SPP Southwest Power Pool

Facility Study For Generation Interconnection Request GEN-2008-022

SPP Generation Interconnection

(#GEN-2008-022)

September 2011

SPP Summary

Xcel Energy Inc. (Xcel) performed a detailed Facility Study at the request of Southwest Power Pool (SPP) for Generation Interconnection request GEN-2008-022. The interconnection of the 300 MW generation facility located in Chaves County, New Mexico is in the control area of the Southwestern Public Service Company (SPS) transmission network. SPS is a New Mexico Corporation and wholly owned subsidiary of Xcel Energy Inc. The request for interconnection was placed with SPP in accordance with SPP's Open Access Transmission Tariff, which covers new generation interconnections on SPP's transmission system.

Interconnection Customer Interconnection Facilities

The Interconnection Customer will be responsible for the 345 kV transmission line from its generator facility substation to the Point of Interconnection (POI), a new 345 kV ring bus switching station on the Eddy County to Tolk 345kV transmission line. Additionally, the customer will be responsible for reactive power compensation equipment to maintain 95% lagging (providing vars) and 95% leading (absorbing vars) power factor at the point of interconnection. Any capacitor banks installed by the Customer shall not cause voltage or other distortion on the transmission system in accordance with Article 9.7.6 of the Standard GIA, Power Quality.

Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades

Per the following Facility Study, the Interconnection Customer is responsible for **$13,042,997** of Transmission Owner Interconnection Facilities and non-shared network upgrades.

Shared Network Upgrades

The interconnection customer was studied within the DISIS-2010-001-3 Impact Restudy (January 2011). At this time, the Interconnection Customer is allocated **$0** of shared network upgrades. If higher queued interconnection customers withdraw from the queue, suspend or terminate their GIA, restudies will have to be conducted to determine the Interconnection Customers' allocation of shared network upgrades. All studies have been conducted on the basis of higher queued interconnection requests and the upgrades associated with those higher queued interconnection requests being placed in service.

If interconnection customers in DISIS-2010-001 that are currently assigned the Hitchland-Border 345kV trnasmission line withdraw from the interconnection queue, a restudy of the GEN-2008-022 request will be required to determine if additional network upgrades are required for its interconnection.

Additional Required Network Upgrade

Certain Network Upgrades are required for Interconnection. These Network Upgrades include:

1. Hitchland – Woodward 345kV Double Circuit transmission line,
2. Medicine Lodge – Woodward 345kV double circuit transmission line,
3. Tuco-Woodward 345kV transmission line.

These network upgrades are not scheduled to be in service until December 31, 2014. Depending upon the status of higher or equally queued customers, the Interconnection Customer's in service date may be delayed until the in service date of these Network Upgrades.

Other Requirements

If the Interconnect Customer chooses to proceed with an Interconnection Agreement (IA), an Electromagnetic Transient Program (EMTP) Study will be required to finalize any 345 kV or higher voltage shunt reactor sizes, cost and delivery. The study will be done after the authorization to proceed has been received as required in the Milestone Schedule of the IA.

Facilities Study For
Southwest Power Pool (SPP)

300 MW Wind-Generated Energy Facility
Chaves County, New Mexico
SPP #GEN-2008-022

February 8, 2011

Xcel Energy Services, Inc.
Transmission Planning

Executive Summary

<Omitted text> ("Interconnection Customer") in 2008 requested the interconnection of a wind energy facility located in Chaves County, New Mexico to the Southwestern Public Service Company (SPS), transmission network. SPS is a New Mexico Corporation and wholly owned subsidiary of Xcel Energy Inc. This facility has a net capacity of 300 MW. The Interconnection Customer's facility will connect to the proposed switching station approximately seven (7) miles east of the customer's substation to SPS's switching station located in Lea County, New Mexico. The Interconnection Customer's expected commercial operation date and back feed date is 6-30-2015 and 12-1-2014, respectively.

The Southwest Power Pool (SPP) originally evaluated the request to interconnect the wind farm facility to the SPS transmission system in a System Impact Study (SIS) GEN-2008-022 completed in July 2010. The original interconnection request was studied using One-Hundred twenty (120) GE wind turbines at 2.5 MW each for a total output of 300 MW. The Interconnection Customer is required to maintain a Power Factor of 0.95 lagging and 0.95 leading at the Point of Interconnection (POI) based on the SPP SIS for Group 6 under the Executive Summary on pages 9 and 13 (Table 5.4).

