SPP Southwest Power Pool

Facility Study for Generation Interconnection Request GEN–2006–049

SPP Tariff Studies
(#GEN-2006-049)

July 2012

Summary
Pursuant to the tariff and at the request of the Southwest Power Pool (SPP), Southwestern Public Service (SPS) performed the following Facility Study to satisfy the Facility Study Agreement executed by the requesting customer and SPP for SPP Generation Interconnection request Gen-2006-049. 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.

The study minimum requirements for this request will consist of constructing a 345kV ring bus substation including three 345kV circuit breakers at the Point of Interconnection on the Hitchland-Finney 345kV transmission line, relay modifications at Hitchland substation, 0.75 miles of 345kV transmission line from Finney to Holcomb, and substation additions at both Finney 345kV and Holcomb 345kV substations. Total estimated cost of interconnection is $22,313,305.

Facilities on the Sunflower Transmission System
For network upgrades not located on the SPS transmission system, SPP will issue a Notice to Construct (NTC) to the appropriate transmission owner under the SPP Tariff for construction of these facilities.

Facilities Study For
Southwest Power Pool (SPP)

399 MW Wind-Generated Energy Facility
Stevens County, Kansas
SPP #GEN-2006-049_Revised

June 18, 2012

Xcel Energy Services, Inc.
Transmission Planning

Executive Summary

Customer [omitted text] in December 2006 ("Interconnection Customer") requested the interconnection of a wind energy facility located in Seward County, Kansas to the Southwestern Public Service Company (SPS), a New Mexico Corporation and wholly owned subsidiary of Xcel Energy Inc. 345 kV transmission network. This facility has a net capacity of 399 MW. The Interconnection Customer's facility will connect to a new 345kV Switching Station located in Stevens County, Kansas approximately twenty-five (25) miles northwest of Liberal, Kansas.

The Southwest Power Pool (SPP) evaluated the request to interconnect the wind farm facility to the SPS transmission system in a Impact Study (IS) (GEN-2006-049) completed in February 2012. The interconnection request was studied using two hundred sixty-six (266) GE 1.5 MW wind turbines. The Interconnection Customer will be required to maintain a Power Factor between 0.95 lagging and 0.95 leading at the Point of Interconnection (POI). The Interconnection Customer's expected commercial operation date is December 31, 2014 and the back feed date is October 1, 2014.

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/Energy_Partners/Generation_Owners/Interconnection_Guidelines/Interconnections_for_Transmission. This document describes the requirements for connecting new generation to the Xcel Energy transmission systems including technical, protection, commissioning, operation, and maintenance. Also, this document has a section on Frequency and Frequency Control for the SPP Region in Section II.H.3, where as allowed under SPP criteria, SPS will open tie lines at 58.5 Hz and automatically trip generators. Due to the structure of the under-frequency load-shedding plan, it is necessary that generators be able to sustain frequencies to at least 58.5 Hz. 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 Direct Assigned Interconnection Facilities; inclusive of all construction required for the 345 kV transmission line (bus) from the Interconnection Customer's substation to the proposed SPS Switching Station.

As for this request (GEN-2006-049) revised, it is anticipated that the entire process to build a new 345 kV 3-breaker ring bus switching station and the new 345 kV line from Finney to Holcomb Plant for the acceptance of the Customer facility output will require approximately 32 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

SPS Network Upgrades:	**$21,998,362**
Interconnection Facilities [1]:	**$ 314,943**
Total:	**$22,313,305**

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

General Description of SPS Facilities [2]

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

   1.1. **Location:** SPS will build a new 345 kV three (3) breaker ring bus at a new switching station. Figure A- 2, Appendix A shows the preliminary one-line of the 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. This is shown Figure A-2.

   1.3. **Line Terminals:** The 345 kV lines and static wire terminals capable of 14,000 pounds per conductor (28,000 per bundle) and the maximum static tension to be considered is 7,000 pounds with a maximum 15° pull-off from normal.

