



**Facility Study
For
Generation Interconnection
Request
GEN-2012-037**

*SPP Generation
Interconnection Studies*

(#GEN-2012-037)

August 2013

Revision History

Date	Author	Change Description
8/20/2013	SPP	Facility Study Report Issued

Summary

Xcel Energy Inc (Xcel), a subsidiary of Southwestern Public Service Company (SPS), performed a detailed Facility Study at the request of Southwest Power Pool (SPP) for Generation Interconnection request GEN-2012-037 (Summer: 196MW/Winter: 203MW/Combustion Turbine) located in Hale County, Texas. The originally proposed in-service date for GEN-2012-037 was March 1, 2015. SPP has proposed the in-service date will be after the assigned Interconnection Facilities, Non-Shared Network Upgrades, and Shared Network Upgrades are completed. 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 facilities connecting the customer owned substation to the Point of Interconnection (POI), at the Southwestern Public Service Company (SPS) owned 345kV bus at the TUCO Interchange Substation. 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.

Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades

To allow interconnection the Transmission Owner will need to construct a new 345kV breaker and associated terminal equipment for acceptance of the Interconnection Customer's Interconnection Facilities. At this time GEN-2012-037 is responsible for \$5,767,038 of Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades.

Shared Network Upgrades

The Interconnection Customer was studied within the DISIS-2012-002 Impact Study. At this time, the Interconnection Customer is allocated \$2,208,498.75 for Shared Network Upgrades (Xcel Energy costs of shared network upgrades within the body of the report were based on an earlier iteration of DISIS-2012-002). 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
TUCO 345/230/13.2kV Autotransformer CKT 3, Build and install a third TUCO 345/230/13.2kV autotransformer, install breakers, and associated terminal equipment.	\$2,208,498.75	\$9,274,171.00
Total	\$2,208,498.75	

Previous Network Upgrades

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

1. Tuco-Woodward 345kV line, scheduled for 5/19/2014 in service
2. Hitchland – Woodward 345kV double circuit, scheduled for 6/30/2014 in-service
3. Beaver County – Buckner 345kV circuit 1, assigned to DISIS-2011-001 Customers
4. Beaver County Expansion – Tap and Tie Hitchland 345kV circuit #2, assigned to DISIS-2011-001 Customers
5. Matthewson – Tap and Tie on Tatonga – Northwest 345kV circuit #1 and Cimarron – Woodring 345kV circuit #1, assigned to DISIS-2011-001 Customers
6. Tatonga – Matthewson – Cimarron 345kV circuit #2, assigned to DISIS-2011-001 Customers
7. Woodward 345/138kV transformer circuit #2, scheduled for 5/19/2014 in-service

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-2012-037 will be delayed until the Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades are constructed. The Interconnection Customer is responsible for \$5,767,038.00 of Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades. At this time, the Interconnection Customer is allocated \$2,208,498.75 for Shared Network Upgrades. After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 196/203 MW (Summer/Winter), as requested by GEN-2012-037, can be allowed. At this time the total allocation of costs assigned to GEN-2012-037 for Interconnection Service are estimated at \$7,975,536.75.



**Facilities Study For
Southwest Power Pool (SPP)**
196 MW Combustion Turbine Generator
Hale County, Texas
SPP #GEN-2012-037

June 13, 2013

Transmission Asset Management
Southwestern Public Service

Executive Summary

[Omitted Text] (“Interconnection Customer”) in 2013 requested the interconnection of a generation facility located in Hale 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 capacity of 196 MW and will connect to the SPS TUCO Interchange also located in Hale County, Texas approximately five (5) miles north of Abernathy, Texas. The Interconnection Customer’s expected commercial operation date is 3/1/2015.

The Southwest Power Pool (SPP) originally evaluated the request to interconnect the generator facility to the SPS transmission system in a Definitive Interconnection System Impact Study (DISIS)-2012-002 for GEN-2012-037, which was completed in February 2013. An updated DISIS-2012-002-1 was completed in May 2013. The interconnection request was studied using one Combustion Turbine Generator for a total output of 196 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) on the 345 kV.

