Facility Study For Generation Interconnection Request GEN-2008-018

SPP Tariff Studies

(#GEN-2008-018)

March 2010

Summary

Southwestern Public Service Company (SPS) performed the following Study at the request of the Southwest Power Pool (SPP) for Generation Interconnection request Gen-2008-018. 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.

Pursuant to the tariff, Southwestern Public Service Company was asked to perform a detailed Facility Study of the generation interconnection request to satisfy the Facility Study Agreement executed by the requesting customer and SPP.

Interconnection Customer Interconnection Facilities

The Interconnection Customer will be responsible for the 345kV transmission line from the point of interconnection to its 345/34.5kV substation that will contain its 345/34.5kV transformer(s) and wind turbine collector feeders. In addition, the Customer will be required to maintain a +/- 98.7% power factor at the point of interconnection (Finney 345kV substation). Using the studied GE wind turbines, additional capacitors may be necessary.

Transmission Owner Interconnection Facilities and Non Shared Network Upgrades

Per the following Facility Study, the Interconnection Customer is responsible for $311,918 of Transmission Owner Interconnection Facilities and $2,252,249 of non shared Network Upgrades.

Shared Network Upgrades

The GEN-2008-018 Interconnection Customer is included in the 1st Cluster Study approved in FERC Docket #ER09-262. The Interconnection Customer's shared upgrade costs are $35,821,722. This cost is subject to change depending upon the Facility Study for the shared network upgrades. This cost is also subject to change for restudies conducted by the Transmission Provider in response to the higher queued customers or other customers in the 1st Cluster that withdraw their interconnection request or suspend, terminate, or request unexecuted filings of their LGIAs.

The in service date for the interconnection request may also be delayed depending upon the in service date of the shared network upgrades.

Facilities Study For

405 MW Wind-Generated Energy Facility
Finney County, Kansas
SPP #GEN-2008-018

March 4, 2010

Xcel Energy Services, Inc.
Transmission Planning

Executive Summary

The Interconnection Customer in 2008 requested the interconnection of a wind energy facility located in Finney County, Kansas 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 405 MW. The Interconnection Customer's facility will connect at Finney Switching Station located in Finney County, Kansas approximately seven (7) miles southwest of Garden City, Kansas. The Interconnection Customer's expected commercial operation date and back-feed date is December 31, 2012 and June 1, 2012 respectively.

The Southwest Power Pool (SPP) evaluated the request to interconnect the wind farm facility to the SPS transmission system in a System Impact Re-Study (SIRS) GEN-2008-018 completed in January 2010. The interconnection request was studied using two-hundred-seventy (270) GE wind turbines at 1.5 MW each for a total output of 405 MW and the interconnection customer will have two (2) 150/250 MVA 345/34.5 kV transformers. The Interconnection Customer is required to provide 66 MVAr and maintain a Power Factor of 0.987 lagging at the point of interconnection based on SPP's SIRS Table 2-3.

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 any additional 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 SPS Finney Switching Station.

As for this request GEN-2008-018, it is anticipated that the entire process of adding the new 345 kV line terminal at Finney Switching Station for the acceptance of the wind farm facility output will require approximately 13 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, Finney Switching Station

SPS Network Upgrades:	**$ 2,252,249**
Interconnection Facilities [1]:	**$ 311,918**
Total:	**$ 2,564,167**

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

General Description of SPS Facilities [2]

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

   1.1. **Location:** SPS will add a new 345 kV line terminal at the existing SPS Finney Switching Station. Appendix A, Figure A-2 shows the one-line of the Switching Station, while Appendix A, Figure A-3 shows the preliminary elevation plan view of the Station.

   1.2. **Bus Design:** The new 345 kV line terminal will be added to the existing 345 kV ring-bus at Finney Switching Station to accommodate the output from the wind energy facility. The existing bus design at Finney Switching Station will be expanded from three ring bus to a four ring bus as shown in the one-line in Appendix A, Figure A-2.

   1.3. **Line Terminals:** The conductor will be pulled in at full tension. The substation dead end structures must be capable of 14,000 pounds per conductor (28,000 per bundle). The maximum static tension to be considered is 7,000 pounds per static wire. The dead end towers must be designed for a 15° pull-off angle.

   1.4. **Control House:** The existing control house will be utilized to accommodate the new metering, protective relaying and control devices, terminal cabinets, and any fiber-optic cable terminations, etc. for the new 345 kV line breaker terminal.

   1.5. **Security Fence:** The existing security fence shall be extended if required when the new branch is added for the new 345 kV line terminal.

