



SPP

*Southwest
Power Pool*

**Facility Study
For
Generator Interconnection
Request
GEN-2013-022**

*SPP Generator
Interconnection Studies*

(#GEN-2013-022)/IFS-2013-002-02

April 2015

Revision History

Date	Author	Change Description
09/18/2014	SPP	Facility Study Report Issued
11/05/2014	SPP	Revised Facility Study and Account for DISIS-2013-002-2 Restudy Results
04/09/2015	SPP	Revised Facility Study to account for Interconnection Configuration Change

Summary

Southwestern Public Service Company (SPS), an operating company subsidiary of Xcel Energy Inc., performed a detailed Facility Study at the request of Southwest Power Pool (SPP) for Generation Interconnection request GEN-2013-022 (25.0 MW, PV Solar) located in Quay County, New Mexico. The Interconnection Request has a requested Point of Interconnection (POI) at the Norton 115kV bus, but the Interconnection Customer is proposing to use/share the Interconnection Facilities of a third party generator owner to make its connection to the Transmission System. Full Interconnection Service will require the Network Upgrades listed in the "Other Network Upgrades" section. 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.

Phases of Interconnection Service

It is not expected that interconnection service will require phases however, interconnection service will not be available until all interconnection facilities and network upgrades can be placed in service.

Interconnection Customer Interconnection Facilities

The Interconnection Customer will be responsible for all of the transmission and/or distribution facilities connecting the customer owned substation to the Point of Interconnection at the SPS owned 115 kV bus at Norton Switching Station. The Interconnection Customer will also be responsible for any equipment located at the Customer substation necessary to maintain a power factor of 0.95 lagging to 0.95 leading at the POI.

Shared Interconnection Facilities Agreement

In addition, the Interconnection Customer will be required to provide a Shared Facilities Agreement with the third party generator owner demonstrating its authorization to use the Interconnection Facilities of that third party generator owner to interconnect to the SPP Transmission System.

Metering Requirements

The Interconnection Customer shall closely coordinate with the third party generator owner to effect the metering requirements listed in the SPS report.

Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades

To allow interconnection the Transmission Owner has verified that Norton 115kV Switching Station will require additional communication equipment for acceptance of the Interconnection Customer's Interconnection Facilities. The Interconnection Customer is responsible for providing the necessary communication circuits at Norton 115kV Switching Station. SPS has proposed a lead time of two (2) months after a fully executed Generation Interconnection Agreement (GIA) for installing communication circuits. At this time GEN-2013-022 is responsible for \$164,078 of Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades.

Shared Network Upgrades

The Interconnection Customer was studied within the DISIS-2013-002-2 Impact Restudy. At this time, the Interconnection Customer is allocated \$0 for 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. At this time, the Interconnection Customer is allocated the following cost for Shared Network Upgrade:

Share Network Upgrade Description	Allocated Cost	Total Cost
None	\$0	\$0
Total	\$0	

Other Network Upgrades

Certain Other Network Upgrades are currently not the cost responsibility of the Customer but will be required for full Interconnection Service. Currently, the following Other Network Upgrades are required:

- NRIS only required only: Hobbs Interchange – Kiowa 345kV Project, per SPP-NTC-200283 on-schedule for 6/1/2018 in-service date.

Depending upon the status of higher or equally queued customers, the Interconnection Customer’s in-service date is at risk of being delayed or their Interconnection Service is at risk of being reduced until the in-service date of these Other Network Upgrades.

Conclusion

Interconnection Service for GEN-2013-022 will be delayed until the Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades are constructed. The Interconnection Customer is responsible for \$164,078 of Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades. At this time, the Interconnection Customer is allocated \$0 for Shared Network Upgrades. After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 25.0 MW, as requested by GEN-2013-022, can be allowed. At this time the total allocation of costs assigned to GEN-2013-022 for Interconnection Service are estimated at \$164,078.



**Facilities Study For
Southwest Power Pool (SPP)**
25 MW PV Plant
Quay County, New Mexico
SPP #GEN-2013-022

April 2015

Transmission Planning
Southwestern Public Service

Executive Summary

GEN-2013-022 (“Interconnection Customer”) in 2013 requested the interconnection of a solar energy facility located in Quay County, New Mexico to the Southwestern Public Service Company (“SPS or Transmission Owner”), transmission network. SPS is a New Mexico Corporation and wholly owned subsidiary of Xcel Energy Inc. This facility has a net capacity of 25 MW. The Interconnection Customer’s facility will connect to an existing Caprock Wind Facility (“Host”) on the 115 kV Bus in Quay County, which is connected on the 115 kV at SPS’ Norton Switching Station (“Norton”). Norton is located approximately 63 miles north of Clovis, New Mexico. The Interconnection Customer’s expected commercial operation date is December 31, 2015.