   1.4. **Control House:** The control house for 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 400' x 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 any site grading and erosion control to accommodate the new line terminal. Soil compaction shall be not less than 95% of laboratory density as determined by ASTM-D-698.

   1.8. **Station Power**: A 199 kV/120-240volt transformer tapped off of the 345 kV bus will provide station power. Station power will be provided by the certificated retail provider at the point of interconnection. A backup station power source may be taken from retail provider's local distribution if it is available. A flip-flop to automatically transfer the station power may need to be installed.

   1.9. **Relay and Protection Scheme:** The new 345 kV breaker line terminal primary protection to the interconnection customer 345 kV transmission line will use line current differential relaying over optical fiber installed in the static of the customer's 345 kV transmission line. Secondary relaying will use mirrored bit, Permissive Overreaching Transfer Trip (POTT) over the optical fiber. An SEL 311L and an SEL 421 will be used as primary and secondary relays, respectively. 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. Modifications at Finney Switchyard and Hitchland Interchange will be required.

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

An SEL 421 will display the bus voltage, GCB amps, MW, MVAR, and fault location. An SEL 2032 will be installed for relay communications and other functions as required.

1.10. **Revenue Metering:** On the proposed SPS new Switching Station 345 kV line terminal to the Interconnection Customer's substation, billing meters will be installed 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. There will be two meters; 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.

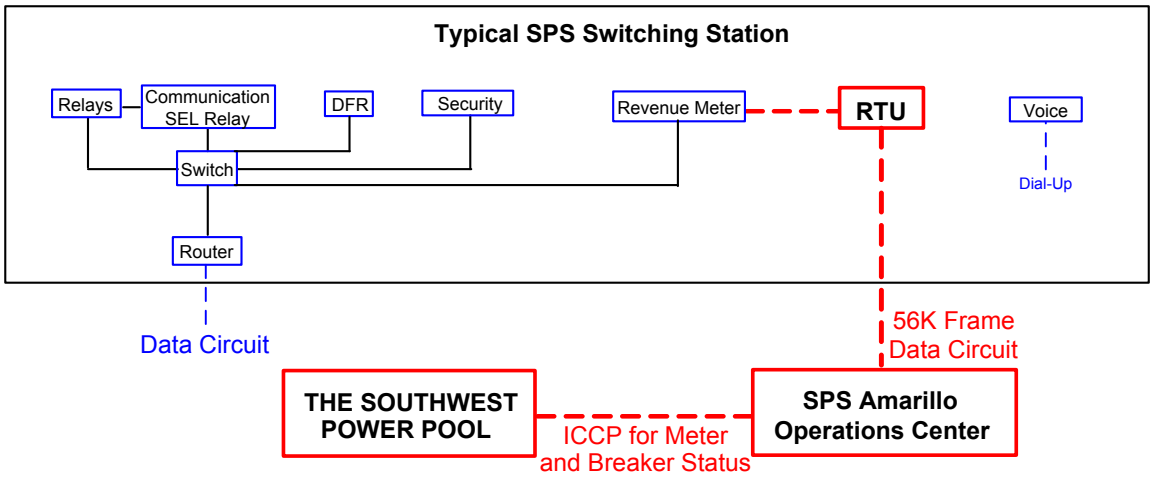
1.11. **Disturbance Monitoring Device:** Disturbance Fault Recorder (DFR), capable of recording faults, swings, and long term trending, will be installed to monitor and record conditions in the substation and on the transmission lines. The disturbance equipment shall also be equipped with a GPS time 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 to accommodate for the new 345 kV Switching Station at Stevens County, Kansas. SPS will provide and install RTU cards for metering and telemetry 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, 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.

The following communications schematic diagram, which includes communication equipment information for the Interconnection Customer, Transmission Provider (Southwest Power Pool) and Transmission Owner (Southwestern Public Service), is provided to assist the Parties.