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, available at: (http://www.xcelenergy.com/Texas/Company/Transmission/Pages/Transmission_Services_Interconnection_Guidelines.aspx). 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 capacitor banks and any Direct Assigned Interconnection Facilities; inclusive of all construction required for the 345 kV transmission line from the Interconnection Customer's substation to the proposed SPS Switching Station.

If the Interconnect Customer chooses to proceed with an Interconnection Agreement (IA), an Electromagnetic Transient Program (EMTP) Study will be required to finalize any 345 kV or higher voltage shunt reactor sizes, cost and delivery. The study will be done after the authorization to proceed has been received as required in the Milestone Schedule of the IA.

As for this request (GEN-2008-022), it is anticipated that the new 345 kV switching station will require approximately 24 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 3.

Table 1, Cost Summary

Stand Alone Network Upgrades:	**$ 6,749,829**
Network Upgrades:	**$ 5,775,793**
Interconnection Facilities [1]:	**$ 517,375**
Total:	**$13,042,997**

[1] This is a direct assigned cost to the Interconnection Customer.

General Description of SPS Facilities [2]

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 345 kV three (3) breaker ring bus at the new switching station. Appendix A, Figure A- 2, shows the preliminary one-line of the new switching station, while Figure A- 3 shows a typical elevation view of the Point of Interconnection (POI).

    1.2. **Bus Design:** The new 345 kV three-breaker ring-bus switching station will be built to accommodate the output from the wind energy facility.

    1.3. **Line Terminals:** The 345 kV lines and static wire terminals will be designed to accommodate 14,000 pounds per phase conductor (28,000 per bundle) at maximum tension, with a maximum 15° 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 345 kV line breaker terminals.

    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 for the proposed switching station for 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 for the proposed 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 199 kV/120-240 volt transformer tapped off of the 345 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 345 kV three (3) breaker ring-bus line terminals primary protections to the interconnection customer 345 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, Permissive Overreaching Transfer Trip (POTT) over the optical fiber. An SEL 311L and a 421 will be used as primary and secondary relays, respectively. No automatic re-closing scheme will be used. The SEL 421 will be used for line/bus SCADA closing conditions for the 345 kV breakers. A SEL 501-0 will be used for breaker failure. Significant modifications will be required at remote terminals.

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

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

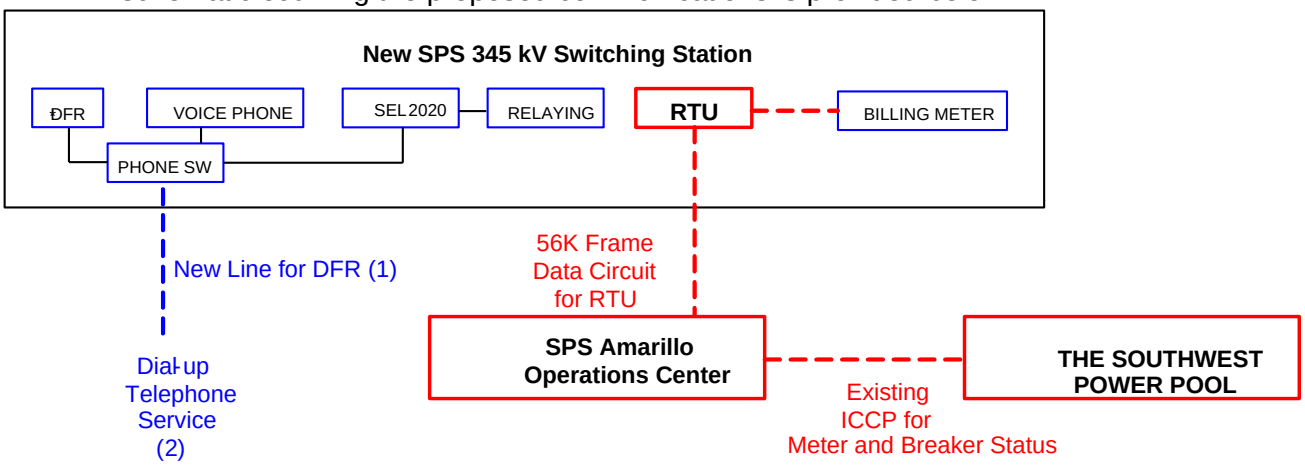
1.10. **Revenue Metering:** On the SPS new 345 kV switching station at the Customer's Point of Interconnection from their substation, an individual billing meter will be installed along with a meter per ANSI C12.1 accuracy class 0.2 (3-PT's IEEE C57.13 accuracy class 0.3 and 3 CT's IEEE C57.13 accuracy class 0.15) for full 3 phase 4-wire metering. Also installed for the metering units will be optical 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 installed to accommodate the new 345 kV line terminals at the proposed switching station. An SEL 2020 will be installed for relay communications and other function 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:** To meet its Communications obligations under Article 8 of this GIA, the Interconnection Customer shall be responsible for making arrangements with the local phone company to provide telephone circuits as required by the Transmission Owner. Transmission Owner equipment may include, but is not limited to, the following: relay communication equipment, RTU, and disturbance monitoring equipment at the new Switching Station. Prior to any construction, the Interconnection Customer is required to contact the Transmission Owner substation-engineering department for all communication details.