The Southwest Power Pool (“SPP or Transmission Provider”) evaluated the request to interconnect the solar farm facility to the SPS transmission system in a Definitive Interconnection System Impact Study (DISIS)-2013-002 for GEN-2013-022 completed in January 2014. The interconnection request was studied using five (5) packages and each package consists of five (5) Inverters rated at 1000 KW PV each for approximate 5 MW for a total output of 25 MW. The Customer will utilize the Host’s existing 115 kV facilities to interconnect its Generating Facility to the SPS Transmission System. The customer is required to comply with SPP power factor requirements, which the solar plant power factor requirements are 0.99 lagging to 0.99 leading at the POI to maintain the required voltage schedule. Per the SPP GIA and OATT, the solar plant will have requirements or 0.95 leading to 0.95 lagging at the POI.

SPP requires that each generator shall implement Automatic Under Frequency Load Shedding (UFLS) according to the SPP UFLS Plan at the following link: http://www.spp.org/publications/SPP%20UFLS%20Plan_Final.pdf. To fulfill this requirement, coordination with Xcel Energy is required during the under-frequency relay-setting phase for the generation. The Interconnection Customer is required to report their generation off-nominal frequency tripping relay settings to SPP and SPS. SPS specifies that generators shall not trip at frequencies above 58.5 Hz unless exceptions in the Transmission Provider Criteria are met. The Interconnection Customer agrees that the energy generating units installed at this interconnection will not be tripped for under-frequency conditions above 58.5 Hz in compliance with Transmission Provider criteria. This means that the generation subject to this Interconnection Agreement may not trip for under-frequency conditions on the transmission system until all under-frequency load shedding relays have operated. 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), SPP, and the Federal Energy Regulatory Commission (FERC) or their successor organizations.

This facilities study addresses the requirements that the Interconnection Customer must meet to interconnect on a third party transmission system or distribution system and provide the appropriate information to the SPS/SPP transmission operator for reliability and operating purposes. This study may require upgrades to communications equipment, data monitoring equipment, transmission element protective equipment, and may also reflect any allocation of shared network upgrades as determined by SPP. This facilities study does not address any data requirements, communications requirements, or any other requirements for registration or operation in the SPP energy market. Those requirements are the sole responsibility of the generation developer and/or their energy purchaser.

The Interconnection Customer is responsible for the cost of the Interconnection Facilities, as designated in their interconnection agreement with the owner of the Host distribution system.

General Description of SPS Facilities¹

1. **No Construction Required:** Interconnection Customer connecting to Caprock Wind Substation, which is connected to Norton Switching Station. See one-line diagram in Figure A-1.

1.1 **Revenue Metering:** The SPS 115 kV Norton Switching Station's line terminal to the Caprock Wind Substation, a billing meter was installed when Caprock Wind was built 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 was 3-PT's and 3-CT's for full 3-phase 4-wire metering. There are two meters per line terminal: one is primary, and the other is a backup. Each has full 4 quadrant metering. Pulses out of the primary billing meter are sent via SCADA to the Transmission Owner's Control Center in Amarillo, Texas. The Interconnection Customer may install a meter at the SPS 115 kV Norton Switching Station that will utilize the same billing PT's and CT's. The physical location of Interconnection Customer's meter **will be outside the SPS Norton Switching Station** fence at a mutually-agreed location. SPS will work with Interconnection Customer for communication specifications for transmittal of Interconnection Customer's meter data back to the Interconnection Customer's Substation.

For more than one generating facility attached to the same Interconnection Customer's Interconnection Facilities and the SPS Norton Switching Station, the generating facility owners will install metering equipment at physical locations beyond the Interconnection Point that will record and differentiate any metering energy values for both consumption and generation that may be used for billing or generation settlements. The metered energy values must be adjusted as applicable to agree with the single SPS 115 kV Switching Station meter values so that transmission line losses are split appropriately to the Interconnection Customers and generating facility owners on a 15-minute, hourly, or other mutually-agreed time interval basis. The metered energy values must include full four-quadrant for VAR energy measurements. Interval data from the generating facility owner's meters must be made available to SPS upon request within 30 days or reasonable time period, and generating facility owner must allow SPS to witness any meter accuracy tests upon request. Pulses out of the primary billing meter will be sent via SCADA to the Transmission Owner's Control Center in Amarillo, Texas.