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 345 kV 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 SPS's new 345 kV Switching Station, which is estimated to be 12 miles. **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. **Permitting**: The State of Kansas Public Utility Commission will not require a permit for the construction of a new 345 kV line terminal to receive output from the Customer's wind farm facility at the new switching station as shown in Figure A-1, Appendix A. The interconnection customer will be responsible for any permitting and right of way of their substation, switching station, the 345 kV transmission lines from their collector substation to the proposed SPS switching station Interconnection Point.

4. **Construction Power and Retail 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 and switching station. **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 service) and the Interconnection Customer needs to make arrangements for retail service from the local retail provider. Retail provider and Customer will be responsible for making any necessary transmission service arrangements as required under the SPP OATT.**

5. **Project and Operating Concerns:**

   5.1 Close work between the SPS 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 The Interconnection customer will be required to maintain a Power Factor between 0.95 lagging and a 0.95 leading at the Point of Interconnection (POI). 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.

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 2006-049				
	Fault Current (Amps)		Impedance (Ω)	
Fault Location	Line-to-Ground	3–Phase	Z^+	Z^0
345 kV Bus	3,639	4,465	3.700+j44.456	14.738+j73.806

Estimated Construction Costs

The projects required for the interconnection of this 399 MW Wind Farm facility consist of the projects summarized in the table below.

Table 3, Required Interconnection Projects[3]

Project	Description	Costs
	SPS Network Upgrades	
1	New 345 kV Switching Station (3-Breaker Ring Bus)	$ 5,762,340
2	Land, 20 Acres	$ 90,594
3	Transmission Line Work (In and Out)	$ 850,326
4	Disturbance Monitoring Device (DFR)	$ 120,000
5	Remote Terminal Unit (RTU)	$ 54,500
4	Relay Modification to Terminal at Hitchland Interchange	$ 120,000
5	Relay Modification to Terminal at Finney Switchyard	$ 120,000
6	Build 0.75 miles of 345 kV Transmission line 2-795 MCM from Finney Switchyard to Holcomb Station.	$ 2,098,356
7	ROW for new transmission line on line 6.	$ 52,283
8	Expansion of the existing Finney Station with additional 10 acres	$ 53,022
9	Replace the 50 MVAr line reactor at Finney on the 345 kV line from Hitchland to Finney with a 30 MVAr line reactor.	$ 2,905,352
10	Convert ring bus to breaker and half at Finney (4-new breakers)	$ 4,771,589
11	Sunflower to add 345 kV line terminal for transmission from Finney Switchyard and Modify the relaying at Holcomb. SPP's Impact Study shows 2-345 kV breakers and etc at $5,000,000.	$ 5,000,000
	Subtotal:	**$21,998,362**
	Interconnection Facilities (at the Interconnection Customer's expense)	
12	Communications [4]	*See footnote*
13	345 kV Disconnect Switch	$ 95,818
14	Revenue metering	$ 200,000
15	345 kV Line arrestors	$ 19,125
	Subtotal:	**$ 314,943**
	Total Cost:	**$22,313,305**

There is a network upgrade to build a 230 kV line from Hitchland Interchange to Moore County Interchange scheduled to be in-service in June 2012.

Engineering and Construction:

An engineering and construction schedule is estimated at approximately 32 months based on the new purchase. Other factors associated with clearances, equipment delays and work schedules could cause additional delays. This is applicable after all required agreements are signed and internal approvals are granted.

[3] The cost estimates are 2012 dollars with an accuracy level of ±20% except as noted, without AFUDC.

