



INTERCONNECTION FACILITIES STUDY REPORT

GEN-2016-070
(IFS-2016-001-18)

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By SPP Generator Interconnections Dept.

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION	COMMENTS
4/12/2018	SPP	Initial draft revision 0 report issued.	
4/25/2018	SPP	Initial final revision 0 report issued.	

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SUMMARY

INTRODUCTION

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2016-070/IFS-2016-001-18 is for a 5.3 MW generating facility located in Carson County, Texas. GEN-2016-070 is an uprate of GEN-2003-020 (160 MW). The Interconnection Request was studied in the DISIS-2016-001 Impact Study and DISIS-2016-001-1 Impact Restudy for Energy Resource Interconnection Service (ERIS) only. The Interconnection Customer's requested in-service date is December 31, 2017.

The interconnecting Transmission Owner, Southwestern Public 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 Non-Shared Network Upgrade(s) and Other Network Upgrade(s) are completed.

The primary objective of the IFS 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, 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 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).

INTERCONNECTION CUSTOMER INTERCONNECTION FACILITIES

The Generating Facility is proposed to consist of uprating GEN-2003-020 Phase 1 fifty-three (53) 1.5 MW General Electric (G.E.) to fifty-three (53) 1.6 G.E. wind generators for a total generating nameplate capacity of 5.3 MW for GEN-2016-070.

The Interconnection Customer's Interconnection Facilities to be designed, procured, constructed, installed, maintained, and owned by the Interconnection Customer at its sole expense include:

- 34.5 kV underground cable collection circuits;
- 34.5 kV to 115 kV transformation substation with associated 34.5 kV and 115 kV switchgear;
- One (1) 115/34.5kV 54/74/90 MVA (ONAN/ONAF/ONAF) step-up transformer that is owned and maintained by the GEN-2003-020 Interconnection Customer at the GEN-2003-020 Phase 1 Interconnection Customer's substation.
- A less than one (<1) mile overhead 115 kV line as part of GEN-2003-020 facilities will connect the Interconnection Customer's substation to the Point of Interconnection (POI) at the 115 kV bus at existing SPS substation ("Martin") that is owned and maintained by SPS;
- All transmission facilities required to connect the Interconnection Customer's facilities to GEN-2003-020 Interconnection Customer's substation to the POI;
- Equipment at the Interconnection Customer's substation necessary to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 95% lagging and 95% leading in accordance with Federal Energy Regulatory Commission (FERC) Order 827. Additionally approximately 3.5 Mvars¹ of reactors will be required to compensate for GEN-2003-020 and GEN-2016-070 combined injection of reactive power into the transmission system under no/reduced generating conditions. The Interconnection Customer may use generator/inverter manufacturing options for providing reactive power under no/reduced generation conditions. The Interconnection Customer will be required to provide documentation and design specifications demonstrating how the requirements are met.

The Interconnection Customer shall coordinate relay, protection, control, and communication system configurations and schemes with the Transmission Owner.

¹ This approximate minimum reactor amount is needed for the current configuration of GEN-2016-070 as studied in the DISIS-2016-001 Impact Study.

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 Generator Interconnection Agreement has been fully executed.

Table 1: Transmission Owner Interconnection Facilities (TOIF)

Transmission Owner Interconnection Facilities (TOIF)	Total Cost Estimate (\$)	Allocated %	Allocated Cost Estimate (\$)	Estimated Lead Time
<u>SPS Martin Interconnection Substation: Transmission Owner Interconnection Facilities</u>	\$0	N/A	\$0	N/A
Total	\$0	N/A	\$0	N/A

Table 2: Non-Shared Network Upgrade(s)

Non-Shared Network Upgrades Description	Z2 Type ²	Total Cost Estimate (\$)	Allocated %	Allocated Cost Estimate (\$)	Estimated Lead Time
<u>SPS Martin Interconnection Substation - Non-Shared Network Upgrades</u>	N/A	\$0	N/A	\$0	N/A
Total		\$0	N/A	\$0	N/A

² 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 Upgrades

Shared Network Upgrades Description	Capacity or Non-Capacity	Total Cost Estimate (\$)	Allocated %	Allocated Cost Estimate (\$)	Estimated Lead Time
<u>Currently None</u>	N/A	\$0	N/A	\$0	N/A
Total		\$0	N/A	\$0	N/A

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.

