AFFECTED SYSTEM INTERCONNECTION FACILITIES STUDY REPORT

ASGI-2016-004

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By SPP Generator Interconnections Dept.

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
7/12/2019	SPP	Draft report issued
7/15/2019	SPP	Revised report posted. Updated Table 6 to include network upgrades.
8/6/2019	SPP	Updated the costs for Table 3: Interconnection Customer Shared Network Upgrades and Table 6: Cost Summary.
8/12/2019	SPP	Final report issued.
8/15/2019	SPP	Final revised report issued. Revised customer interconnection facilities description.
10/1/2019	SPP	Corrected capacity to 10 MW on Page 3 and 7.
1/6/2020	SPP	Revised final report to remove Shared NUs and Previous NUs in Table 3 & 4 per DISIS-2016-001-5 report.

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SUMMARY

INTRODUCTION

This Affected System Interconnection Facilities Study (ASIFS) for Affected System Generator Interconnection (ASGI) Request ASGI-2016-004 is for a 10 MW generating facility located in Randall County, Texas. The Interconnection Request was studied in the DISIS-2016-001 Impact Study Energy Resource Interconnection Service (ERIS) and Restudies for ERIS. The Interconnection Customer's original Commercial Operation Date was not provided.

The interconnecting Transmission Owner Southwestern Power Service Company (SPS), performed a detailed IFS at the request of SPP. The full report is included in Appendix A. SPP has determined that full Interconnection Service will be available after the assigned Transmission Owner Interconnection Facilities (TOIF), Non-Shared Network Upgrades, Shared Network Upgrades, Previous Network Upgrades, and Affected System Upgrades that are required for full interconnection service are completed.

The primary objective of the ASIFS is to identify necessary Transmission Owner Interconnection Facilities, Network Upgrades, other direct assigned upgrades, cost estimates, and associated upgrade lead times needed to grant the requested Interconnection Service.

PHASE(S) OF INTERCONNECTION SERVICE

It is not expected that Interconnection Service will occur in phases. However, full Interconnection Service will not be available until all Interconnection Facilities and Network Upgrade(s) can be placed in service.

CREDITS/COMPENSATION FOR AMOUNTS ADVANCED FOR NETWORK UPGRADE(S)

Interconnection Customer shall be entitled to compensation in accordance with Attachment Z2 of the SPP OATT for the cost of SPP creditable-type Network Upgrades, including any tax gross-up or any other tax-related payments associated with the Network Upgrades, that are not otherwise refunded to the Interconnection Customer. Compensation shall be in the form of either revenue credits or incremental Long Term Congestion Rights (iLTCR).

AFFECTED SYSTEM INTERCONNECTION CUSTOMER INTERCONNECTION FACILITIES

The Generating Facility is proposed to consist of wind turbine generator(s) for a total generating nameplate capacity of up to 10 MW.

TRANSMISSION OWNER INTERCONNECTION FACILITIES AND NON-SHARED NETWORK UPGRADE(S)

To facilitate interconnection, the interconnecting Transmission Owner will perform work as shown below necessary for the acceptance of the Interconnection Customer's Interconnection Facilities.

Table 1 and **Table 2** lists the Interconnection Customer's estimated cost responsibility for Transmission Owner Interconnection Facilities (TOIF) and Non-Shared Network Upgrade(s) and provides an estimated lead time for completion of construction. The estimated lead time begins when the Facilities Construction Agreement has been fully executed.

Table 1: Transmission Owner Interconnection Facilities (TOIF)

Transmission Owner Interconnection Facilities (TOIF)	Total Cost Estimate ($)	Allocated Percent (%)	Allocated Cost Estimate ($)	Estimated Lead Time
SPS Palo Duro 115 Interconnection Substation: Substation Load side PT installed for out of step protection, line switches, dead end structure, line relaying, communications, revenue metering, line arrestor, and all associated equipment and facilities necessary to accept transmission line from Interconnection Customer's Generating Facility.	$15,000	100%	$15,000	TBD
Total	**$15,000**	**100%**	**$15,000**	

Table 2: Non-Shared Network Upgrade(s)

Non-Shared Network Upgrades Description	Z2 Type[1]	Total Cost Estimate ($)	Allocated Percent (%)	Allocated Cost Estimate ($)	Estimated Lead Time
None	N/A	$0	N/A	$0	N/A
Total		**$0**		**$0**	

[1] Indicates the method used for calculating credit impacts under Attachment Z2 of the Tariff.

