



# **INTERCONNECTION FACILITIES STUDY REPORT**

GEN-2015-091  
(IFS-2015-002-47)

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By SPP Generator Interconnections Dept.

## REVISION HISTORY

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DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION	COMMENTS
4/10/2017	SPP	Initial draft report issued.	

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## SUMMARY

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### *INTRODUCTION*

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2015-091/IFS-2015-002-47 is for a 101.20 MW generating facility located in Stark County, North Dakota. The Interconnection Request was studied in the DISIS-2015-002 Impact Study for Energy Resource Interconnection Service (ERIS). The Interconnection Customer's requested in-service date is December 1, 2017.

The interconnecting Transmission Owner, Basin Electric Power Cooperative (BEPC), performed a detailed IFS at the request of SPP. The full report is included in Appendix A. Additionally, the Affected System, Midcontinent Independent System Operator (MISO), has identified the need to perform a detailed Affected System Facilities Study for impacts on the MISO transmission system. SPP has determined that full Interconnection Service will be available after the assigned Transmission Owner Interconnection Facilities, Non-Shared Network Upgrade(s), Other Network Upgrade(s), Shared Network Upgrade(s), and Affected System 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 forty-four (44) 2.3 MW General Electric (G.E.) wind generators for a total generating nameplate capacity of 101.20 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:

- 34.5 kV underground cable collection circuits;
- 34.5 kV to 230 kV transformation substation with associated 34.5 kV and 230 kV switchgear;
- One (1) 230/34.5 kV 69/92/115 MVA (ONAN/ONAF/ONAF) step-up transformer to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation;
- A less than one (<1) mile overhead 230 kV line to connect the Interconnection Customer's substation to the POI at the 230 kV bus at the existing BEPC substation ("Daglum") that is owned and maintained by BEPC;
- 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 3.7 Mvars<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.

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

<b>TOIF and Non-Shared Network Upgrades Description</b>	<b>Total Cost Estimate (\$)</b>	<b>Allocated Percent (%)</b>	<b>Allocated Cost Estimate (\$)</b>	<b>Estimated Lead Time</b>
<b><u>BEPC Daglum Interconnection Substation: Transmission Owner Interconnection Facilities</u></b> Construct one (1) 230 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.	\$300,000	100%	\$300,000	25 Months
<b><u>BEPC Daglum Interconnection Substation - Non-Shared Network Upgrades</u></b> Construct three (3) 230 kV 2000 continuous ampacity breakers, control panels, line relaying, disconnect switches, structures, foundations, conductors, insulators, and all other associated work and materials.	\$2,924,682	100%	\$2,924,682	
<b>Total</b>	<b>\$3,224,682</b>	<b>100%</b>	<b>\$3,224,682</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 Upgrade(s)*

<b>Shared Network Upgrades Description</b>	<b>Total Cost Estimate (\$)</b>	<b>Allocated Percent (%)</b>	<b>Allocated Cost Estimate (\$)</b>
<b>Daglum - Dickinson 230kV Circuit #1:</b> Build twenty-eight (28) miles of 1272 ACSR 230kV circuit from Daglum – Dickinson, one (1) new 230kV 2000 continuous ampacity breaker at Daglum, and one (1) new 230kV 2000 continuous ampacity breaker at Dickinson. Daglum and Dickson substations will also require work for new control panels, line relaying, disconnect switches, structures, foundations, conductors, insulators, and all other associated work and materials.	\$23,109,504	33.83	\$7,817,147
<b>Dickinson 230/115/13kV Transformer Circuit #2:</b> Expand Dickinson Substation, build new 230kV line terminal, build new three (3) breaker ring “East” bus for 115kV configuration, one (1) 230kV 2000 continuous ampacity breaker, three (3) 115kV 1200 continuous ampacity breakers, new 230/115/13kV 166MVA transformer, control panels, line relaying, disconnect switches, structures, foundations, conductors, insulators, and all other associated work and materials.	\$11,764,180	22.69	\$2,669,854
<b>Total</b>	<b>\$34,873,684</b>	<b>30.00</b>	<b>\$10,487,001</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 are listed in **Table 3** below.

*Table 3: Interconnection Customer Other Network Upgrade(s)*

Description	Current Cost Assignment	Estimate In-Service Date
<b>Gentleman – Thedford – Holt 345kV (R-plan) Project:</b> assigned in the SPP 2012 Integrated Transmission Plan – 10 Yea Assessment (2012 ITP10) per SPP-NTC-200220	\$323,613,423	10/1/2019
<b>Judson – Tande 345kV Circuit #1:</b> assigned in Integrated System/Upper Missouri Zone (IS/UMZ) Integration Study.	\$86,000,000	10/31/2017
<b>Neset – Tande 230kV Circuit #1:</b> assigned in Integrated System/Upper Missouri Zone (IS/UMZ) Integration Study	\$3,000,000	10/31/2017
<b>Tande 345/230/13kV Substation and Transformer Circuit #1:</b> assigned in Integrated System/Upper Missouri Zone (IS/UMZ) Integration Study.	\$18,000,000	10/31/2017
<b>Kummer Ridge – Roundup 345kV Circuit #1:</b> assigned in the 2016 Integrated Transmission Plan – Near Term (2016 ITPNT) per SPP-NTC-200417	\$52,312,877	12/31/2019

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.

