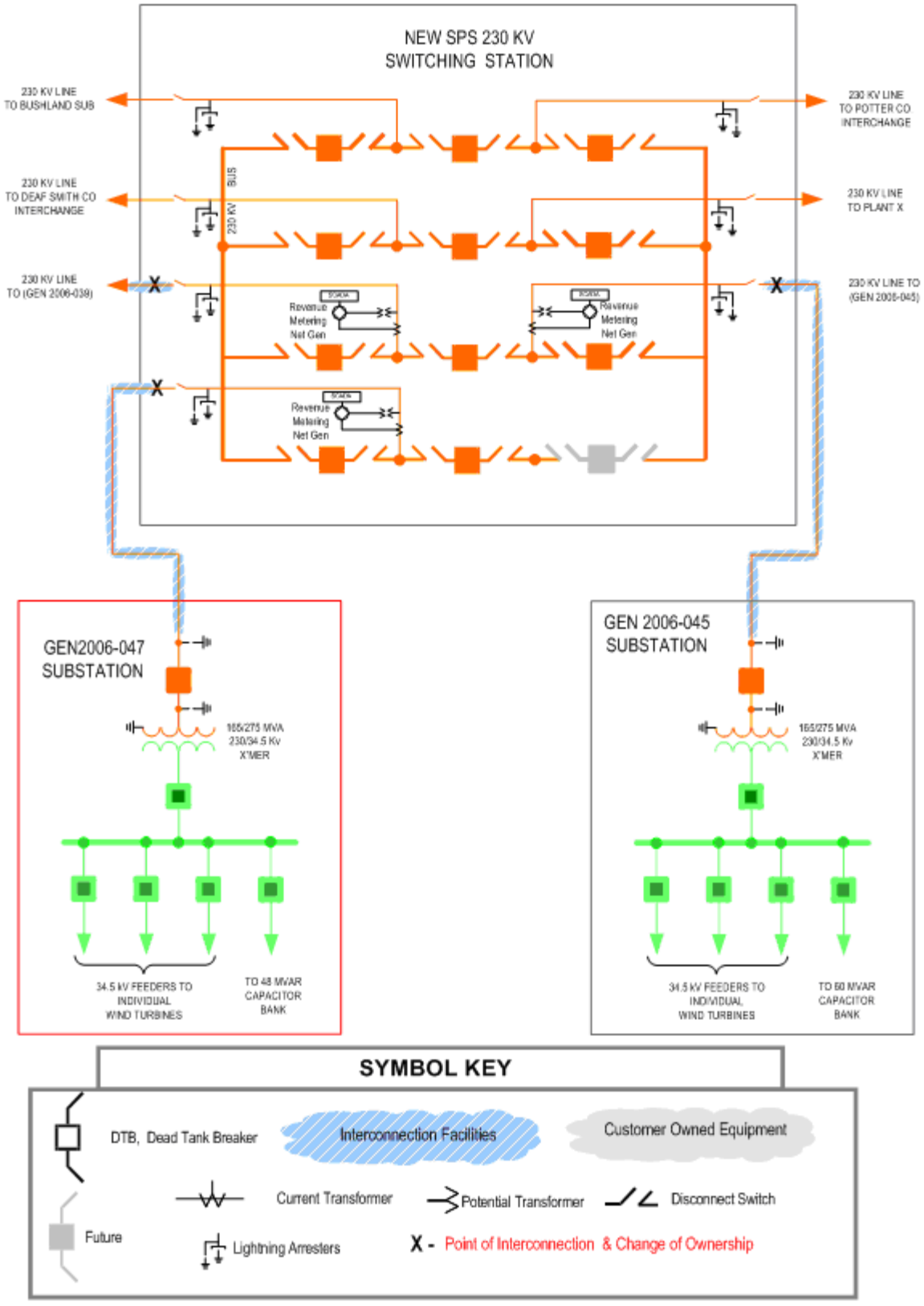


Figure A- 2 One-line Diagram of New Switching Station (Scenario 1)