SHARED NETWORK UPGRADE(S)

The Interconnection Customer's share of costs for Shared Network Upgrades is estimated in **Table 3** below.

Table 3: Interconnection Customer Shared Network Upgrade(s)

Shared Network Upgrades Description	Z2 Type	Total Cost Estimate ($)	Allocated Percent (%)	Allocated Cost Estimate ($)	Estimated Lead Time
None	N/A	$0	N/A	$0	N/A
Total		**$0**		**$0**	

All studies have been conducted assuming that higher-queued Interconnection Request(s) and the associated Network Upgrade(s) will be placed into service. If higher-queued Interconnection Request(s) withdraw from the queue, suspend or terminate service, the Interconnection Customer's share of costs may be revised. Restudies, conducted at the customer's expense, will determine the Interconnection Customer's revised allocation of Shared Network Upgrades.

PREVIOUS NETWORK UPGRADE(S)

Certain Previous Network Upgrades are **currently not the cost responsibility** of the Interconnection Customer but will be required for full Interconnection Service.

Table 4: Interconnection Customer Previous Network Upgrade(s)

Previous Network Upgrade(s) Description	Current Cost Assignment	Estimated In-Service Date
None	$0	N/A

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

AFFECTED SYSTEM UPGRADE(S)

To facilitate interconnection, the Affected System Transmission Owner will be required to perform the facilities study work as shown below necessary for the acceptance of the Interconnection Customer's Interconnection Facilities. **Table 5** displays the current impact study costs provided as part of the Affected System Impact review. The Affected System facilities study could provide revised costs and will provide each Interconnection Customer's allocation responsibilities for the upgrades.

Table 5: Interconnection Customer Affected System Upgrade(s)

Affected System Upgrades Description	Total Cost Estimate ($)	Allocated Share (%)	Allocated Cost Estimate ($)
None	$0	N/A	$0
Total	**$0**		**$0**

CONCLUSION

After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 10 MW can be granted. Full Interconnection Service will be delayed until the transmission owner interconnect facilities (TOIF), non-shared network upgrades, shared network upgrades, previously allocated, and affected system upgrades that are required for full interconnection service are completed. The Interconnection Customer's estimated cost responsibility is summarized in the table below.

Table 6: Cost Summary

Description	Allocated Cost Estimate
Transmission Owner Interconnection Facilities	$15,000
Network Upgrades	$0
Total	**$15,000**

A draft Facilities Construction Agreement will be provided to the Interconnection Customer consistent with the final results of this ASIFS report. The Transmission Owner and Interconnection Customer will negotiate the terms of the agreement consistent with the SPP Open Access Transmission Tariff (OATT).

APPENDICES

A: AFFECTED SYSTEM TRANSMISSION OWNER'S INTERCONNECTION FACILITIES STUDY REPORT AND NETWORK UPGRADES REPORT(S)

See next page for the Affected System Transmission Owner's Interconnection Facilities Study Report and Network Upgrades Report(s).

Affected System Facilities Study For Southwest Power Pool (SPP)

10 MW Wind
Randall County, Texas
SPP #ASGI-2016-004

September 15, 2017

Transmission Planning South
Xcel Energy Services

Executive Summary

The Interconnection Customer in 2015 requested the interconnection of a 10 MW wind energy facility located in Randall County, Texas to the SPS Distribution Grid at Palo Duro Substation which connects to Southwestern Public Service Company (SPS), transmission network. SPS is a New Mexico Corporation and wholly owned subsidiary of Xcel Energy Inc. The Interconnection Customer's facility will connect to the 12.47 kV system fed off SPS Palo Duro Distribution Substation Circuit # 5235, which is served off of SPS' T66115 kV transmission line between SPS' Randall and Happy substations.

The Southwest Power Pool ("SPP or Transmission Provider") evaluated the request to interconnect ASGI-2016-004 wind generation facility to the SPS transmission system in a Definitive Interconnection System Impact Study (DISIS)-2016-001 for to be completed on November 30, 2016 The customer would like to proceed with their generation. The customer is required to comply with SPP, Generation Interconnection Agreement and OATT power factor requirements, which are 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.xcelenergy.com/Energy_Partners/Generation_Owners/Interconnections_for_Transmission. 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 facility 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 shared network upgrades will be determined at a later date by SPP and may impact the total costs for interconnection for the Interconnection Customer.

