SPP Southwest Power Pool

Facility Study For Generation Interconnection Request GEN-2008-088

SPP Generation Interconnection

(#GEN-2008-088)

April 2011

Summary

Xcel Energy Inc. (Xcel) performed a detailed Facility Study at the request of Southwest Power Pool (SPP) for Generation Interconnection request GEN-2008-088. The interconnection of the 50.6 MW wind energy facility located in Oldham County, Texas 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 69 kV transmission line from the Wind turbine Collector Substation to the Point of Interconnection (POI), the existing SPS Vega 69 kV Substation near Vega, TX. In addition, 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 **$2,884,830** of Transmission Owner Interconnection Facilities and non-shared network upgrades.

Shared Network Upgrades

The interconnection customer was studied within the DISIS-2010-001 Impact Restudy. At this time, the Interconnection Customer is allocated the following costs for shared network upgrades:

1. Switch 2749 - Wildorado 69kV CKT 1. Rebuild approximately 4 miles of 69kV.	$1,461,321
2. Hitchland – Border 345kV Double Circuit. Build approximately 105 miles of 345kV. Includes substation work at Border and Hitchland	$4,449,794
3. Add -50/+100Mvar SVC at Hitchland 230kV	$675,795
Shared Network Upgrade Costs - TOTAL	**$6,586, 910**

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.

Additional Required Network Upgrades

SPS's future plans are to convert the 69 kV Transmission Line into Vega's substation to 115 kV. When SPS converts Vega to 115 kV, the interconnection customer's Point of Interconnection (POI) will have to be converted to 115 kV at the interconnection customer's expense.

Certain Network Upgrades that are not the cost responsibility of the Customer are required for Interconnection. These Network Upgrades include:

1. Hitchland – Woodward 345kV double circuit transmission line,
2. Medicine Lodge – Woodward 345kV transmission line, and
3. Medicine Lodge – Wichita double circuit 345kV transmission line.
4. Tuco – Woodward 345kV transmission line

These network upgrades are not schedule 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.

Facilities Study For
Southwest Power Pool (SPP)

50.6 MW Wind-Generated Energy Facility
Oldham County, Texas
SPP #GEN-2008-088

December 8, 2010

Xcel Energy Services, Inc.
Transmission Planning

Executive Summary

<Omitted text> in 2008 requested the interconnection of a wind energy facility located in Oldham County, Texas 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 50.6 MW. The Interconnection Customer's facility will connect to the existing SPS Vega Substation located approximately one-forth (1/4) mile northeast of Vega, Texas. The Interconnection Customer's expected commercial operation date and back-feed date are November 1, 2014 and June 1, 2014 respectively.

The Southwest Power Pool (SPP) evaluated the request to interconnect the wind farm facility to the SPS transmission system in System Impact Study (SIS) GEN-2008-088 completed in July 2010. The interconnection request was studied using twenty-two (22) Siemens SWT wind turbines rated at 2.3 MW each for a total output of 50.6 MW at their substation, which will have one (1) 36/47/58 MVA 69/34.5 kV transformer. The Interconnection Customer is required to build approximately 3.0 miles of 69 kV transmission lines from their substation wind farm facility to the SPS Vega Substation 69 kV bus. The Interconnection Customer is required to maintain a Power Factor of 0.95 lagging and 0.95 leading on the 34.5 kV side of their collector's 69/34.5 kV bus at the Point of Interconnection (POI).

SPS's future plans are to convert the 69 kV Transmission Line into Vega's substation to 115 kV. When SPS converts Vega to 115 kV, the interconnect customer's Point of Interconnection (POI) will have to be converted to 115 kV at the IC's expense.

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 their capacitor banks if needed and any Direct Assigned Interconnection Facilities; inclusive of all construction required for the 69 kV transmission line from the Interconnection Customer's substation to the SPS Vega Substation.

As for this request (GEN-2008-088), it is anticipated that the entire process of adding the new 69 kV line terminal at Vega Substation and rebuild approximately four miles of 69kV line from switch 2749 to Wildorado for the acceptance of the wind farm facility output, will require approximately 18 months to complete after an Interconnection Agreement is signed and 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[1]

	Interchange
Network Upgrades:	**$ 2,124,897**
Interconnection Facilities[2]:	**$ 759,933**
Total:	**$ 2,884,830**

[1] The cost estimates are 2010 dollars with an accuracy level of ±20%.