   1.6. **Ground Grid**: The existing ground grid shall be extended to accommodate the additional bay required for the new line terminal 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:** The existing switching station power, provided from the local distribution system, will be utilized.

   1.9. **Relay and Protection Scheme:** The new 345 kV breaker line terminal primary protections 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 230 kV transmission line. Secondary relaying will use mirrored bit, Permissive Overreaching Transfer Trip (POTT) 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 345 kV breakers. Also, a SEL 501-0 will be used for breaker failure. The bus relaying will have to be modified for wind generation. A revision of the cross tripping scheme that may exist on the Potter to Hitchland to Finney 345 kV may be needed.

[2] 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. An SEL 2020 will be installed for relay communications and other functions as required.

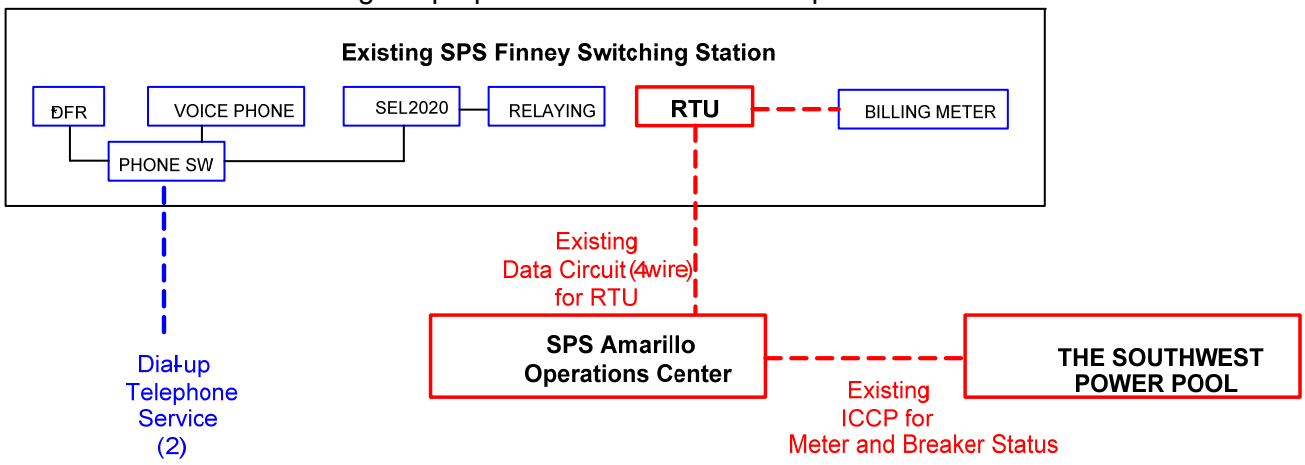
1.10. **Revenue Metering:** On the proposed SPS Finney Switching Station 345 kV line terminal to the Interconnection Customer's switching station, an individual billing meter will be installed along with an ION 8400 meter unit, ANSI C12.1 accuracy class 0.2 (3-PT's IEEE C57.13 accuracy class 0.3 and 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 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:** The required input and output points for the new line terminal will be added to the existing disturbance-monitoring equipment (DFR). The DFR is equipped with a GPS time synch clock, is also capable of recording faults, swings, and long term trending. It is used to monitor and record conditions in the substation and on the transmission lines. This equipment has a remote communication capability with a dedicated telephone circuit.

1.12. **Remote Terminal Unit (RTU):** The existing RTU will be utilized to accommodate the new 345 kV line terminals at Finney Switching Station. SPS will provide and install if needed additional 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:** Existing telephone and data circuit at Finney Switching Station to the Amarillo Control Center will be utilized. ***It is the Interconnection Customer's responsibility to make arrangements with the local phone company to provide telephone circuits to the relay communication equipment and disturbance-monitoring equipment at Finney Switching Station and to their 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 indicated in Section 1.9 from the customer's switching station to Finney Switching Station control house. Also customer will be responsible for additional communication relays required at Finney Switching Station the new wind farm terminal to interrogate protective relays mentioned in Section 1.9.