OTHER NETWORK UPGRADE(S)

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

Table 4: Interconnection Customer Other Network Upgrade(s)

Other Network Upgrade(s) Description	Current Cost Assignment	Estimate In-Service Date*
Beaver County 345kV Reactive Power Support assigned to DISIS-2015-001 Interconnection Customer(s)	\$26,264,777	24 Months from executed GIA
Highland Park Tap – Pantex South 115kV Circuit #1 terminal equipment upgrade assigned in 2017 Integrated Transmission Plan – 10 Year Assessment (2017 ITP10) per SPP-NTC-200444.	\$324,392	3/15/2018
Martin – Pantex North 115kV Circuit #1 terminal equipment upgrade assigned in 2017 Integrated Transmission Plan – 10 Year Assessment (2017 ITP10) per SPP-NTC-200444.	\$324,392	3/15/2018
Potter County 345/230/13kV Transformer Circuit #2 build assigned to DISIS-2015-001 Interconnection Customer(s)	\$5,924,670	36 Months from executed GIA

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 Other Network Upgrades.

CONCLUSION

After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 9.8 MW can be granted. Interconnection Service will be delayed until the Non-Shared Network Upgrade(s) and Other Network Upgrade(s) are completed. The Interconnection Customer's estimated cost responsibility for Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades is summarized in the table below.

Table 5: Cost Summary

Description	Allocated Cost Estimate
Transmission Owner Interconnection Facilities	\$0
Network Upgrades	\$0
Total	\$0

A draft Generator Interconnection Agreement will be provided to the Interconnection Customer consistent with the final results of this IFS report. The Transmission Owner and Interconnection Customer will have 60 days to negotiate the terms of the GIA consistent with the SPP Open Access Transmission Tariff (OATT).

APPENDICES

A: TRANSMISSION OWNER'S INTERCONNECTION FACILITIES STUDY REPORT

See next page for the Transmission Owner's Interconnection Facilities Study Report.



Facilities Study For
Southwest Power Pool (SPP)
Uprate of GE Wind Turbine Generators
Carson Co., Texas
GEN-2016-070
High Majestic Wind 5.3MW
Generation Facilities

Xcel Energy Services, INC

Transmission Planning South

September 25, 2017

Executive Summary

An Interconnection Customer (IC) in 2016 requested to uprate of 53 GE wind turbines from 1.5 MW to 1.6 MW each at the existing Majestic Wind Farm facility located in Carson Co., Texas approximately 21 miles northwest of Amarillo, Texas connected to the Southwestern Public Service Company (SPS) transmission network. The Interconnection Customer's requested commercial operation date is on or before December 31, 2017.

The Southwest Power Pool (SPP) evaluated the request (GEN-2016-070) to interconnect the Wind generation facility to the SPS transmission system in a Definitive Interconnection System Impact Study (DISIS-2016-001). The interconnection request studied 53 GE Turbines at 1.5 MW each (originally GEN 2003-020 Phase II) to 1.6 MW increasing the total capacity by 5.3 MW for a total of 84.8 of Wind generation. No upgrades will be required at the interconnection point at the existing 115 kV Martin Switching Station however the IC will be required to maintain a Power Factor between 0.95 lagging and 0.95 leading at the Point of Interconnection (POI).

SPP requires that each generator shall implement automatic Under Frequency Load Shedding (UFLS) according to the SPP UFLS Plan for SPS found in the Xcel Energy Interconnection Guidelines For Transmission Interconnected Producer-Owned Generation Greater Than 20 MW at the following link:

<http://www.transmission.xcelenergy.com/staticfiles/microsites/Transmission/Files/PDF/Interconnection/Interconnections-POL-TransmissionInterconnectionGuidelineGreat20MW.pdf>.