Table 1, Cost Summary[1]

Shared Network Upgrades	**TBD**
Network Upgrades:	**$ 0.00**
Transmission Owner Interconnection Facilities:	**$15,000.00**
Total:	**$ 15,000.00**

[1] The cost estimates are 2017 dollars with an accuracy level of ±20%.

General Description of SPS Facilities [2]

1. **Metering Facilities:**

1.1 Revenue Metering: The existing SPS metering is already bi-directional, thus no changes are required to existing revenue meters.

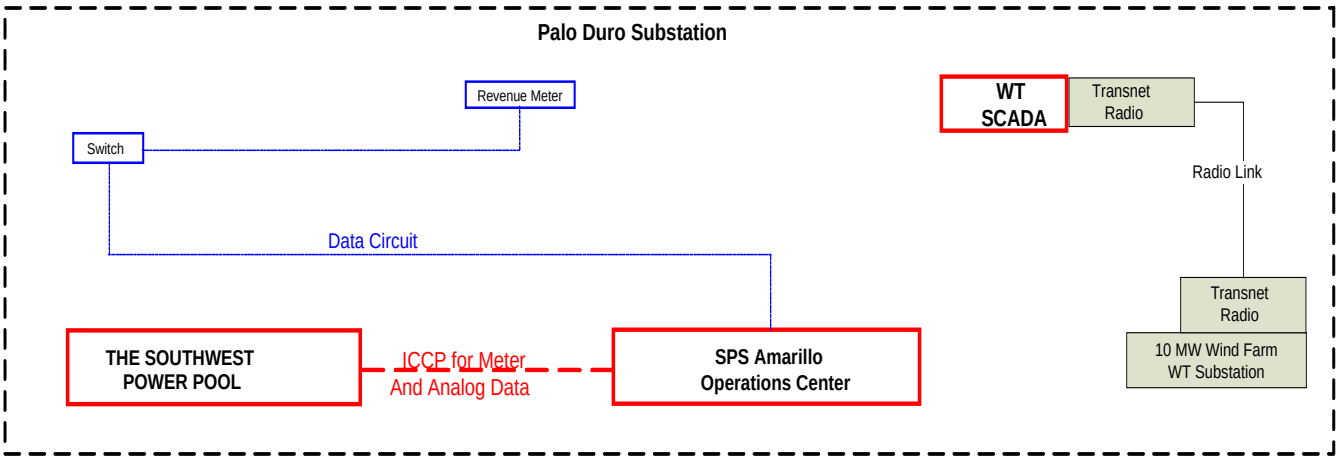
1.2 Generator Output Meters: West Texas A & M University (WT) will provide generator information to SPS over the SPP Inter-Control Center Communications Protocol Link (ICCP).

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

1.3 **Communications:** To meet its communications obligations, the Interconnection Customer shall be responsible for making arrangements with West Texas A & M University to provide analog data for output of their facility to SPS via the ICCP Link.

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 as a template.

A schematic outlining the existing communications is provided below:



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

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

Short Circuit Current at Palo Duro 115 kV Bus (524530) without contribution from 10 MW Wind Generation Facility (ASGI-2016-004)				
	Fault Current (Amps)		Impedance (Ω)	
Fault Location	Line-to-Ground	3–Phase	Z^+	Z^0
115 kV Bus	4,530	6,426	1.55 +j10.22	1.55 +j10.22

Estimated Construction Costs

The projects required for the interconnection of this 10 MW Wind Generation facility consist of the projects summarized in the table below.

Table 2, Required Interconnection Projects[3]

Project	Description	Estimated Cost
	Shared Network Upgrades: (TBD at a later date)	TBD
1		
	Subtotal:	**$ 0.00**
	Network Upgrades (at the Interconnection Customer's expense)	
	Subtotal:	**$ 0.00**
	Transmission Owner Interconnection Facilities (at the Interconnection Customer's expense)	
2	Communications [4]	*$ See footnote*
3	Substation Load side PT installed for out of step protection	$ 15,000
	Subtotal:	**$15,000.00**
	Total Cost	**$15,000.00**

[3] The cost estimates are 2017 dollars with an accuracy level of ±20%.

[4] It is the Requester's responsibility to provide both the data circuit and communication circuits, see Section 1.8.

There are no transmission costs since Analog data will be coming in from the SPS ICCP link.

Engineering and Construction:

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 One-line Diagram of ASGI-2016-004 at Palo Duro Substation