



**INTERCONNECTION  
FACILITIES STUDY  
REPORT**

GEN-2015-083  
(IFS-2015-002-17)

Published March 2017

By SPP Generator Interconnections Dept.

## REVISION HISTORY

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DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION	COMMENTS
3/15/2017	SPP	Initial draft report issued.	

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## SUMMARY

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### *INTRODUCTION*

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2015-083/IFS-2015-002-17 is for a 125.00 MW generating facility located in Sumner 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 31, 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 fifty-four (54) 2.3 MW General Electric (G.E.) wind generators for a total generating nameplate capacity of 124.2 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) 138/34.5kV 84/112/140 MVA (ONAN/ONAF/ONAF) step-up transformer to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation;
- A five (5) mile overhead 138 kV line to connect the Interconnection Customer's substation to the POI at the 138 kV bus at a new WERE substation ("GEN-2015-083 Tap") to be owned and maintained by WERE. GEN-2015-083 Tap will be located close to Belle Plains 138kV transmission circuit;
- All transmission facilities required to connect the Interconnection Customer's substation to the POI;
- Equipment at the Interconnection Customer's substation necessary to maintain a power factor at the POI between 95% lagging and 95% leading, including approximately 8.8Mvars<sup>1</sup> 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.

The interconnecting Transmission Owner reviewed requested POI at Belle Plaine substation for expansion for a new line terminal. Upon review, the Transmission Owner has determined the existing Belle Plaine substation is not suitable for expansion to accommodate another line terminal and would require a new greenfield three breaker substation to accommodate the Interconnection Request.

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<sup>1</sup> 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
<b><u>WERE GEN-2015-083 Tap Interconnection Substation: Transmission Owner Interconnection Facilities</u></b> Construct one (1) 138 kV line terminal, line switches, dead end structure, line relaying, communications, revenue metering, line arrester and all associated equipment and facilities necessary to accept transmission line from Interconnection Customer's Generating Facility.	\$400,000	100%	\$400,000	90 Weeks
<b><u>WERE GEN-2015-083 Tap Interconnection Substation - Non-Shared Network Upgrades</u></b> Construct three (3) 138 kV 3000 continuous ampacity breakers, 345kV and 138kV transmission line work, control panels, line relaying, disconnect switches, structures, foundations, conductors, insulators, and all other associated work and materials. Allowance for Funds Used During Construction (AFUDC) and Contingency funds are included in this cost estimate.	\$6,313,963	100%	\$6,313,963	
<b>Total</b>	<b>\$6,713,963</b>	<b>100%</b>	<b>\$6,713,963</b>	

**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 (\$)
<b><u>Currently none</u></b>	\$0	N/A	\$0
<b>Total</b>	<b>\$0</b>	<b>N/A</b>	<b>\$0</b>

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 125.00 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*

<b>Description</b>	<b>Allocated Cost Estimate</b>
Transmission Owner Interconnection Facilities	\$400,000
Network Upgrades	\$6,313,963
<b>Total</b>	<b>\$6,713,963</b>

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

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# A: TRANSMISSION OWNER'S INTERCONNECTION FACILITIES STUDY REPORT

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

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**Generation Interconnection Facility Study**

**For**

**Generation Interconnection Request  
SPP-GEN-2015-083**

**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) to evaluate a generation interconnection request for 124.2 MW of wind-powered generation in south central, Kansas, to the transmission system. The proposed interconnection is by way of a new substation on the Farber – Belle Plaine – Sumner Co. 138 kV line near Oxford, Kansas. A System Impact Study has been completed for this project. The requested in-service date of the generating facility is December 31, 2017.

## **Project Location and Existing Facilities**

The project is located in Sumner County in south central Kansas. The proposed interconnection will be at a new substation on the Farber – Belle Plaine – Sumner Co. 138 kV line. The location for this new station will be close to the existing Belle Plaine substation.

Figure 1 shows the approximate location of the project. Figure 2 shows a preliminary one-line diagram for the new 138 kV substation.

## **DISIS Study Review**

WR has reviewed the steady-state, short-circuit, and dynamic study results for GEN-2015-083 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 WR transmission system will be by way of a new 138kV substation on the existing Farber – Belle Plaine – Sumner Co. 138 kV line. Note: the specific site for the new substation has not yet been determined.

## **138 kV Substation Work**

The estimated cost includes three (3) 138 kV 3000 A breakers, two (2) 2000 A wave traps, ten (10) 2000 A switches, three (3) 2000 A stand alone CTs, three (3) 138 kV PTs, six (6) 138 kV CCVTs, seven (7) 138 kV control panels, relay coordination, and all associated site, yard, cable, grounding, and conduit work.

## **138 kV Transmission Line Work**

The estimated cost is for 0.5 miles of new single 1192.5 Bunting ACSR line with 64mm OPGW static wire, two (2) steel dead end structures, and four (4) steel tangent structures from Belle Plaine – Sumner Co.

## **345 kV Transmission Line Work**

The estimated cost is for a reconductor of 0.2 miles of double 1590 Lapwing ACSR with 64mm OPGW static wire, and two (2) steel tangent structures on the existing Rosehill – Open Sky 345kV line to accommodate the interconnection on the Farber – Belle Plaine – Sumner Co. 138kV line.

The total cost estimate for Transmission Owner Interconnection Facilities (Interconnection Metering) and Stand Alone Network Upgrades (345 kV Substation and Transmission Line Work) is:

**\$ 4,434,315 138 kV Substation Work**  
**\$ 1,040,298 138 kV & 345 kV Transmission Line Work**  
**\$ 292,966 AFUDC**  
**\$ 946,384 Contingency**  
**\$ 6,713,963**

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.

20 weeks      Engineering Time  
40 weeks      Procurement Time  
30 weeks      Construction Time  
**90 weeks Total**

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





## 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 (Belle Plaine 138 kV bus 533063) 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-2015-083 Wind Farm generation was 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
8337.10	1992.76	6128.43	1464.84	0.00788 +j 0.04956	0.00793 +j 0.04979	0.02393 +j 0.10156

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