A schematic outlining the proposed communications is provided below:



To facilitate its compliance with Appendix D of the GIA, Interconnection Customer shall be responsible for providing fiber optic communication circuit installed in the overhead transmission line static wire for protective relaying from the customer substation to the new Switching Station.

2. **Transmission Work:**

   2.1. The Interconnection Customer will construct, own, operate, and maintain any customer owned 345 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 345 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 and Permits:**

   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 345 kV line terminal at the switching station is not required from the Public Utility Commission in the State of New Mexico. The interconnection customer will be responsible for any permitting and right of way of their substation and the 345 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:**

   5.1. 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.

   5.2. It is understood that the Capacitor Banks will be installed at the Interconnection Customer's substation on the 34.5 kV bus side to avoid voltage spikes on the 345 kV that adversely affects the Xcel Energy transmission system. The Interconnection customer will be required to maintain a Power Factor of 0.9998 lagging at the Point of Interconnection

(POI) by using switched capacitor banks or set the GE 2.5 MW turbines to regulate their terminal voltage to 717.6 Volts (1.04 p.u.), which is based on SPP's Impact Cluster Study under Executive Summary Group 6 on page 5 and 6. The capacitor banks need to be switched in stages of 20 MVAr or less. This is required to maintain acceptable dynamic voltage rise as per latest revision of the Xcel Energy Interconnection Guidelines for Transmission Interconnection Producer-Owned Generation Greater than 20 MW, http://www.xcelenergy.com/Texas/Company/Transmission/Pages/Transmission_Services_Interconnection_Guidelines.aspx

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 below.

Table 2, - Available Fault Current at Point of Interconnection Location

Short Circuit Information without contribution from Wind Farm Facilities GEN 2008-022[3]				
	Fault Current (Amps)		Impedance (Ω)	
Fault Location	Line-to-Ground	3–Phase	Z^+	Z^0
345 kV Bus	2855	3512	4.473+j56.546	21.624+j94.022

Short Circuit Information without contribution from Wind Farm Facilities GEN 2008-022 But with the addition of all the Proposed Infrastructure Transmission Lines by SPP.[4]				
	Fault Current (Amps)		Impedance (Ω)	
Fault Location	Line-to-Ground	3–Phase	Z^+	Z^0
345 kV Bus	Not Available	3577 @-113°	Not Available	Not Available

[3] Fault contribution from the proposed 345 kV lines from Hitchland-Woodward-Northwest also not included.
[4] Fault contribution from the proposed 345 kV lines from Hitchland-Woodward-Northwest are included.

Estimated Construction Costs

An Electromagnetic Transient Program (EMTP) Study will be required to finalize any 345 kV or higher voltage shunt reactor sizes, cost and delivery (See Executive Summary for more details). The projects required for the interconnection of this 300 MW Wind Farm facility consist of the projects summarized in the table below.

