



INTERCONNECTION FACILITIES STUDY REPORT

GEN-2015-046
(IFS-2015-002-46)

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By SPP Generator Interconnections Dept.

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION	COMMENTS
4/10/2017	SPP	Initial draft report issued.	
2/02/2018	SPP	Final report revision 1 issued.	To account for DISIS-2015-002-4 Upgrades and MISO DISIS-2015-002 Restudy (1/18/2018)
4/12/2019	SPP	Final report revision 2 issued.	Updated costs in Table 1 and removed Shared Network Upgrade in Table 2 per DISIS-2015-002-8.

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SUMMARY

INTRODUCTION

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2015-046/IFS-2015-002-46 is for a 300.00 MW generating facility located in Williams County, North Dakota. 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 Restudies. 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 one-hundred-fifty (150) 2.0 MW Vestas V110 wind generators for a total generating nameplate capacity of 300.00 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 345 kV transformation substation with associated 34.5 kV and 345 kV switchgear;
- Two (2) 345/34.5 kV 120/160/200 MVA (ONAN/ONAF/ONAF) step-up transformers to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation;
- A nineteen-and-a-half (19.5) mile overhead 345 kV line to connect the Interconnection Customer's substation to the POI at the 345 kV bus at the planned BEPC substation ("Tande") 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 40.0 Mvars¹ 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.

¹ 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.

Error! Reference source not found. 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)

TOIF and Non-Shared Network Upgrades Description	Total Cost Estimate (\$)	Allocated Percent (%)	Allocated Cost Estimate (\$)	Estimated Lead Time
<u>BEPC Tande Interconnection Substation:</u> Construct one (1) 345kV 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.	\$1,149,053	100%	\$1,149,053	18 Months
<u>BEPC Tande Interconnection Substation:</u> Construct one (1) 345kV breaker, breaker disconnect switches, structures, foundations, conductors, insulators, and all other associated work and materials.	\$1,667,915	100%	\$1,667,915	
Total	\$2,816,968	100%	\$2,816,968	

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)

Shared Network Upgrades Description	Total Cost Estimate (\$)	Allocated Percent (%)	Allocated Cost Estimate (\$)
None	\$0	N/A	\$0
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.

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
Judson – Tande 345kV Circuit #1: assigned in Integrated System/Upper Missouri Zone (IS/UMZ) Integration Study.	\$86,000,000	In Service
Neset – Tande 230kV Circuit #1: assigned in Integrated System/Upper Missouri Zone (IS/UMZ) Integration Study	\$3,000,000	In Service
Tande 345/230/13kV Substation and Transformer Circuit #1: assigned in Integrated System/Upper Missouri Zone (IS/UMZ) Integration Study.	\$18,000,000	In Service

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
<u>None</u>	\$0	N/A	\$0
Total Affected System Upgrades	\$0		\$0

Big Stone South – Ellendale MVP Project was included in MISO analysis with an anticipated in-service date by 12/31/2019. Therefore the DISIS-2015-002 Group 9 and Group 16 request are conditional to the MVP project being in-service.

CONCLUSION

After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 300.00 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

Description	Allocated Cost Estimate
Transmission Owner Interconnection Facilities	\$1,149,053
Network Upgrades	\$1,667,915
Total	\$2,816,968

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.

1. Introduction

Interconnection Customer has requested an Interconnection Facilities Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnecting a 300.00 MW wind generation facility in Williams County, North Dakota to the transmission system of Basin Electric Power Cooperative (BEPC). The generator facility, GEN-2015-046, is comprised of one-hundred fifty (150) 2.0 MW Vestas V110 wind generators for a total generating nameplate capacity of 300.00 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-2015-046/IFS-2015-002-46 is planned to interconnect at the BEPC owned 345kV bus located at Tande Substation. The estimated lead time for Transmission Owner Interconnection Facilities and Network Upgrades is eighteen (18) months after a fully executed Generator Interconnection Agreement (GIA).

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

Description	Total Project Cost	Allocated Cost
<p><u>Tande Interconnection Substation:</u> Construct one (1) 345kV 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.</p>	\$1,149,053	\$1,149,053
<p><u>Tande Interconnection Substation:</u> Construct one (1) 345kV breaker, breaker disconnect switches, structures, foundations, conductors, insulators, and all other associated work and materials.</p>	\$1,667,915	\$1,667,915
Total:	\$2,816,968	\$2,816,968

2.1. Interconnection Customer Facilities – The Interconnection Customer will be responsible for its Generating Facility and its two (2) 345/34.5 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 \$2,816,968.