



INTERCONNECTION FACILITIES STUDY REPORT

GEN-2015-090
(IFS-2015-002-21)

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By SPP Generator Interconnections Dept.

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION	COMMENTS
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4/28/2017	SPP	Initial final report issued.	

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SUMMARY

INTRODUCTION

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2015-090/IFS-2015-002-21 is for a 220.00 MW generating facility located in Pratt County, Kansas. The Interconnection Request was studied in the DISIS-2015-002 Impact Study for Energy Resource Interconnection Service (ERIS) and Network Resource Interconnection Service (NRIS). Prior to an executed IFS agreement, the Interconnection Customer requested to withdraw NRIS per Section 4.4.1 of the Southwest Power Pool (SPP) Generator Interconnection Procedures (GIP), therefore ERIS-only was analyzed for this request in the DISIS-2015-002-1 Impact Restudy and DISIS-2015-002-2 Impact Restudy. The Interconnection Customer's requested in-service date is December 1, 2017.

The interconnecting Transmission Owner, Westar Energy, Inc. (WERE), 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 and Non-Shared Network Upgrades are completed.

The primary objective of the IFS is to identify necessary Transmission Owner Interconnection Facilities, Network Upgrade(s), other direct assigned upgrade(s), and associated upgrade lead times needed to grant the requested Interconnection Service at the specified Point of Interconnection (POI).

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 one-hundred-ten (110) 2.0 MW General Electric (G.E.) wind generators for a total generating nameplate capacity of 220.0 MW.

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

- A 34.5kV collector system;
- One (1) 345/34.5kV 147/196/245 MVA (ONAN/ONAF/ONAF) step-up transformer to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation;
- A eight (8) mile overhead 345 kV line to connect the Interconnection Customer's substation to the Point of Change of Ownership (PCO) with GEN-2015-024/IFS-2015-001-02 and GEN-2015-025/IFS-2015-001-03 facilities under a "shared usage" agreement to the POI at the 345 kV bus at existing WERE substation ("Buffalo Flats") that is owned and maintained by WERE;
- All transmission facilities required to connect the Interconnection Customer's substation to the POI;
- To accommodate the "shared usage," Interconnection Customer will be required to attain a Shared Facilities Agreement and provide a copy of the Shared Facilities Agreement with the Transmission Provider and Transmission Owner before Interconnection Customer energizes its facilities;
- Equipment at the Interconnection Customer's substation necessary to maintain a power factor at the POI between 95% lagging and 95% leading, including approximately 11.1Mvars¹ of reactors to compensate for injection of reactive power into the transmission system under no/reduced generating conditions. The Interconnection Customer may use wind turbine 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.

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 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.

¹ This approximate minimum reactor amount is needed for the current configuration of the wind farm as studied in the DISIS-2015-002 Impact Study.

Table 1: Interconnection Customer TOIF and Non-Shared Network Upgrade(s)

TOIF and Non-Shared Network Upgrades Description	Allocated Cost Estimate (\$)	Allocated Percent (%)	Total Cost Estimate (\$)	Estimated Lead Time
<u>WERE Buffalo Flats Interconnection Substation: Transmission Owner Interconnection Facilities</u>	\$0	100%	\$0	6 Weeks
<u>WERE Buffalo Flats Interconnection Substation - Non-Shared Network Upgrades</u> review relay settings and update as required	\$10,000	100%	\$10,000	
Total	\$10,000	100%	\$10,000	

SHARED NETWORK UPGRADE(S)

The Interconnection Customer’s share of costs for Shared Network Upgrades is estimated in **Table 2** below.

Table 2: Interconnection Customer Shared Network Upgrades

Shared Network Upgrades Description	Allocated Cost Estimate (\$)	Allocated Percent (%)	Total Cost Estimate (\$)
<u>Currently none</u>	\$0	N/A	\$0
Total	\$0	N/A	\$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.

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.

- 1) Currently None

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 220.00 MW can be granted. Interconnection Service will be delayed until the Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades are completed. The Interconnection Customer’s estimated cost responsibility for Transmission Owner Interconnection Facilities, Non-Shared Network Upgrades is summarized in the table below.

Table 3: Cost Summary

Description	Allocated Cost Estimate
Transmission Owner Interconnection Facilities	\$0
Network Upgrades	\$10,000
Total	\$10,000

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.