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

General Description of SPS Facilities [3]

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

   1.1. **Location:** SPS will add a new 69 kV line terminal at the existing SPS Vega Substation. Appendix A, Figure A- 2, shows the one-line of the existing substation, while Appendix A, Figure A- 3 shows the typical elevation of the Point of Interconnection (POI).

   1.2. **Bus Design:** The new 69 kV line terminals will be added to the existing 69 kV bus at Vega Substation to accommodate the output from the wind energy facility. The existing bus design at Vega Substation is a main bus design to serve the distribution transformer shown in Appendix A, Figure A- 2.

   1.3. **Line Terminals:** The 69 kV 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 existing control house will accommodate the new metering, protective relaying and control devices, terminal cabinets, and any fiber-optic cable terminations, etc. for the new 69kV line breaker terminal.

   1.5. **Security Fence:** The existing security fence shall be extended if required when the new bay is added for the new 69 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 station power, provided from the local distribution system, will be utilized.

   1.9. **Relay and Protection Scheme**: The new 69 kV breaker line terminal primary protection to the interconnection customer 69 kV transmission line will use line current differential relaying over optical fiber installed in the static of the customer's 69 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. No automatic re-closing scheme will be used. The SEL 421 will be used for line/bus SCADA closing conditions for the 69 kV breakers. Also, a SEL 501-0 will be used for breaker failure. Main bus relaying will have to be modified for wind generation.

[3] 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. A communications relay will be installed and for other functions as required.

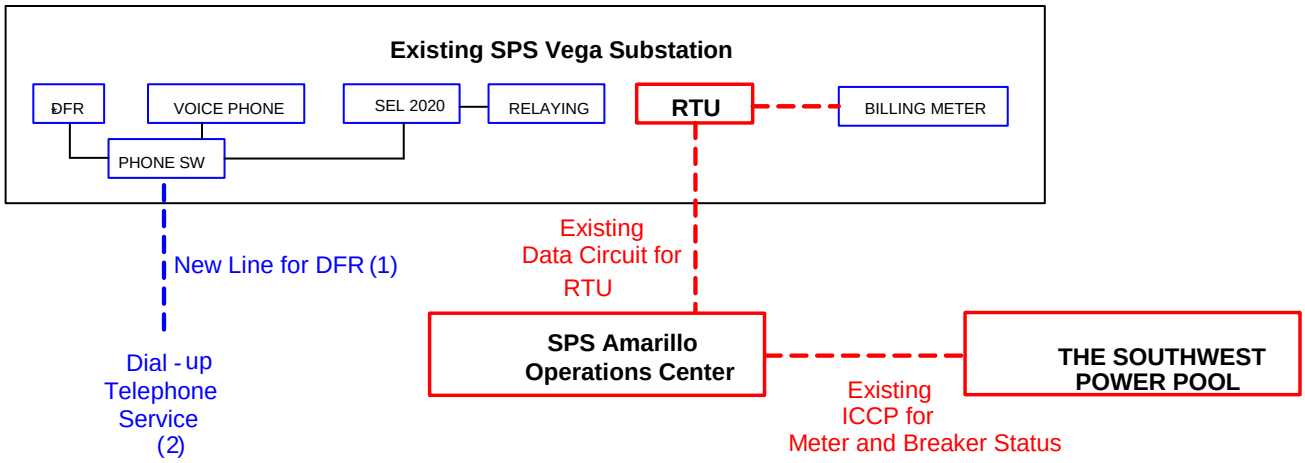
1.10. **Revenue Metering:** On the proposed SPS Vega Substation 69 kV line terminal to the Interconnection Customer's substation, an individual billing meter will be installed, which meets the standards: ANSI C12.1 accuracy class 0.2 (3-PT's IEEE C57.13 accuracy class 0.3 and 3 CT's IEEE C57.13 accuracy 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:** A 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):** The existing RTU will be utilized to accommodate the new 69 kV line terminal at Vega Substation. 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:** 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 Vega Substation.

2. **Transmission Work:**

2.1. The Interconnection Customer will construct, own, operate, and maintain any customer owned 69 kV transmission line from the Interconnection Customer's substation to the Point of Interconnection at SPS Vega Substation 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 69 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 Vega Substation 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**: Permitting for the construction of a new 69 kV line terminal at Vega Substation 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 69 kV transmission line from their substation to the Point of Interconnection at Vega Substation.

