

INTERCONNECTION FACILITIES STUDY REPORT

GEN-2016-017 IFS-2016-001-08

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By SPP Generator Interconnections Dept.

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
8/23/2018	SPP	Initial draft report issued.
11/12/2018	SPP	Final report issued. Updated cost change in Table 1, 2 and 6.
10/15/2019	SPP	 Revise Transmission Owner report attached. Change in requirement under Section 3.2 last bullet point from 12 MVAR to 67 MVAR. Updated Table 5 Affected System Upgrade(s) from "TBD" to "None.

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SUMMARY

INTRODUCTION

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2016-017/IFS-2016-001-08 is for a 250.7 MW generating facility located in Hyde County, SD. The Interconnection Request was studied in the DISIS-2016-001 Impact Study and DISIS-2016-001-1 Impact Restudy for ERIS. The Interconnection Customer's requested in-service date is 12/1/2017.

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. SPP has determined that full Interconnection Service will be available after the assigned transmission owner interconnect facilities (TOIF), non-shared network upgrades, shared network upgrades, previously allocated, and affected system upgrades that are required for full interconnection service 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 creditable-type 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).

Southwest Power Pool, Inc.

INTERCONNECTION CUSTOMER INTERCONNECTION FACILITIES

The Generating Facility is proposed to consist of One hundred nine (109) GE 2.3 - 116, 2.3MW wind turbines for a total generating nameplate capacity of 250.7 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 collector circuits;
- 34.5 kV to 345 kV transformation substation with associated 34.5 kV and 345 kV switchgear;
- One (1) 34.5/345 kV, 170/220/280 MVA (ONAN/ONAF/ONAF) step-up transformers to be owned and maintained by the Triple H Wind at the Interconnection Customer's substation;
- A 0.5 mile overhead 345 kV line to connect the Interconnection Customer's substation to the Point of Interconnection ("POI") at the 345 kV bus at a new BEPC Substation ("Tap Leland Olds Fort Thompson 345kV") 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 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 11.5 Mvars¹ of reactors or turbine inverters will be required to compensate for injection of reactive power into the transmission system under no/reduced generating conditions. The Interconnection Customer may use 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 GEN-2016-017 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.

Transmission Owner Interconnection Facilities (TOIF)	Total Cost Estimate (\$)	Allocated Percent (%)	Allocated Cost Estimate (\$)	Estimated Lead Time
BEPC Tap Leland Olds - Fort Thompson 345kV Interconnection Substation: Construct a new 345kV Switchyard with 3 breaker ring bus configuration with 345kV line terminals, 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.	\$2,304,000	100%	\$2,304,000	27 Months
Total	\$2,304,000	100%	\$2,304,000	

Table 1: Transmission Owner Interconnection Facilities (TOIF)

Table 2: Non-Shared Network Upgrade(s)

Non-Shared Network Upgrades Description	Z2 Type ²	Total Cost Estimate (\$)	Allocated Percent (%)	Allocated Cost Estimate (\$)	Estimated Lead Time
BEPC Tap Leland Olds- Fort Thompson 345kV Interconnection Substation: Construct three (3) 345kV 3000 continuous ampacity breakers, control panels, line relaying, acquire land, disconnect switches, structures, foundations, conductors, insulators, and all other associated work and materials.	non- creditable	\$20,753,774	100%	\$20,753,774	27 Months
Total		\$20,753,774	100%	\$20,753,774	

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² Indicates the method used for calculating credits 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.

Shared Network Upgrades Description	Z2 Type	Total Cost Estimate (\$)	Allocated Percent (%)	Allocated Cost Estimate (\$)	Estimated Lead Time
None	-	-	-	-	
Total		-	-	-	

Table 3: Interconnection Customer Shared Network Upgrades

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.

PREVIOUS NETWORK UPGRADE(S)

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

Previous Network Upgrade(s) Description	Current Cost Assignment	Estimated In- Service Date
None	-	-

Depending upon the status of higher- or equally-queued customers, the Interconnection Request's inservice date is at risk of being delayed or Interconnection Service is at risk of being reduced until the inservice date of these Previous Network Upgrades. Southwest Power Pool, Inc.

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 5** 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 5: Interconnection Customer Affected System Upgrade(s)

Affected System Upgrades Description	Total Cost Estimate (\$)	Allocated Share (%)	Allocated Cost Estimate (\$)
None	-	-	-
Total	-	-	-

CONCLUSION

After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 250.7 MW can be granted. Interconnection Service will be delayed until the transmission owner interconnect facilities (TOIF), non-shared network upgrades, shared network upgrades, previously allocated, and affected system upgrades that are required for full interconnection service are completed. The Interconnection Customer's estimated cost responsibility is summarized in the table below.

Table 6: Cost Summary

Description	Allocated Cost Estimate
Transmission Owner Interconnection Facilities	\$2,304,000
Network Upgrades	\$20,753,774
Affected System Upgrades	None
Total	\$23,057,774

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).



A: TRANSMISSION OWNER'S INTERCONNECTION FACILITIES STUDY REPORT

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

Basin Electric Power Cooperative Facility Study Analysis GI Cluster Impact Study DISIS-2016-001 GEN-2016-017

1. Background:

Per SPP Generation Interconnection Process 2014 revision¹, Basin Electric Power Cooperative (Basin Electric) received a request to perform a DISIS Facility Study Analysis for the following Interconnection Request:

GI Request #	Point of Interconnection	Capacity (MW)	Fuel Type	Comments
GEN-2016-017	Tap Fort Thompson-Leland Olds 345kV	250.7	Wind	The location of this new switching station is approximately 30 miles from Fort Thompson 345kV on the Fort Thompson – Leland 345kV transmission line. Please verify that this location for a new station is acceptable.