SPS requires that all construction for this request be in compliance with the latest revision of the Xcel Energy Interconnection Guidelines for Transmission Interconnection Produced-Owned Generation. SPP requires that each Generator shall implement Automatic Under Frequency Load Shedding according to Regional Reliability Standard: PRC-006-SPP-01. To fulfill this requirement, coordination with Xcel Energy is required during the under-frequency relay-setting phase for the generator plant. The Interconnection Customer is required to report their generator off-nominal frequency tripping relay settings to SPP and SPS. 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, 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 TUCO Interchange. The Interconnection Customer is also responsible for obtaining any permits and/or Certificate of Convenience and Necessity (CCN) for building their 345kV transmission lines from the Public Utility Commission of Texas.

The current estimated shared network upgrades allocation cost from DISIS-2012-002-1) for the new Combustion Turbine Generator project (GEN-2012-037) total \$70,828,387, as calculated by SPP, and includes the following: Muncy-Sweetwater (Chisholm) 345 kV transmission line; \$30,340,755; Sweetwater (Chisholm) - Gracemont 345 kV transmission line \$37,769,434; Sweetwater (Chisholm) 345 kV Substation \$2,718,198. Muncy Interchange is located 35 miles east of TUCO Interchange and is tapping the TUCO to Border 345 kV line. The allocation cost of these network upgrades may change as the content of the GI Cluster group changes. The network upgrades for the Interconnection at TUCO on the 345 kV is \$5,429,663.

It is anticipated that the entire process of building a new 345 kV terminal at TUCO Interchange for the acceptance of the Generation facility output and the building of the new shared facilities will require approximately 30 months to complete after an Interconnection Agreement is signed and an authorization to proceed is received. It is anticipated that the entire process of building the new shared facilities will require approximately 66 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 Combustion Turbine Generator facility, is shown below in Table 1, with the detailed description of the cost shown in Table 3.

Table 1, Cost Summary, TUCO Interchange

Shared Network Upgrades Total (\$335,504,679): Shared Cost (21%)	\$ 70,828,387
SPS Network Upgrades:	\$ 5,429,663
Interconnection Facilities ¹ :	\$ 337,375
Total:	\$ 76,595,425

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

General Description of SPS Facilities²

1. **Construction of New Line Terminal:** See Appendix A, Figure A-1, for general vicinity location map
 - 1.1. **Location:** SPS will build a new 345 kV terminal at TUCO Interchange. Appendix A, Figure A-2 shows the one-line diagram of the Interchange, while Appendix A, Figure 3 shows a typical elevation view of the Point of Interconnection (POI).
 - 1.2. **Bus Design:** The existing 345 kV at TUCO Interchange is a breaker and half configuration and is designed to accommodate the output from the Combustion Turbine Generator facility. This scheme is shown in the one-line diagram in Appendix A, Figure A-2
 - 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 angle 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 345 kV line breaker terminals.
 - 1.5. **Security Fence:** The existing security fence has 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 for the 345 kV yard is approximately 720’ by 730’ with a rock yard surface.
 - 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 345 kV breaker line terminal primary protection to the interconnection customer’s 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 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. Other relay modifications at TUCO Interchange may also be required.