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 on the Interconnection Customer's 34.5 kV bus side to maintain a Power Factor of 0.95 lagging and 0.95 leading at the Point of Interconnection (POI). The Interconnection customer will be required to switch their 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, available at: (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 at Vega Substation without contribution from Wind Farm Facility (GEN 2008-088)				
Fault Location	Fault Current (Amps)		Impedance (Ω)	
	Line-to-Ground	3–Phase	Z^+	Z^0
69 kV Bus	743	1174	14.38 +j30.75	31.82 +j87.53

Estimated Construction Costs

The projects required for the interconnection of this 50.6 MW Wind Farm facility consist of the projects summarized in the table below.

Table 3, Required Interconnection Projects

Project	Description	Estimated Cost[4]
	Network Upgrades	
1	Disturbance Monitoring Device	$ 51,346
2	Transmission Line Work (Re-conductor)	$ 1,282,576
F3	Right-Of-Way	$ 96,222
4	69 kV Breaker Terminal	$ 694,753
	Subtotal:	**$ 2,124,897**
	Transmission Owner Interconnection Facilities (at the Interconnection Customer's expense)	
4	Communications [5]	*$ See footnote*
5	69 kV Breaker Line Terminal	$ 694,753
6	Remote Terminal Unit (RTU)	$ 4,500
7	Revenue metering	$ 48,000
8	69 kV Line arrestors	$ 12,680
	Subtotal:	**$ 759,933**
	Total Cost:	**$ 2,884,830**

Engineering and Construction:

An engineering and construction schedule for the installation of the 69 kV line terminals is estimated at approximately 18 months. Other factors associated with clearances, equipment delays and work schedules could cause additional delays. This 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.

[4] The cost estimates are 2010 dollars with an accuracy level of ±20%.