¹ SPP Tariff Attachment V Generator Interconnection Procedures (GIP) Section 8.4.4

2. Study Requirements:

Basin Electric has performed this Facility Study Analysis in accordance with SPP Tariff Attachment V, Generator Interconnection Procedures (GIP) Section 8.4.4 for the Interconnection Request(s) as described in Section 1.

- 2.1. The Facility Study Analysis includes an evaluation of the following:
 - **2.1.1.** Perform/develop a substation layout, perform a preliminary bus design, determine all electrical equipment requirements, and determine a suitable site location to accommodate the Request. Develop/compile cost estimates for all Basin Electric labor, overheads, equipment additions, modifications, etc. to accommodate the generator interconnection.
 - **2.1.2.** Develop an overall construction schedule for completion of the necessary additions and/or modifications.
 - **2.1.3.** Point Of Change of Ownership. For the purposes of this Study Analysis, the Point of Change of Ownership location is defined as the take-off structure(s) at the Basin Electric Substation/Switching Station where the Interconnection Customer's transmission line(s) connects to the take-off structure(s). Interconnection Customer will furnish and install the conductor jumper and insulator assembly to the take-off structure(s).
 - 2.1.4. Other Interconnection/Metering Requirements. Basic indication, metering, monitoring, control, and relaying requirements due to a generator interconnection are included in the cost estimate. Basin Electric's generation metering requirements, as an SPP Transmission Owner, must be met. A list of specific needs will be provided by Basin Electric once design has progressed.

3. Study Results for GEN-2016-017:

The following results document the analysis of the required facilities for this Interconnection Request as outlined in Section 1 for a new 345kV Switchyard. Basin Electric has determined that the following additions and improvements are required to maintain a safe and reliable interconnection to Basin Electric's transmission system.

3.1. Transmission Line/Transmission Structures

The total transmission structures required for the transmission cut-in near existing structure 022-514 on the Fort Thompson to Leland Olds 345kV transmission line will depend on the final switchyard layout and arrangement relative to the line. For purposes of this Study and cost estimate, it is assumed that four (4) new 90 degree steel monopole deadend structures on drilled piers will be required for the cut-in, and one existing lattice tower transmission structure will need to be removed with foundations removed to a depth of 4' below grade. It is assumed 3000 circuit feet of new conductor (2312 kcmil) and 6000 feet of static wire will be installed. This line does not have OPGW.

No additional ROW is anticipated or accounted for in this study beyond the switchyard site land acquisition.

3.2. Substation/Switchyard

A new 345kV Switchyard will be built to accommodate the new generation resource interconnection. This switchyard will initially be built in a 3 breaker ring bus configuration with future potential to be converted to a breaker-and-a-half configuration with 6 line terminals. The grading plan, control building, and any common infrastructure will be sized appropriately for the ultimate build out configuration. All equipment will follow Basin Electric's internal design standards for minimum BIL, ampacity, and fault capabilities.

The associated work at the new 345kV Switchyard is shown in Section 3.7 and includes the following major additions:

- (3) 345kV Line Take-Off
- (3) 345kV Breakers
- (8) 345kV Breaker Disconnect Switches
- (3) Sets of Line Potential Transformers
- (3) Sets of Line Surge Arrestors
- (1) 67 MVAR 345 kV oil filled Line Reactor on the Leland Olds Line Terminal. This
 reactor is new equipment with the existing reactor on the Leland Olds Ft.
 Thompson circuit remaining at Ft. Thompson

Additional associated work will include a review and update to relay/protection schemes and SCADA RTU configurations at both the Fort Thompson and Leland Olds line terminals.

3.3. Environmental Requirements

Compliance with all applicable federal, state and local regulations will be strictly adhered to. Additionally, all applicable and required permits and approvals will be obtained prior to construction. For the purposes of this Study, it is anticipated that this new 345kV Switchyard will require incidental minor local permitting.

3.4. Cost Estimate

GEN-2016-017 Estimated Costs	Transmission Current Year \$	Switchyard Current Year \$	Total Current Year \$
Engineering Labor	\$250,000	\$1,488,560	\$1,738,560
Construction Labor	\$980,000	\$8,149,690	\$9,129,690
Material	\$690,000	\$8,749,241	\$9,439,241
Contingency	\$384,000	\$2,366,283	\$2,750,283
Sub-Total	\$2,304,000	\$20,753,774	\$23,057,774

3.5. Construction Schedule

The preliminary project schedule provided is for planning level purposes only and will be adjusted with additional project definition. If it is determined that NEPA and/or ROW condemnation is required, 12-18 months will be added to the In-Service date.

Activity	Duration	Estimated Start	Estimated Finish
Receive NTC From SPP		Month 0	
Project Planning	1 Month	Month 0	Month 1
Land Acquisition/Environmental	7 Months	Month 1	Month 8
Engineering Design	6-9 Months	Month 1	Month 10
Equipment Procurement	12-14 Months	Month 2	Month 16
Advertise and Award Construction Contracts	2-3 Months	Month 9	Month 12
Construction	10-14 Months	Month 12	Month 26
Energize and In-Service Date	1 Month	Month 26	Month 27



LEGEND:

■ EXISTING EQUIPMENT

- NON SHARED NETWORK UPGRADES
- SHARED NETWORK UPGRADES
- TRANSMISSION OWNERS INTERCONNECTION FACILITIES
- INTERCONNECTION CUSTOMER INTERCONNECTION FACILITIES

FUTURE







GEN-2016-017 GREENFIELD SWITCHYARD



POINT OF INTERCONNECTION DETAIL