Table 3, Required Interconnection Projects[5]

Project	Description	Estimated Cost
	Stand Alone Network Upgrades	
1	New Switching Station (3-Breaker Ring Bus) Facility	$ 6,484,204
2	Control House	$ 265,625
	Subtotal	**$ 6,749,829**
	Network Upgrades	
3	Transmission Line Work	$ 580,335
4	Right-of-Way	$ 45,000
5	Relay Upgrades at remote terminals	$ 300,000
6	Disturbance Monitoring Device	$ 51,376
7	345 kV 2-25 MVAr Reactor (Preliminary until EMTP Study)	$ 4,799,082
	Subtotal:	**$ 5,775,793**

	Interconnection Facilities (at the Interconnection Customer's expense)	
7	Communications [6]	*$ See footnote*
8	345 kV Disconnect Switch	$ 210,375
9	Revenue metering	$ 250,000
10	345 kV Line arrestors	$ 57,375
	Subtotal:	**$ 517,375**

Total Cost:	**$13,042,997**

Engineering and Construction:

An engineering and construction schedule to build the new switching station and at 345 kV line is estimated at approximately 24 months. Other factors associated with clearances, equipment delays and work schedules could cause additional delays. The schedule is applicable after all required agreements are signed, and internal approvals are granted.

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

[5] The cost estimates are 2010 dollars with an accuracy level of ±20% except as noted, without AFUDC.

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

Appendix A

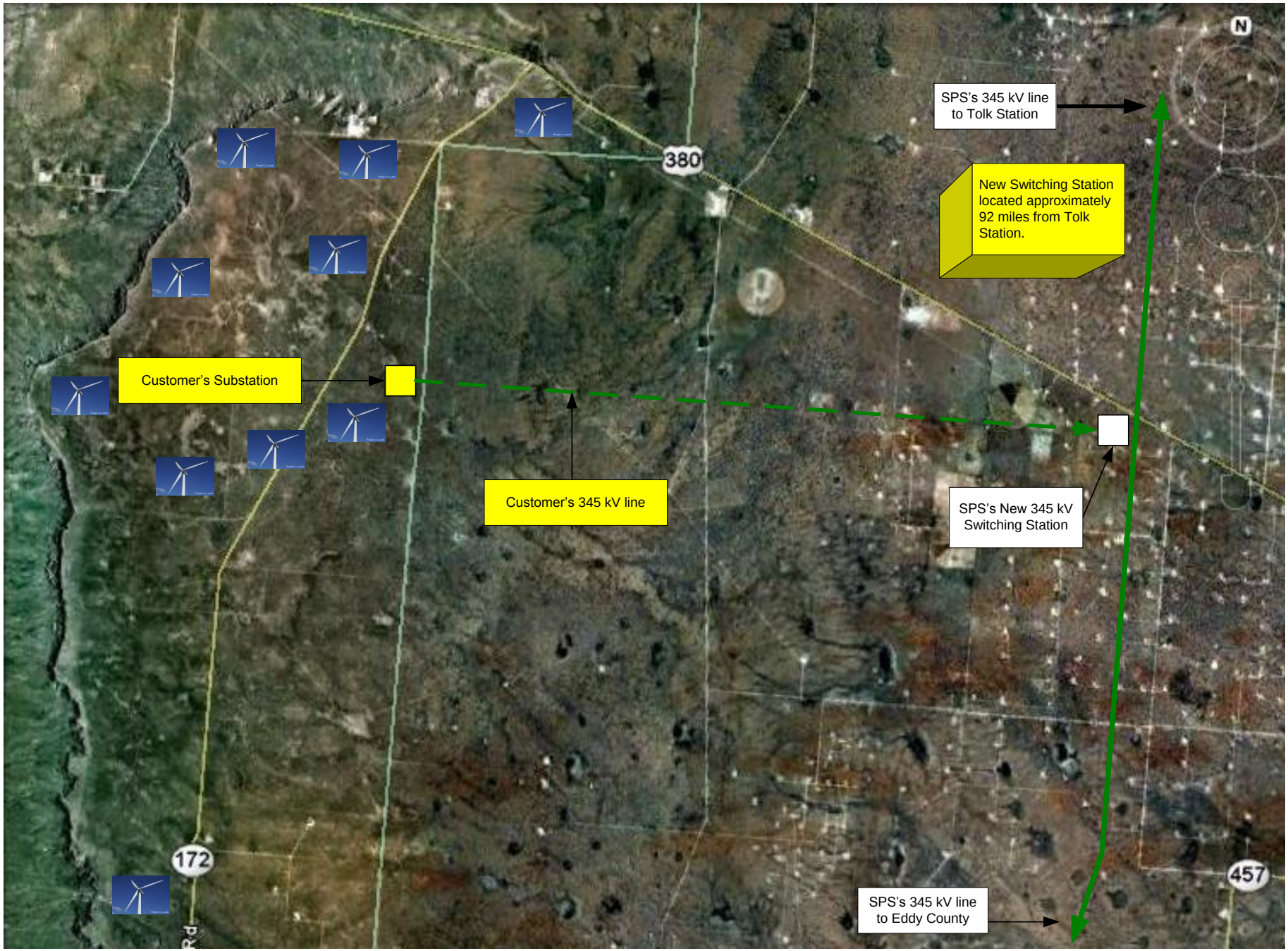


Figure A- 1 Approximate location of proposed SPS Switching Station and Wind Farm Facility