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

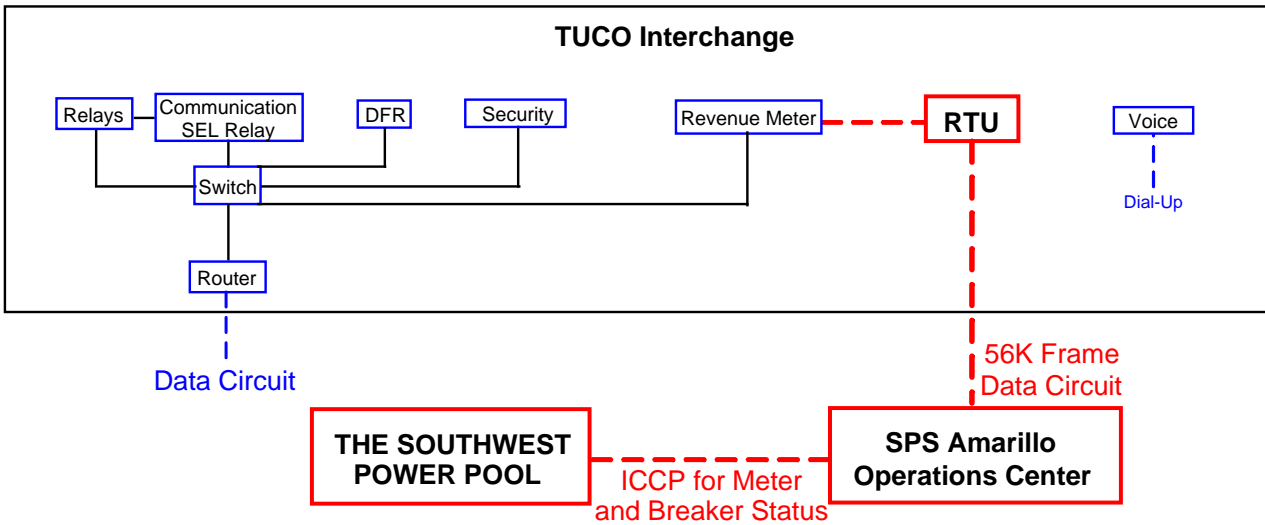
² All modifications to SPS facilities will be owned, maintained and operated by SPS.

- 1.10. **Revenue Metering:** On the 345 kV line terminal to the Interconnection Customer's 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. Pulses out of the 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 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 communications circuit. A second DFR will be added for the 345 kV line from TUCO to Border.
- 1.12. **Remote Terminal Unit (RTU):** The existing RTU will be utilized to accommodate the new 345 kV line terminals at TUCO Interchange. 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, 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 TUCO Interchange. 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 TUCO Interchange indicated 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 Substation to the Interconnection Point at SPS TUCO Interchange as shown in Appendix A, Figure A-3. ***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 TUCO Interchange 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 Texas Public Utility Commission will not require a permit for the construction of the new 345 kV line terminals to receive output from the Customer's Combustion Turbine Generator facility at TUCO Interchange. The interconnection customer will be responsible for any permitting and right of way of their substation, switching station, and the 345 kV transmission lines from their Substation to the Interconnection Point at TUCO Interchange.

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 Combustion Turbine Generator facility and their substation. **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 The Interconnection customer will be required to maintain a Power Factor of 0.95 lagging and 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 TUCO Interchange with the 345 kV line from TUCO to Border in service for the interconnection of GEN-2012-037, without any contribution from the Generator facility, is shown in Table 2 below.

Table 2, - Available fault current at Point of Interconnection Location

Short Circuit Current Availability at TUCO Interchange without contribution from GEN 2012-037				
Fault Location	Fault Current (Amps)		Impedance (Ω)	
	Line-to-Ground	3-Phase	Z^+	Z^0
345 kV Bus	8,318	7,954	2.07+j24.96	1.33+j21.573

Estimated Construction Costs

The projects required for the interconnection of this 196 MW Combustion Turbine Generator facility at TUCO Interchange consist of the projects summarized in the table below.

Table 3, Required Interconnection Projects³

Project	Description	Estimate
	Shared Network Upgrades:	
1	Sweetwater (Chisholm) -Gracemont 345 kV CKT #1 107 miles; Sweetwater (Chisholm) Substation; Muncy-Sweetwater (Chisholm) 345 kV 163 miles; Total Cost \$335,504,679. Shared Cost (21%). (Interconnection Customer's Expense)	\$ 70,828,387
	Subtotal:	\$ 70,828,387
	SPS Network Upgrades	
2	Add two 345 kV Breakers at TUCO breaker and one-half configuration.	\$ 5,429,663
	Subtotal:	\$ 5,429,663
	Interconnection Facilities (Interconnection Customer's Expense)	
3	Communications ⁴	\$ See footnote
4	Revenue metering	\$ 280,000
5	345 kV Line arrestors	\$ 57,375
	Subtotal:	\$ 337,375
	Total Cost:	\$ 76,595,425

An Electro-magnetic 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.