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

Appendix A

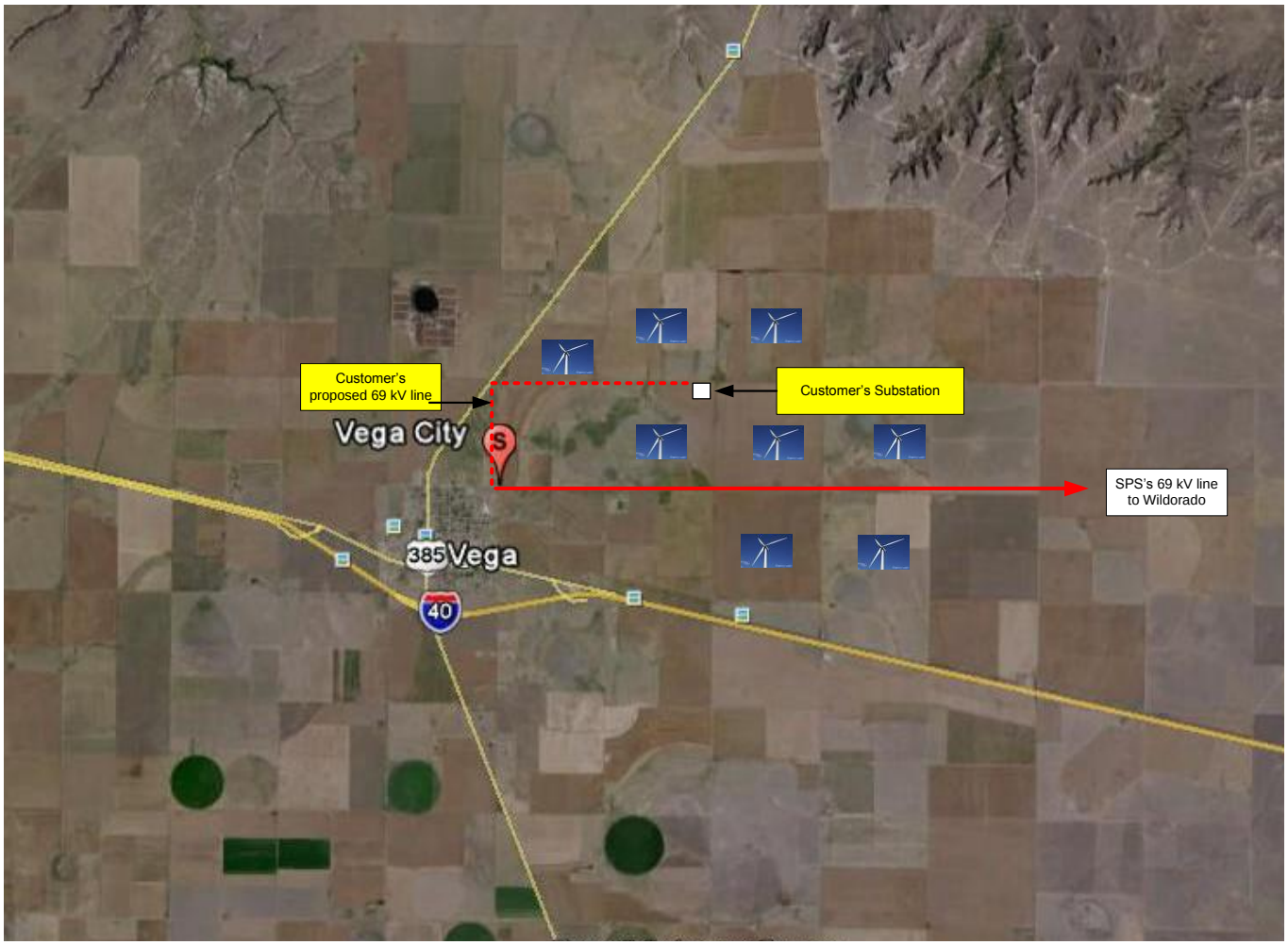


Figure A- 1 Approximate location of proposed Wind Farm Facility and Interconnection Customer 69 KV Transmission Line[6]

[6] 69 kV customer transmission line shown does not represent actual route.