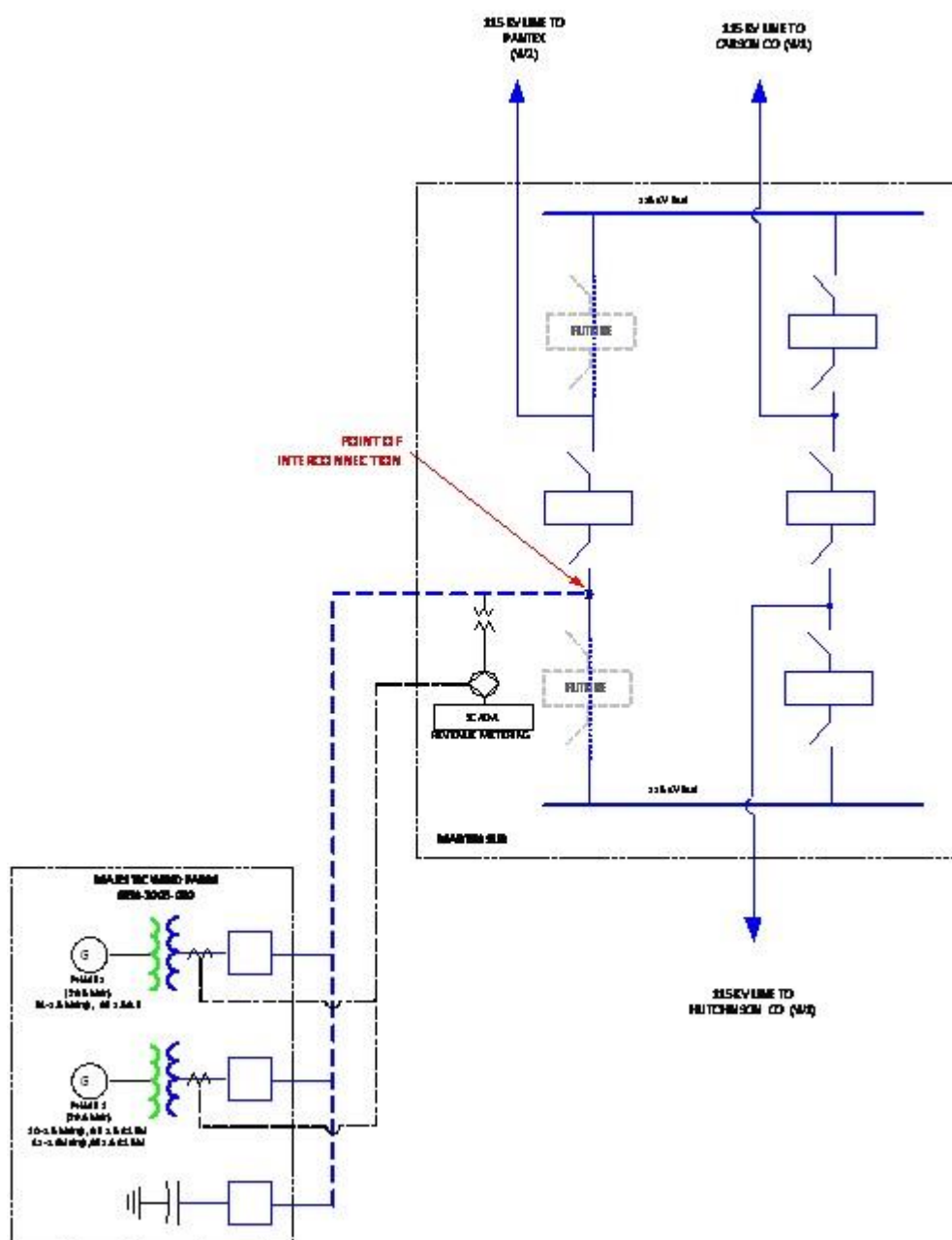
To fulfill this requirement, coordination with Xcel Energy is required during the under-frequency relay-setting phase for the generation. The Interconnection Customer is required to report their generation off-nominal frequency tripping relay settings to SPP and SPS. SPS specifies that generators shall 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.

The Interconnection Customer will be responsible for any unforeseen cost impacted by the requested uprate of the requested Interconnection Facilities to the SPS's Martin Switching Station.

The shared network upgrades will be determined at a later date by SPP and may impact the total overall costs for interconnection of the Interconnection Customer.

General Description of SPS Facilities ¹

1. **No construction is required. IC will utilize GEN-2003-020's existing Line Terminal.**
 - 1.1. **Revenue Metering:** Metering was originally installed on GEN-2003-020 Phase II project.



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

2. **Transmission Work:**

2.1. No additional transmission work required.

3. **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 Generator facility and their collector substation.

4. **Project and Operating Concerns:**

4.1 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.

4.2 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.

5. **Fault or Short Circuit Study:** The available fault current at Martin Switching Station using CAPE 14 software on the 115 kV bus (Bus # 523928), without any contribution from the wind farm facility, is shown in Table 1 below.

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

Short Circuit Current Availability at Martin Switching Station 115 kV Bus without contribution from GEN-2016-070				
Fault Location (Bus#523928)	Fault Current (Amps)		Impedance (Ω)	
	Line-to-Ground	3-Phase	Z+	Z0
115 kV Bus	6,317	6,576	3.73+j17.44	3.73+j17.44

Estimated Construction Costs

This project is to uprate all 53 x 1.5 MW GE Wind Turbine Generators to 1.6 MW increasing total capacity by 5.3 MW (GEN-2016-070) for a total of 84.8 MW, which is connected at Martin Switching Station. No network upgrade costs will be required for this Interconnection request. However, SPP may at a later date announce any Shared Network Upgrades cost and the Interconnection customer will be responsible for this additional cost.