Engineering and Construction:

An engineering and construction schedule for the Shared Network Upgrades is estimated at approximately 66 months, and 30 months for the installation of the 2-345 kV line Breakers at TUCO Breaker and one-half configuration. 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.

³ The cost estimates are 2013 dollars with an accuracy level of $\pm 20\%$ except it does not include AFUDC.

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 Interconnection Customer Combustion Turbine Generator

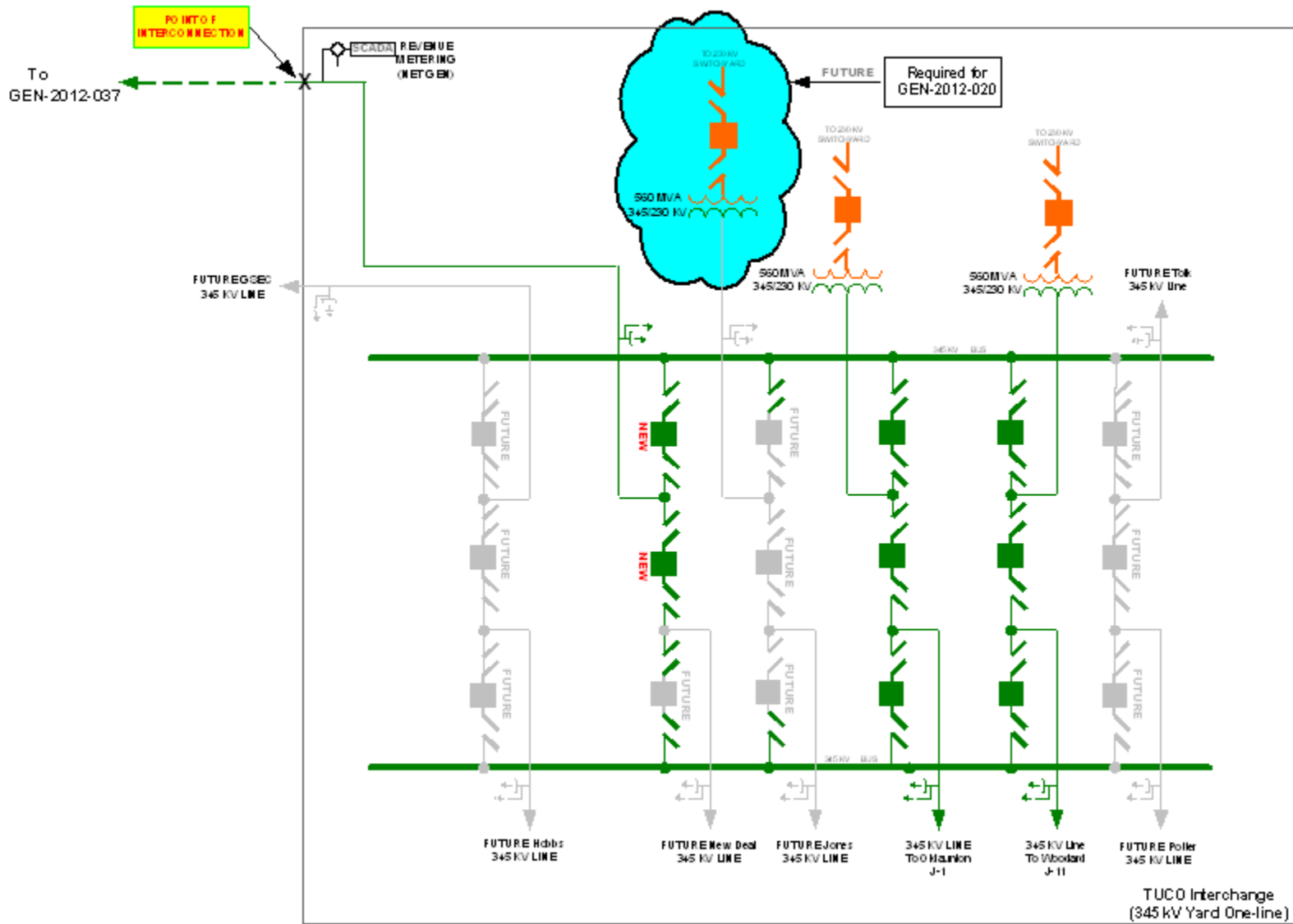


Figure A- 2 One-line Diagram of TUCO Interchange to Customer Interconnection Facility