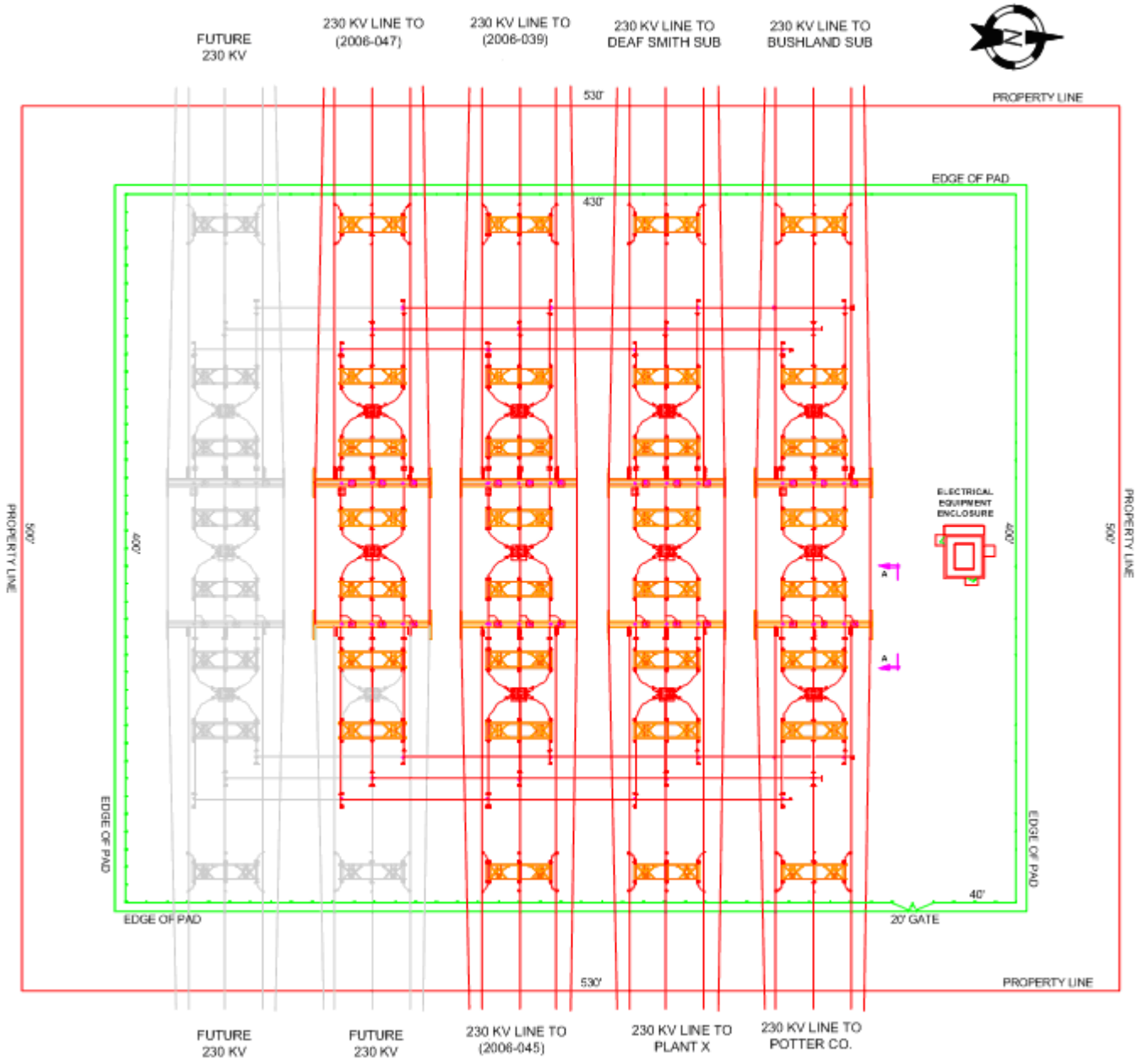


Figure A- 3 New SPS Switching Station Interconnection Facility Plan View

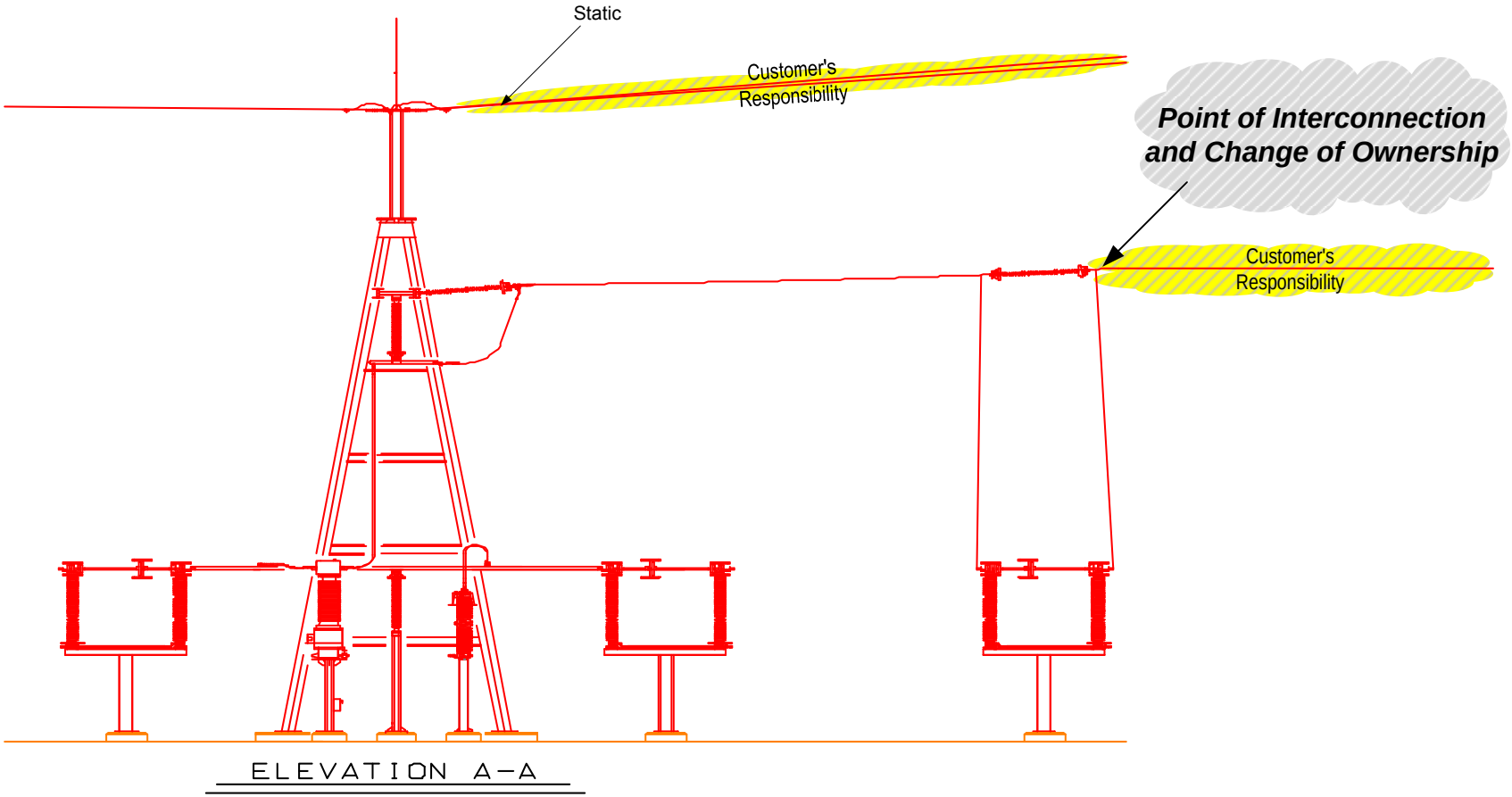


Figure A- 4 Point of Interconnection & Change of Ownership (Typical)

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