1.2 **Disturbance Monitoring Device:** A Disturbance-Fault Recorder (DFR), capable of recording faults, swings, and long term trending exists that monitors and records conditions in the substation and on the transmission lines. The disturbance equipment is equipped with a GPS time synch clock. This equipment has communication capability with a dedicated communication circuit. The disturbance equipment has its own dedicated dial-up communications telephone circuit.

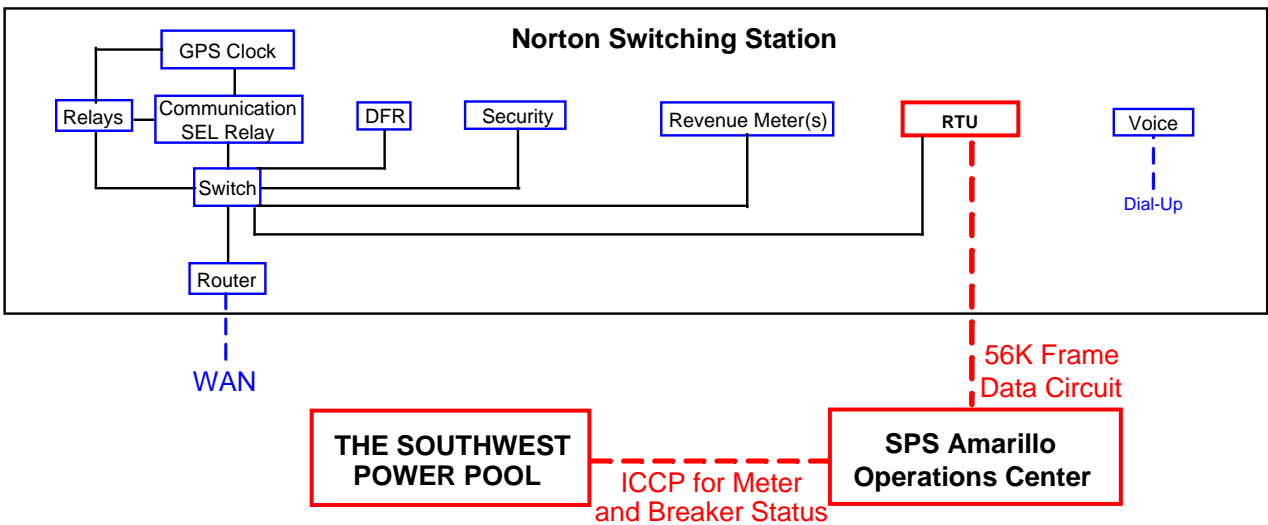
1.3 **Remote Terminal Unit (RTU):** The existing RTU will be utilized to accommodate the 115 kV line terminals at Norton Switching Station. SPS will provide and install if needed additional RTU cards for metering and telemetry as required by the latest Xcel Energy Interconnection Guidelines. The direct cost will be charged to the Interconnection Customer.

¹ All modifications to SPS facilities will be owned, maintained and operated by SPS.

1.4 **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 Norton 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 and Transmission Owner, is provided to assist the Parties.

A schematic outlining the proposed communications is provided below:



2. **Fault Current Study:** The available fault current at the interconnection location, without any contribution from the solar farm facilities, is shown in Table 1 below.

Table 1, - Available fault current at Point of Interconnection Location

<i>Short Circuit Current at Norton Interchange without contribution from Solar Farm Facility (GEN 2013-022)</i>				
Fault Location	Fault Current (Amps)		Impedance (Ω)	
	Line-to-Ground	3-Phase	Z^+	Z^0
115 kV Bus	1,961	1,773	7.46 +j36.69	5.00 +j26.58

Estimated Construction Costs

The projects required for the interconnection of this 25 MW Solar Farm facility consist of the projects summarized in the table below.

Table 2, Required Interconnection Projects

Project	Description	Estimated Cost ²
	Network Upgrades	
	No Network Upgrades Required	\$ 0
	Subtotal:	\$ 0
	Transmission Owner Interconnection Facilities (at the Interconnection Customer's expense)	
1	Communications ³ Caprock PV Plant MW and MVAR output indication to SPS/SPP at Norton Switching Station.	\$ See footnote
2	Siemens 5700 RTU	\$ 164,078
	Subtotal:	\$ 164,078
	Total Cost:	\$ 164,078

Engineering and Construction:

An engineering and construction schedule for the installation of the any communications is estimated at approximately 2 months. Other factors associated with clearances, equipment delays and work schedules could cause additional delays. The estimated time (2 months) 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.