2. **Transmission Work:**

   2.1. The Interconnection Customer will construct, own, operate, and maintain the 345 kV transmission line from the Interconnection Customer's switching station to the Interconnection Point at SPS Finney Switching Station as shown in Appendix A, Figure A-2. ***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 SPS Finney 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 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 Finney Switching Station. 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 Point of Interconnection at Finney 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:**

   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 0.987 lagging at the Point of Interconnection (POI) based on SPP's Impact Cluster #1 Restudy Table 2-3 and switch the capacitor banks 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, Version 3.0 dated December 31, 2006, and is available at (http://www.xcelenergy.com/XLWEB/CDA/0,3080,1-1-1_16699_24407-1428-000-0,00.html)

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 Current Availability at Finney Switching Station without contribution from GEN 2008-018				
	Fault Current (Amps)		Impedance (Ω)	
Fault Location	Line-to-Ground	3–Phase	Z^+	Z^0
345 kV Bus	2,079	5,456	2.355+j36.434	1.539+j22.746

Estimated Construction Costs

The projects required for the interconnection of this 405 MW Wind Farm facility consist of the projects summarized in the table below.

Table 3, Required Interconnection Projects[3]

Project	Description	Estimate
	SPS Network Upgrades	
1	New 345 kV Breaker Line Terminal	$ 2,022,202
2	Disturbance Monitoring Device	$ 51,346
3	345 kV Disconnect Switch	$ 178,701
	Subtotal:	**$ 2,252,249**
	Interconnection Facilities (at the Interconnection Customer's expense)	
4	Communications [4]	*$ See footnote*
5	345 kV Disconnect Switch	$ 44,675
6	Remote Terminal Unit (RTU)	$ 4,500
7	Revenue metering	$ 250,000
8	345 kV Line arrestors	$ 12,743
	Subtotal:	**$ 311,918**
	Total Cost:	**$ 2,564,167**

Engineering and Construction:

An engineering and construction schedule for the installation of the 345 kV line terminals is estimated at approximately 13 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, CCN are issued, 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.

[3] The cost estimates are 2009 dollars with an accuracy level of ±20% except as noted, with AFUDC added.