Table 2, Required Interconnection Projects²

Project	Description	Estimate
	Shared Network Upgrades:	
1	TBD by SPP	TBD
	Subtotal:	TBD
	SPS Network Upgrades	
2	No additional SPS Network Upgrades required	0
	Subtotal:	0
	Interconnection Facilities (Interconnection Customer's Expense)	
3	Communications ³	\$ See footnote
4	Revenue metering	\$ 0
	Subtotal:	\$0.00
Total Cost:		\$0.00

Engineering and Construction:

No additional work is required by this study.

² The cost estimates are 2017 dollars with an accuracy level of $\pm 20\%$ except it does not include AFUDC.

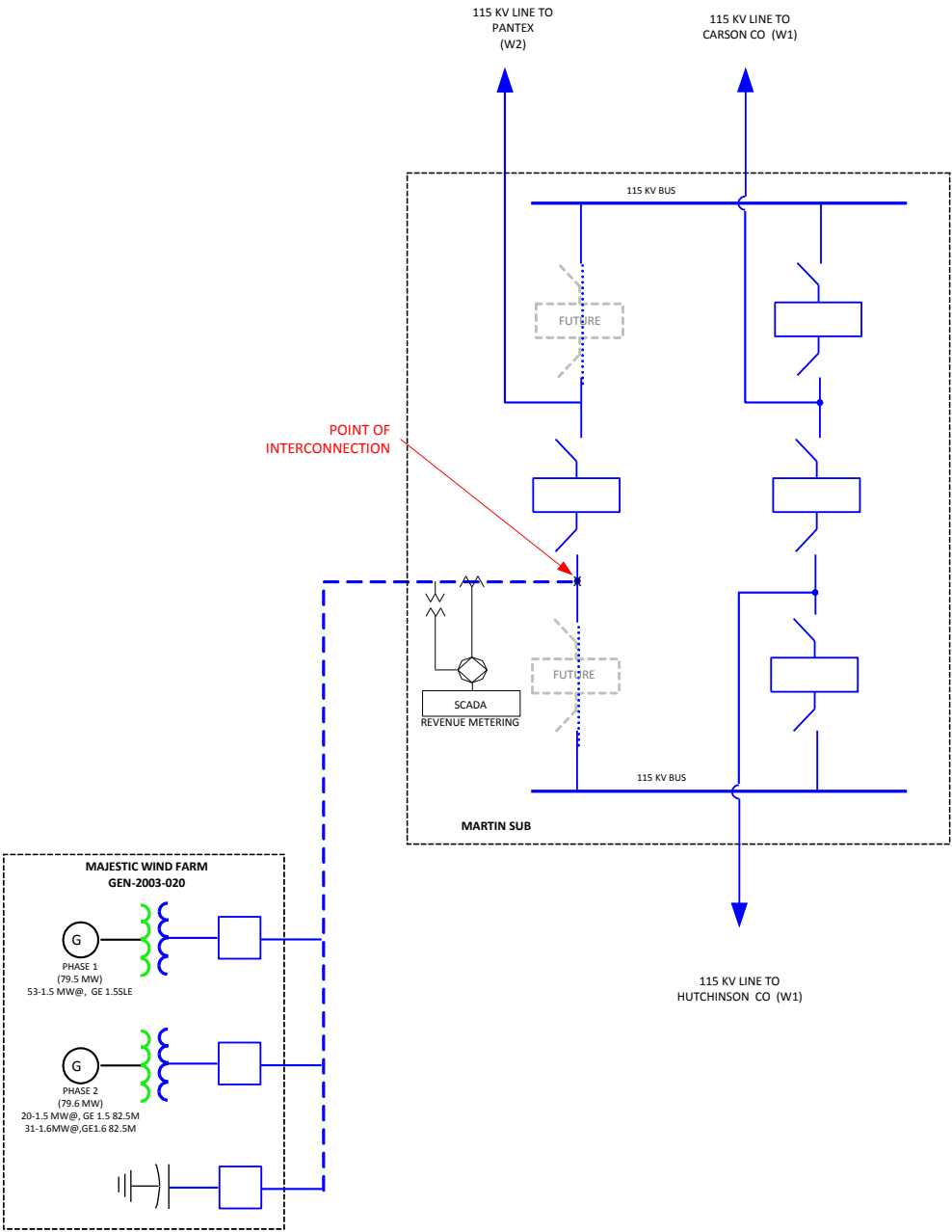
³ Generator output data such as generator auto voltage regulator status shall be provided over Customer's ICCP data link to SPP.

Appendix A

Figure A- 1 Approximate location of proposed 5.3 MW Uprate for High Majestic Wind Farm Facility



Figure A- 2 One-line Diagram of Martin Switching Station to Interconnection Customer (IC) Facility



– *END OF REPORT* –