POINT OF INTERCONNECTION
TO CUSTOMER

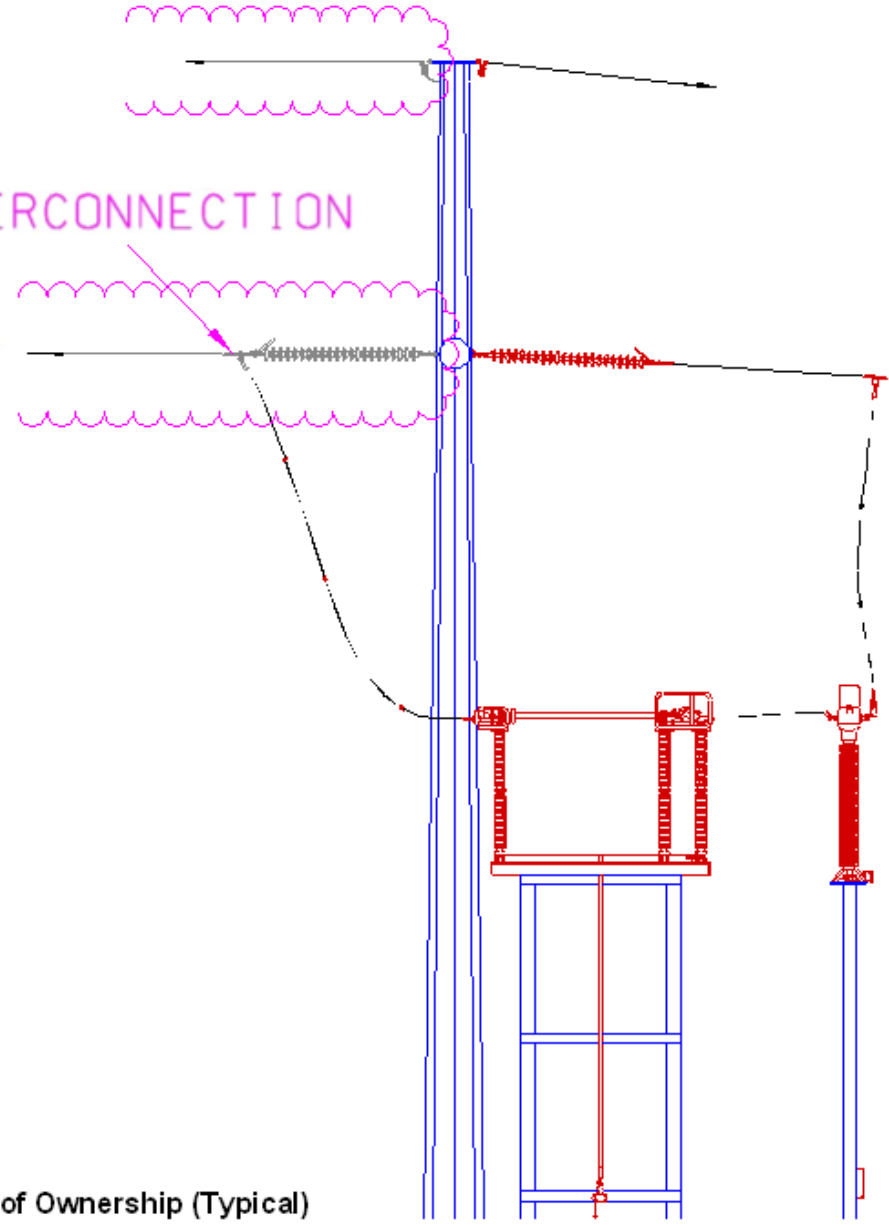


Figure A-3 Point of Interconnection & Change of Ownership (Typical)

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