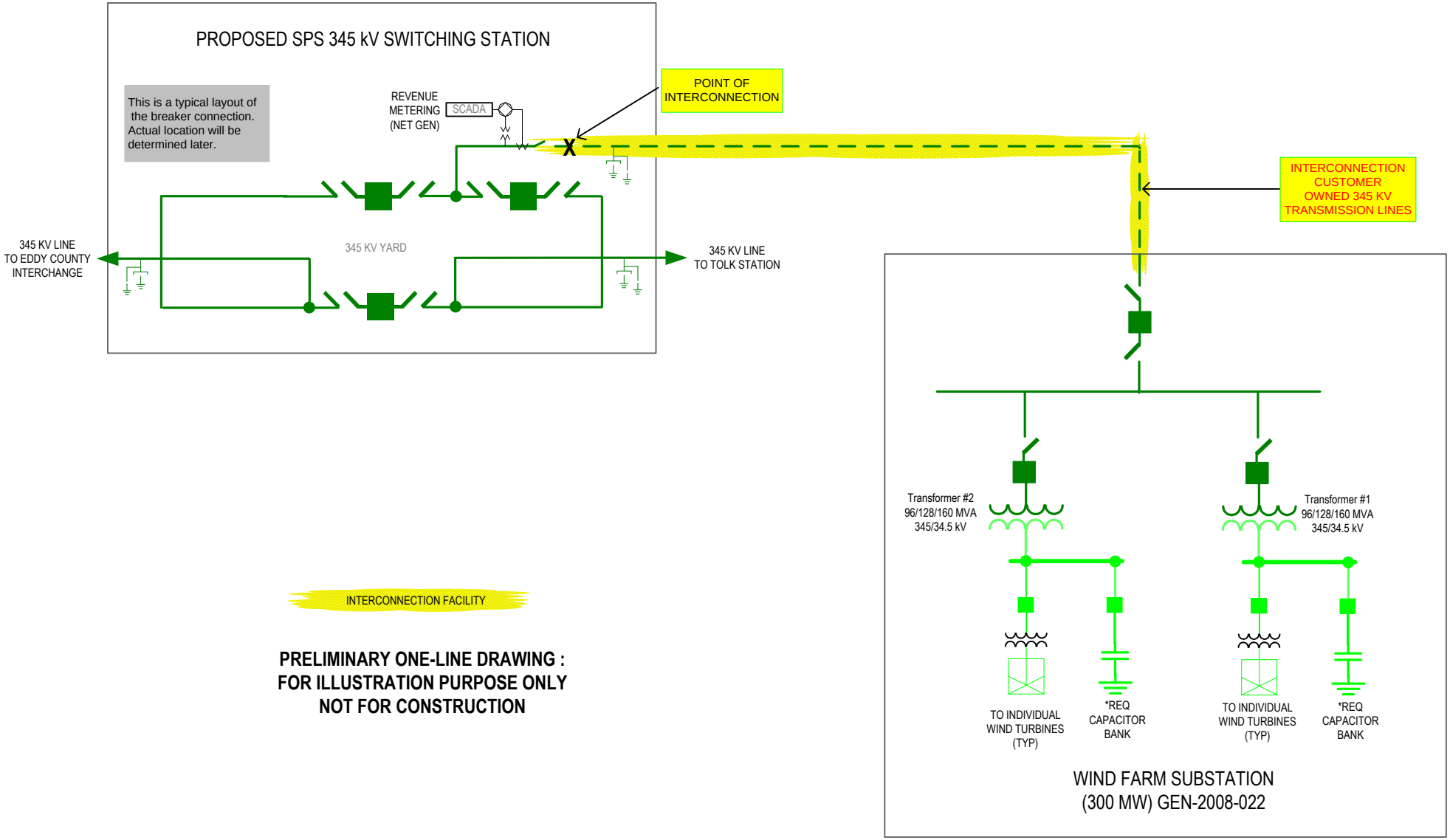


Figure A- 2 One-line Diagram of Proposed SPS Switching Station to Customer Interconnection Facility