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

Appendix A

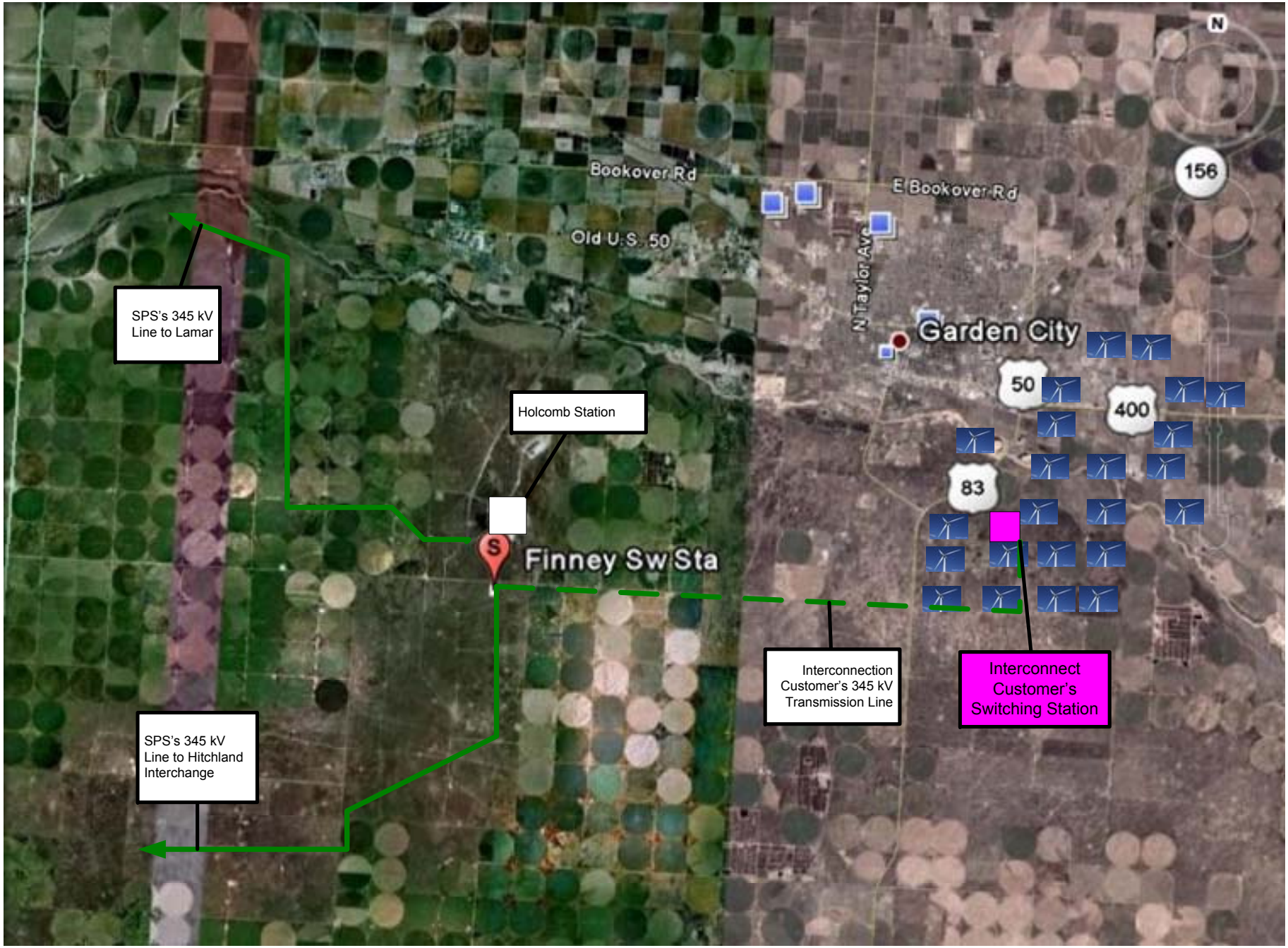


Figure A- 1 Approximate location of proposed Wind Farm Facility

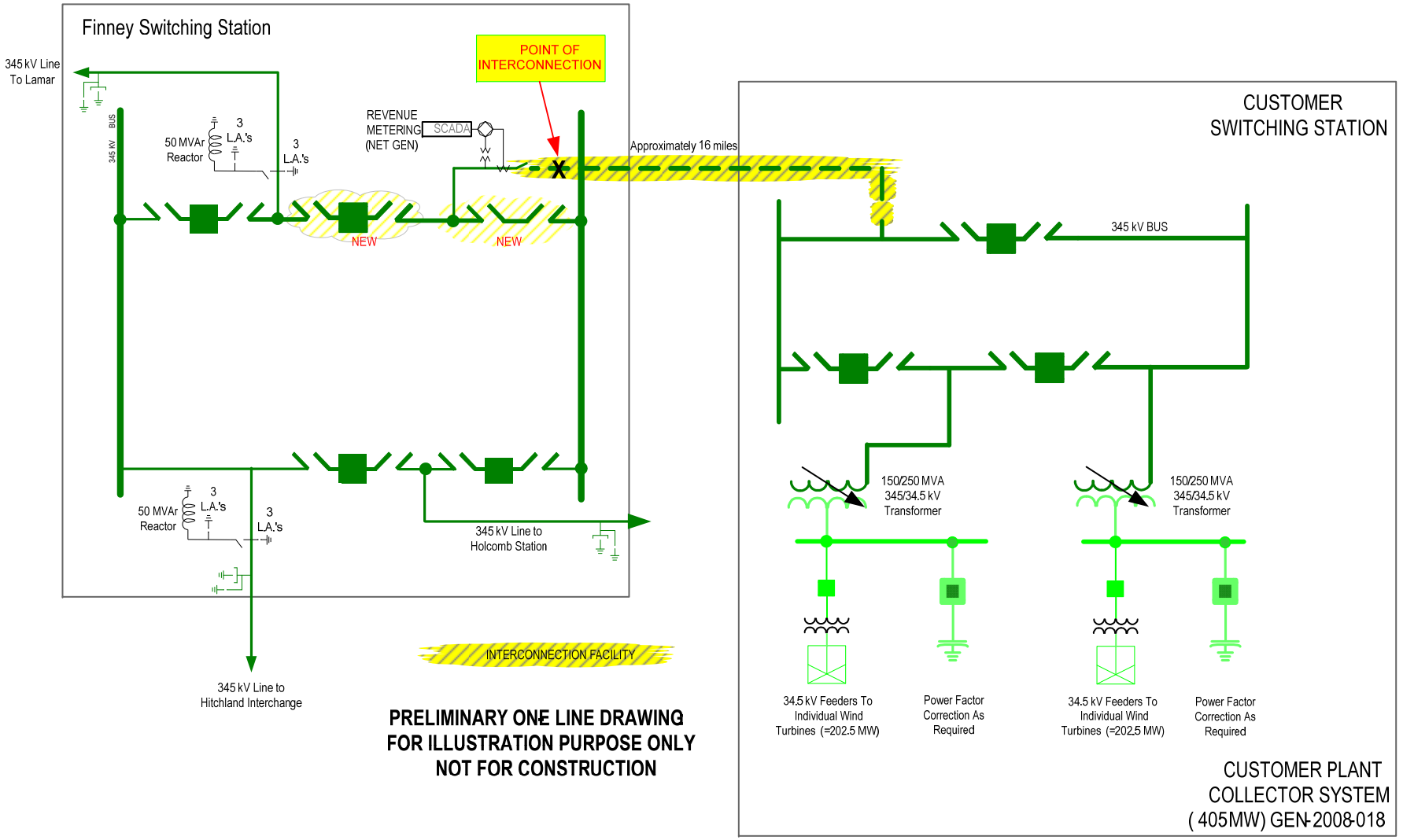
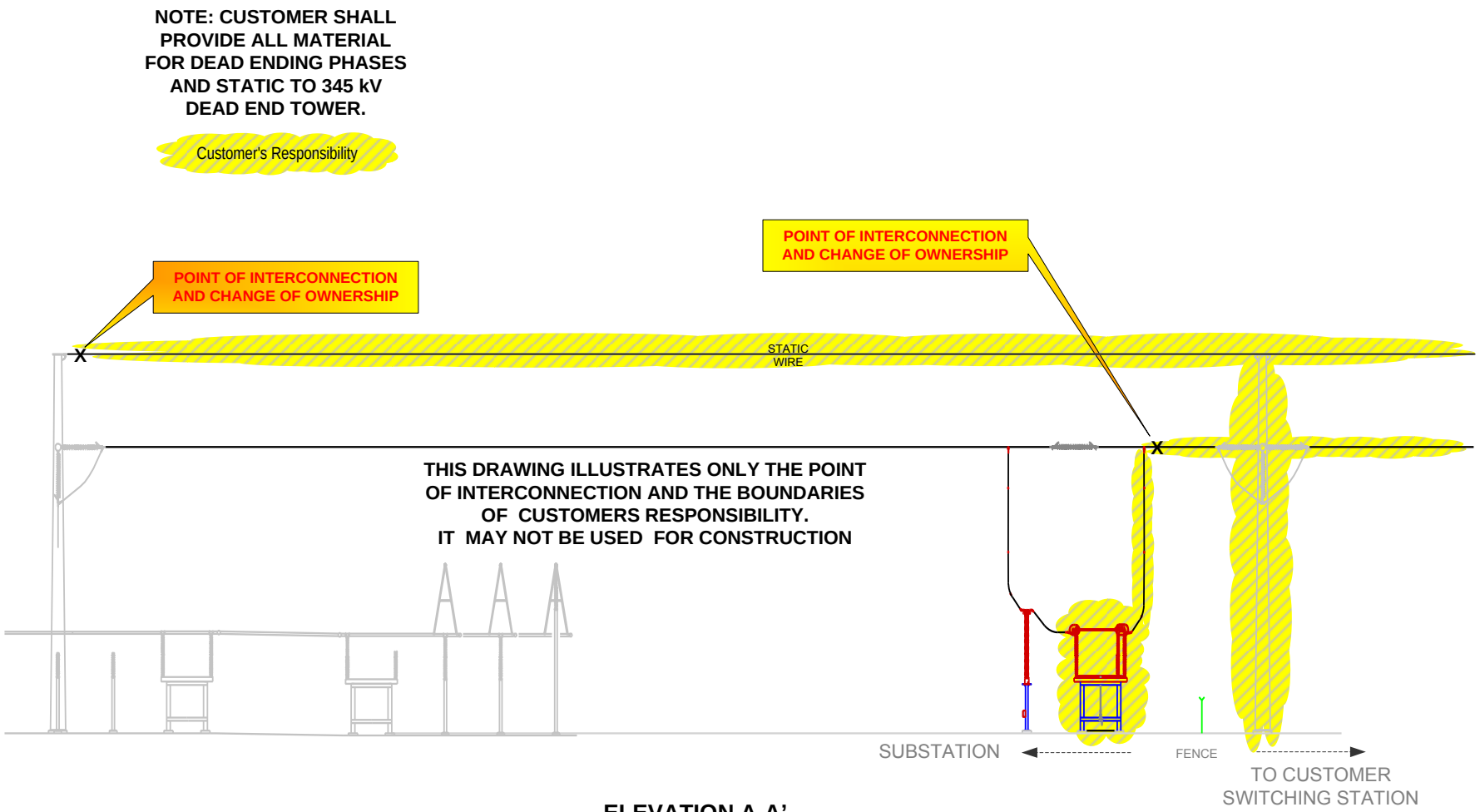


Figure A- 2 One-line Diagram of Finney Switching Station to Customer Interconnection Facility



ELEVATION A-A'

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

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