**Generation Interconnection Facility
Study**

For

**Generation Interconnection Request
SPP-GEN-2015-090**

August 19, 2016

Introduction

This report summarizes the results of a Generation Interconnection Facilities Study performed for the Southwest Power Pool (SPP) by Westar Energy (WR) on behalf of Prairie Wind Transmission (PWT) to evaluate a generation interconnection request for 220 MW of wind-powered generation in south central, Kansas, to the PWT transmission system. The proposed interconnection will occur at the new substation on the Thistle – Wichita 345 kV double circuit. This substation is currently assigned to GEN-2015-024 and is approximately 15 miles from Wichita substation on the Thistle – Wichita double circuits. GEN-2015-090 is proposing to connect to the GEN-2015-024 345 kV customer system and utilize the 345 kV transmission to the point of interconnection. A System Impact Study has been completed for this project. The requested in-service date of the generating facility is December 1, 2017.

Project Location and Existing Facilities

The project is located in Pratt County in south central Kansas. The proposed interconnection will be on new 345kV generator lead constructed for GEN-2015-024, which will connect at the new 345kV breaker and a half substation on the Wichita-Thistle 345kV line #1 and line #2 near Cheney, Kansas. The substation will connect to customer facilities at 345kV. Figure 1 shows the approximate location of the project.

DISIS Study Review

WR has reviewed the steady-state, short-circuit, and dynamic study results for GEN-2015-090 included within SPP DISIS-2015-002-1 assessing the reliability impact of the proposed generation interconnection. WR agrees with the study approach and findings of the DISIS as posted by SPP. However, it should be noted that the 717 MVA terminal equipment limitations identified for Emporia Energy Center-Swissvale and Swissvale-West Gardner 345 kV lines has been increased to 956 MVA. The identified loading levels for the Group 8 Cluster analysis will not overload the facilities at the new rating.

Interconnection Facilities

Interconnection to the PWT transmission system will be by way of new 345kV generator lead constructed for GEN-2015-024, which will connect to the new 345kV breaker and half switching station on the existing Wichita-Thistle 345kV line #1 and line #2.

This request will share a generator lead with GEN-2015-024 from the customer facility to the Point of Interconnection. If for any reason GEN-2015-024 does not occur, all costs associated with the GEN-2015-024 interconnection will be required for GEN-2015-090.

No additional infrastructure will be required at the existing interconnection identified by GEN-2015-024. Relaying setting changes will be required.

Assuming this interconnection occurs at the same time as GEN-2015-024, no dollars will be needed to interconnect GEN-2015-090.

345 kV Substation Work

- The estimated cost includes relaying settings changes at the new 345kV switching station identified for GEN-2015-024, after applicable protection data is received from GEN-2015-090. No substation physical upgrades are needed by Westar.

General Considerations

Additional consideration should be given to the following items:

- Westar Energy recommends that the interconnection customer construct breakered stations at the wind farm connections to the 345kV generator lead to prevent three-terminal line configurations with sources at each terminal.

The total cost estimate for Stand Alone Network Upgrades (345 kV Substation Relay Work) is:

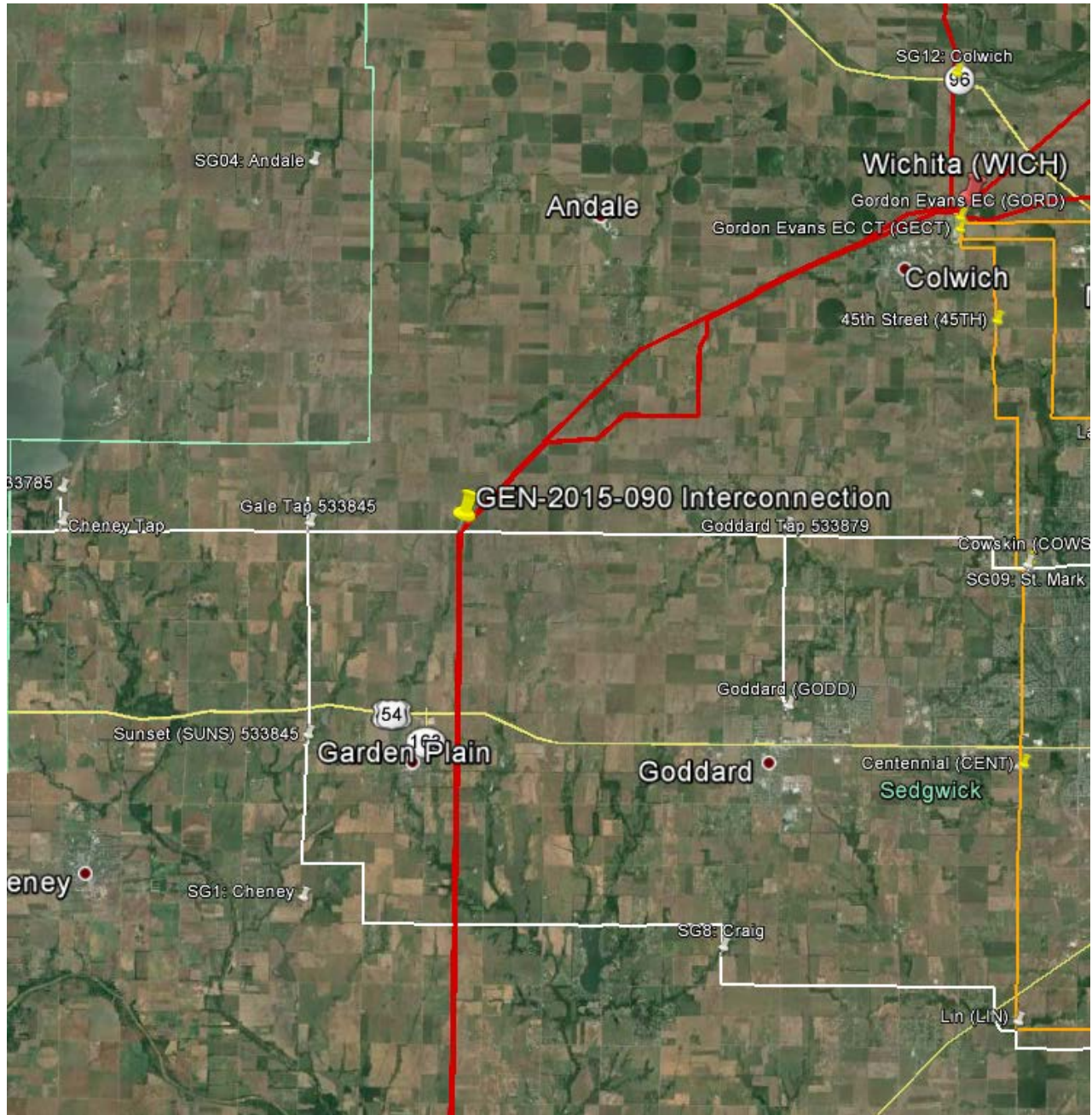
\$	10,000	345 kV Substation Work
\$	0	345 kV Line Work
\$	0	AFUDC
\$	0	Contingency
\$	10,000	

This estimate is accurate to +/- twenty (20) percent, based on current prices, in accordance with Attachment A of Appendix 4 of the Interconnection Facilities Study Agreement. However, recent cost fluctuations in materials are very significant and the accuracy of this estimate at the time of actual settings cannot be assured.

3 weeks	Engineering Time
0 weeks	Procurement Time
3 weeks	Construction Time
6 weeks	Total

Westar Energy also maintains its own Facility Connection Requirements, which may be found at (<http://www.oasis.oati.com/WR/index.html>).

Figure 1 – Interconnection Map



The proposed interconnection project is 10 miles from Wichita 345kV substation

Results of Short Circuit Analysis

As a part of this Facility Study, a short circuit study was performed to determine the available fault current at the interconnection bus (GEN-2015-024 Interconnection 345 kV) using PSS/E's activity ASCC. The 2017 Summer Peak case from the 2016 Series MDWG Classical, Max Fault Short-Circuit models were used. All GEN-2015-024, GEN-2015-025, and GEN-2015-090 Wind Farm generation facilities were taken out of service for this analysis, and all other transmission facilities are in service. As a result, the numbers generated represent the available utility interconnection fault current:

2017 Summer:

3-PH FAULT		1-PH FAULT		THEVENIN IMPEDANCE (PU on 100 MVA and bus base KV)		
AMP	MVA	AMP	MVA	Positive Sequence	Negative Sequence	Zero Sequence
19392.19	11587.95	14143.20	8451.37	0.00057 +j 0.00861	0.00057 +j 0.00861	0.00387 +j 0.01792