[4] 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

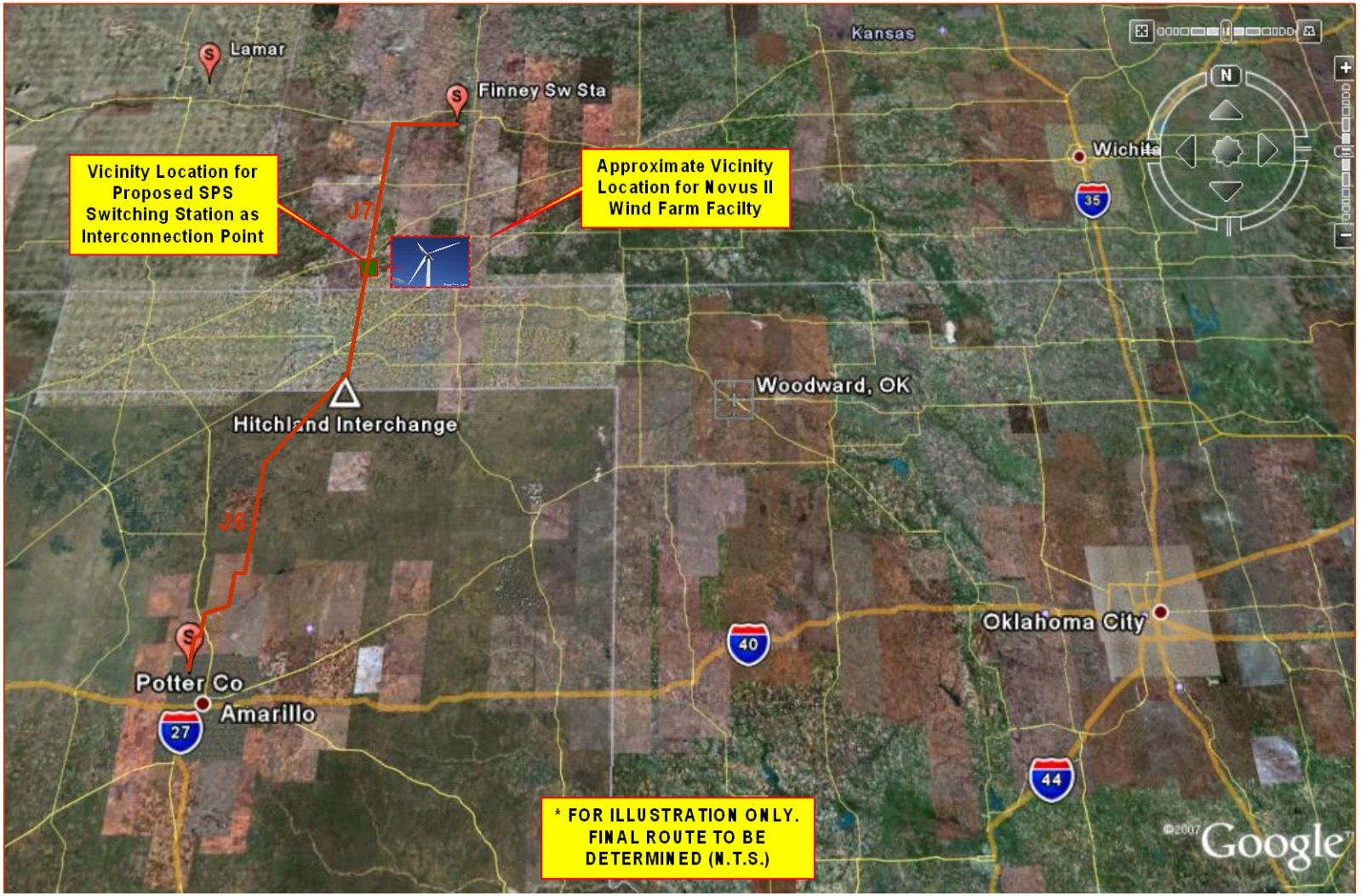


Figure A- 1 Approximate location of proposed SPS Switching Station and Wind Farm Facility