² The cost estimates are 2014 dollars with an accuracy level of $\pm 20\%$.

³ It is the Requester's responsibility to provide both the data circuit and both dial-up telephone circuits, see Section 1.4.

Appendix A

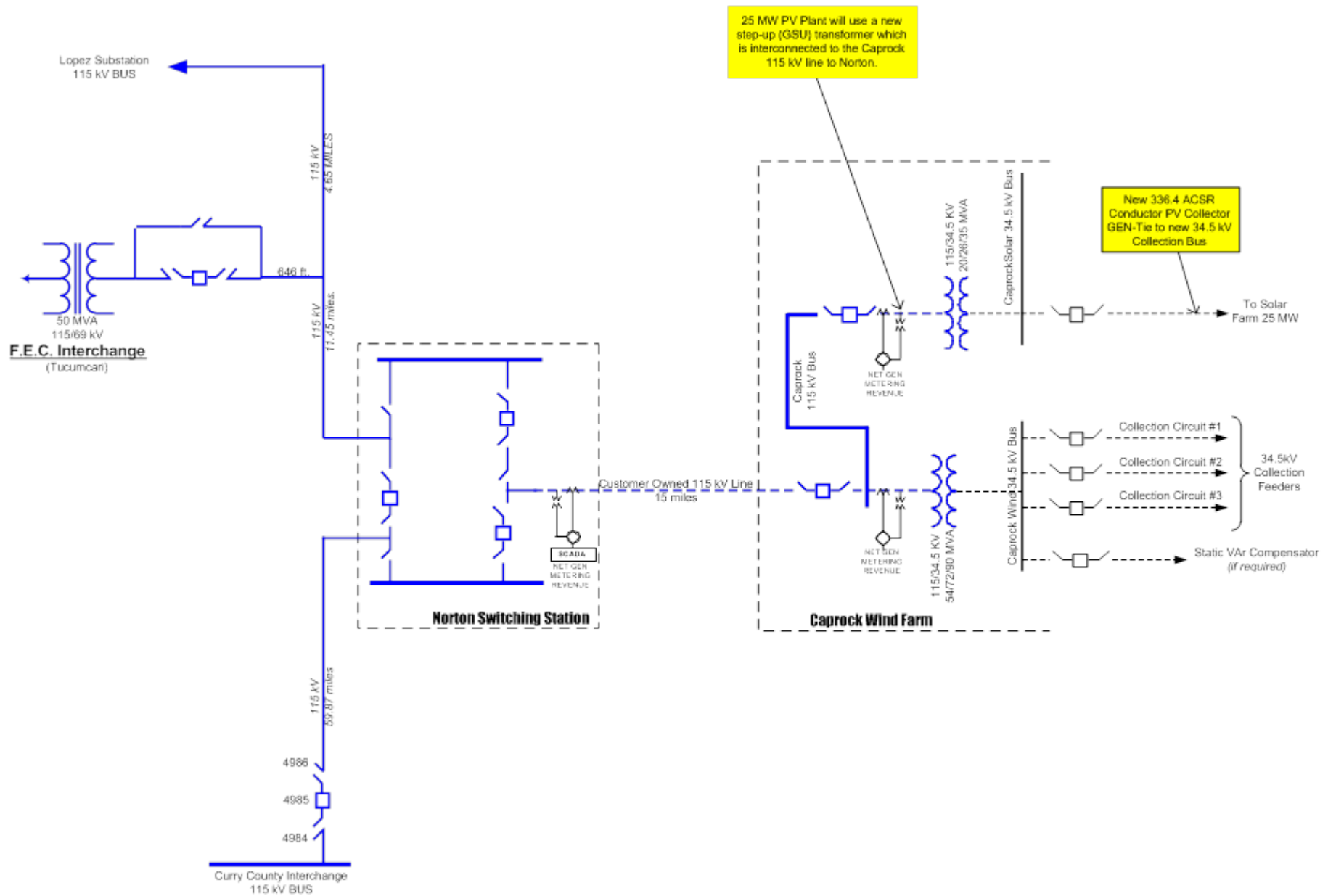


Figure A- 1 One-line Diagram of GEN-2013-022 at Norton Interchange

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