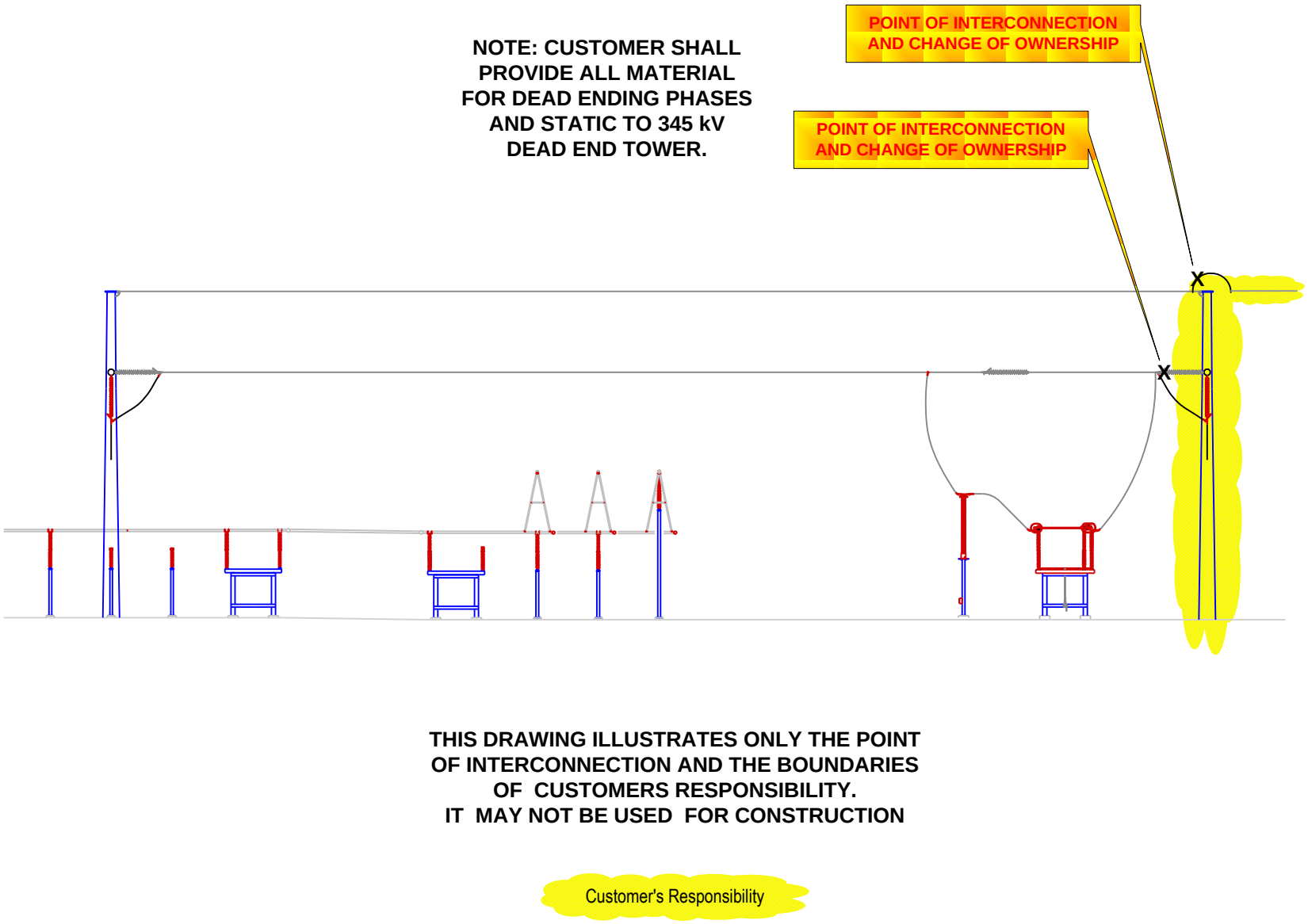


Figure A- 3 New Switching Station Interconnection Facility Preliminary Elevation View

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