**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 4** displays the current impact study costs provided by MISO 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 4: Interconnection Customer Affected System Upgrade(s)*

Affected System Upgrades Description	Total Cost Estimate	Allocated Share	Allocated Cost Estimate
<b>Morgan Valley – Tiffin 345kV Circuit #1:</b> Structure replacement on the MEC owned section to at least 961MVA.	\$100,000	TBD by MISO	TBD by MISO
<b>Total Shared Network Upgrades</b>	<b>\$100,000</b>	<b>TBD by MISO</b>	<b>TBD by MISO</b>



**CONCLUSION**

After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 101.20 MW can be granted. Interconnection Service will be delayed until the Transmission Owner Interconnection Facilities, Non-Shared Network Upgrade(s), Other Network Upgrade(s), Shared Network Upgrade(s), and Affected System Upgrade(s) are completed. The Interconnection Customer’s estimated cost responsibility for Transmission Owner Interconnection Facilities, Non-Shared Network Upgrade(s), and Shared Network Upgrade(s) is summarized in the table below.

*Table 5: Cost Summary*

<b>Description</b>	<b>Allocated Cost Estimate</b>
Transmission Owner Interconnection Facilities	\$300,000
Network Upgrades	\$13,411,683
Affected System Upgrades	TBD by MISO
<b>Total</b>	<b>\$13,711,683</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.

**1. Introduction**

<OMITTED TEXT> (Interconnection Customer) has requested an Interconnection Facilities Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnecting a 101.20 MW wind generation facility in Stark County, North Dakota to the transmission system of Basin Electric Power Cooperative (BEPC). The generator facility, GEN-2015-091, is comprised of forty-four (44) 2.3 MW General Electric (G.E.) wind generators for a total generating nameplate capacity of 101.20 MW.

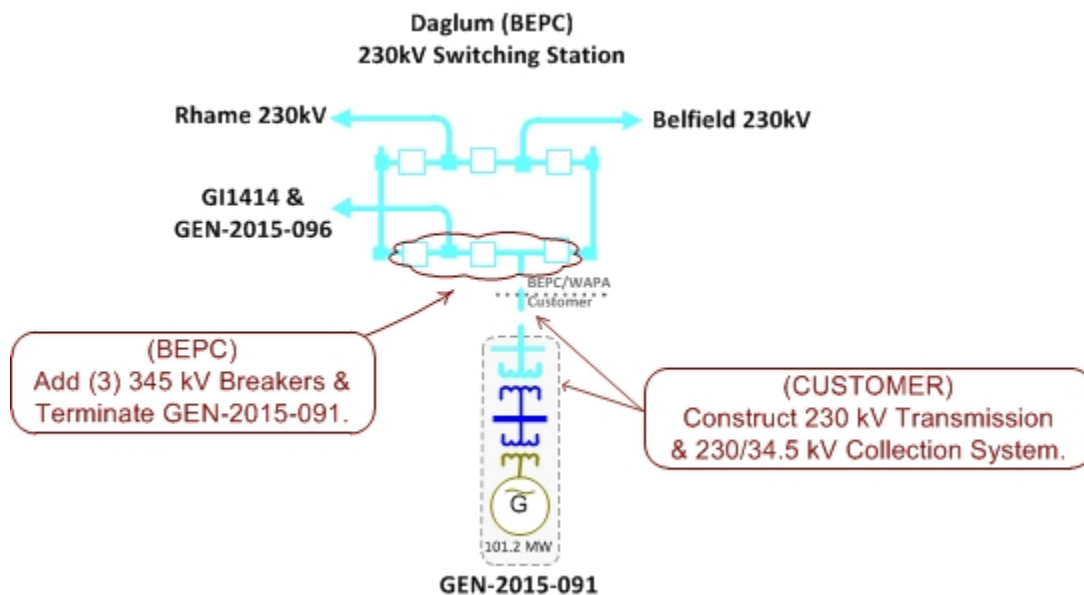
**2. Transmission Owner Interconnection Facilities and Shared Network Upgrades**

The cost for the Transmission Owner Interconnection Facilities and Shared Network Upgrades is listed below in **Table 1**. GEN-2015-091/IFS-2015-002-47 is planned to interconnect at the BEPC owned 230 kV bus located at Daglum Substation. The estimated lead time for Transmission Owner Interconnection Facilities and Network Upgrades is twenty-five (25) months after a fully executed Generator Interconnection Agreement (GIA). The one-line diagram is shown in **Figure 1**.

**Table 1: Required Transmission Owner Interconnection Facilities and Non Shared Network Upgrades**

Description	Total Project Cost	Allocated Cost
<p><b><u>BEPC Daglum Interconnection Substation: Transmission Owner Interconnection Facilities</u></b> Construct one (1) 230 kV line terminal, 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.</p>	\$300,000	\$300,000
<p><b><u>BEPC Daglum Interconnection Substation - Non-Shared Network Upgrades</u></b> Construct three (3) 230 kV 2000 continuous ampacity breakers, control panels, line relaying, disconnect switches, structures, foundations, conductors, insulators, and all other associated work and materials.</p>	\$2,924,682	\$2,924,682
<b>Total:</b>	<b>\$3,224,682</b>	<b>\$3,224,682</b>

**Figure 1: Interconnection Configuration for GEN-2015-091**



**2.1. Interconnection Customer Facilities** – The Interconnection Customer will be responsible for its Generating Facility and its one (1) 230/34.5 kV transformer that connect to the wind generators to the Point of Interconnection. In addition, the Interconnection Customer will be required to install the following equipment in its facilities.

**2.1.1. Reactive Power Equipment** – The Customer will be responsible for reactive power compensation equipment to maintain 95% lagging (providing vars) and 95% leading (absorbing vars) power factor at the POI, which may be provided in part by the reactive power capability of the generators. Any capacitor banks installed by the Interconnection Customer shall not cause voltage distortion in accordance with Article 9.7.4 of the standard SPP Generator Interconnection Agreement.

**3. Conclusion**

The Interconnection Customer’s Interconnection Facilities and Non-Shared Network Upgrades are estimated at \$3,224,682.