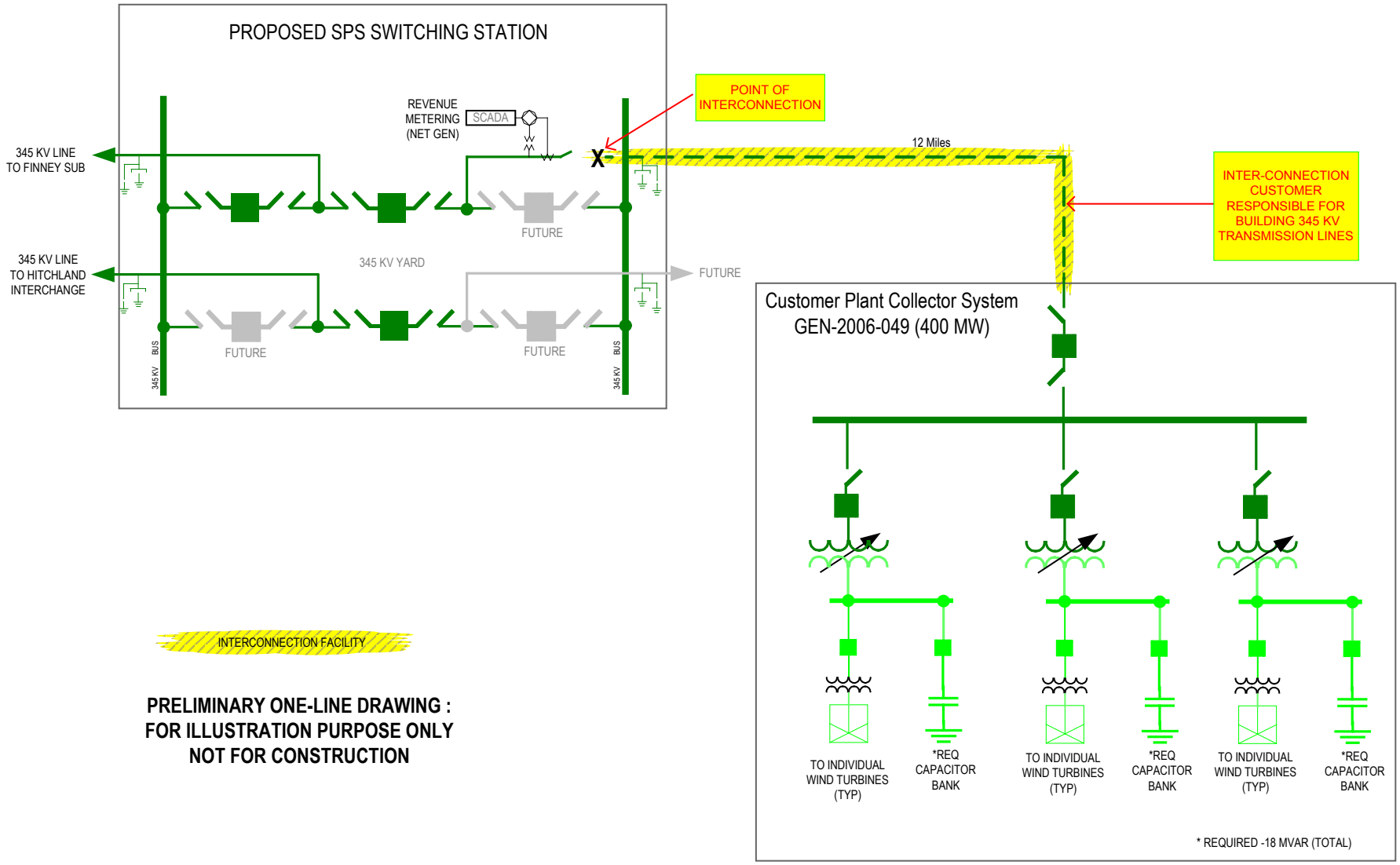


Figure A- 2 One-line Diagram of Proposed SPS Switching Station to Customer Interconnection Facility