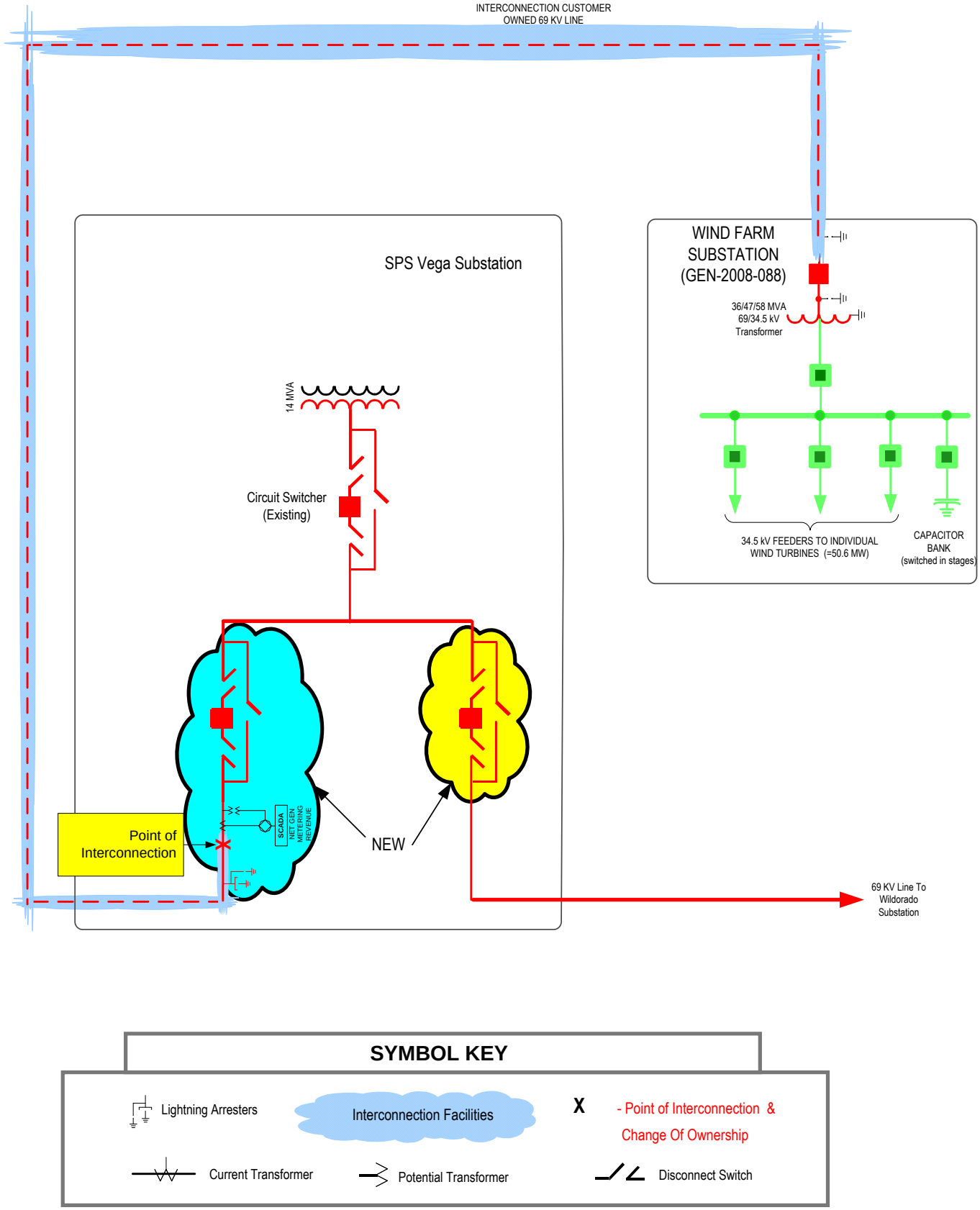


Figure A- 2 One-line Diagram of Vega Substation

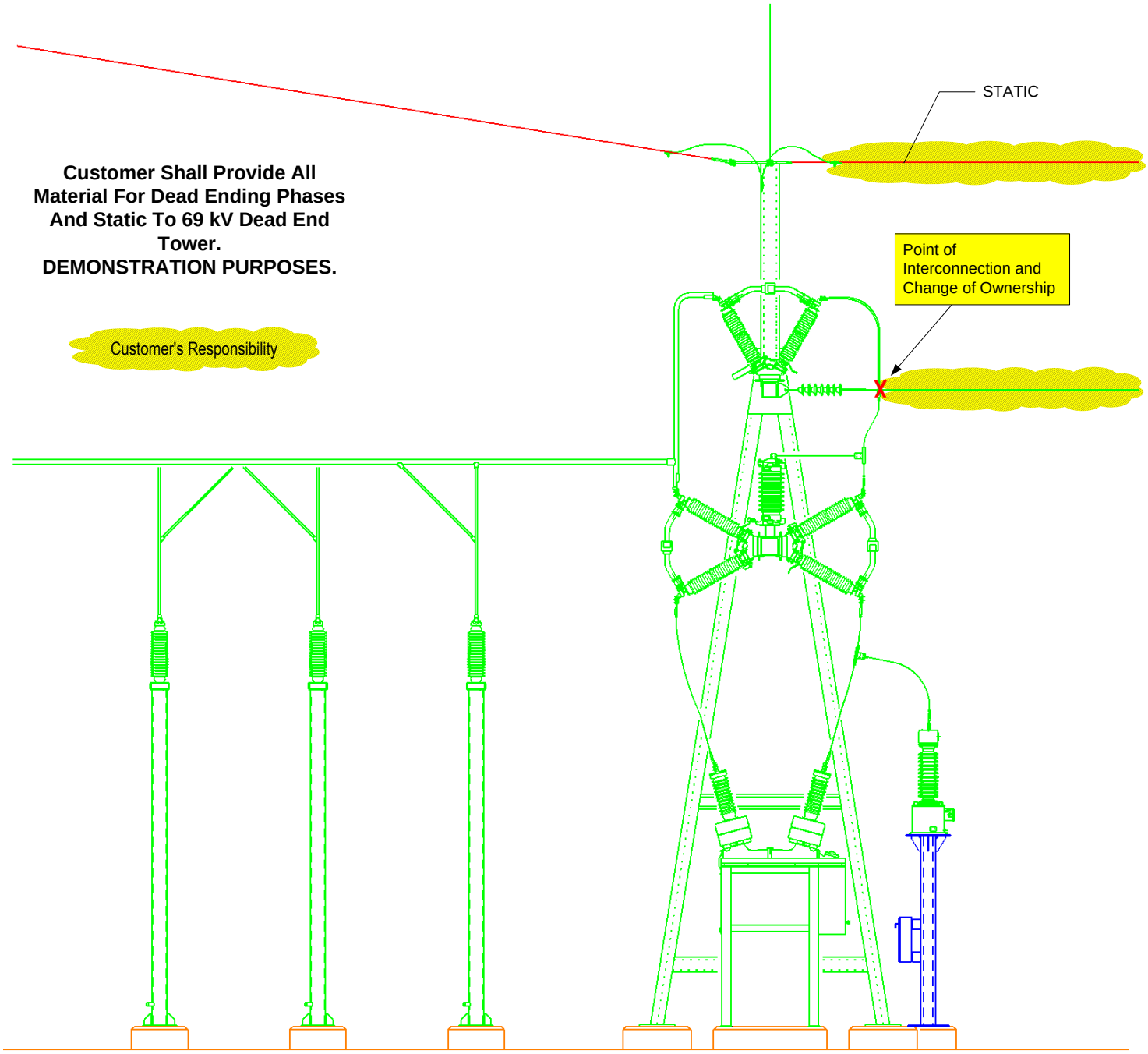


Figure A- 3 Point of Interconnection & Change of Ownership (Typical)

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