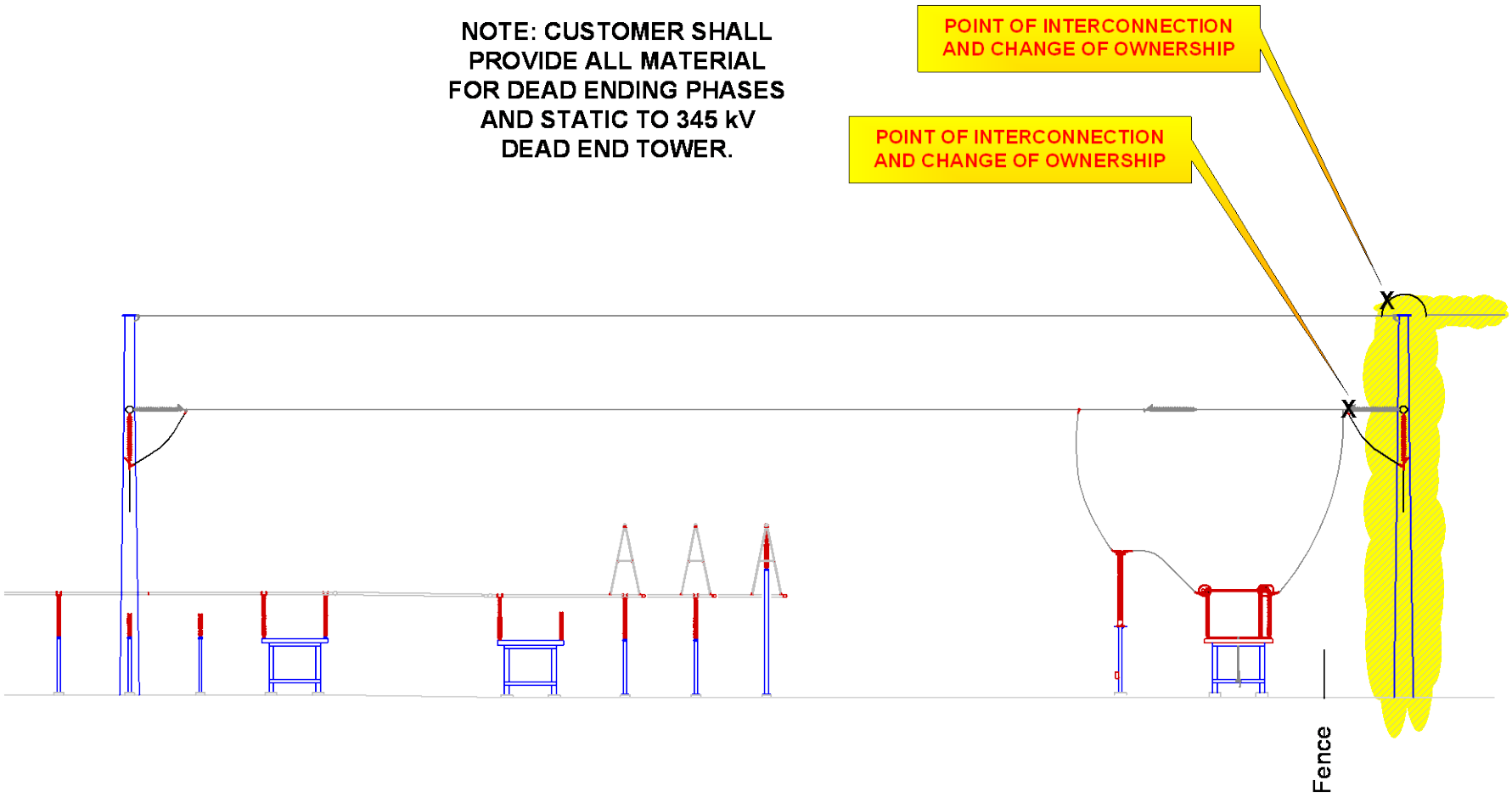


Figure A- 3 Point of Interconnection & Change of Ownership (Typical)

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