



INTERCONNECTION FACILITIES STUDY REPORT

GEN-2016-028
(IFS-2016-001-38)

Published January 2018

By SPP Generator Interconnections Dept.

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION	COMMENTS
12/13/2017	SPP	Initial draft report issued.	
1/4/2018	SPP	Initial final report issued.	

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SUMMARY

INTRODUCTION

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2016-028/IFS-2016-001-38 is for a 100.00 MW generating facility located in Pushmataha County, Oklahoma. The Interconnection Request was studied in the DISIS-2016-001 Impact Study and DISIS-2016-001-1 Impact Restudy for Energy Resource Interconnection Service (ERIS) only. The Interconnection Customer's requested in-service date is December 31, 2018.

The interconnecting Transmission Owner, American Electric Power Oklahoma Transmission Company, Inc. (AEPOK), 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 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 fifty (50) 2.0 MW Vestas V110 VCSS wind generators for a total generating nameplate capacity of 100.00 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 138 kV transformation substation with associated 34.5 kV and 138 kV switchgear;
- One (1) 138/34.5kV 69/92/110 MVA (ONAN/ONAF/ONAF) step-up transformers to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation.
- An approximate seven (7) mile overhead 138 kV line to connect the Interconnection Customer's substation to the Point of Interconnection (POI) at the 138 kV bus at existing AEPOK substation ("Clayton") that is owned and maintained by AEPOK;
- 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 8.4 Mvars¹ of reactors will be required to compensate for injection of reactive power into the transmission system under no/reduced generating conditions. The Interconnection Customer may use inverter 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-2016-028 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.

Table 1: Transmission Owner Interconnection Facilities (TOIF)

Transmission Owner Interconnection Facilities (TOIF)	Total Cost Estimate (\$)	Allocated Percent (%)	Allocated Cost Estimate (\$)	Estimated Lead Time
<u>AEPOK Clayton Interconnection Substation: Transmission Owner Interconnection Facilities</u> 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.	\$700,000	100%	\$700,000	30 months
Total	\$700,000	100%	\$700,000	

Table 2: Non-Shared Network Upgrade(s)

Non-Shared Network Upgrades Description	Total Cost Estimate (\$)	Allocated Percent (%)	Allocated Cost Estimate (\$)	Estimated Lead Time
<u>AEPOK Clayton Interconnection Substation - Non-Shared Network Upgrades</u> Construct a three breaker ring bus, three (3) 138 kV 2000 continuous ampacity breakers, control panels, line relaying, cut in transmission line and re-terminate, acquire land, disconnect switches, structures, foundations, conductors, insulators, and all other associated work and materials.	\$6,898,000	100%	\$6,898,000	30 Months
<u>AEPOK Lone Oak - Broken Bow 138kV Substation - Non-Shared Network Upgrades</u> Install turning structures and replace relay panels at Lone Oak.	\$1,502,000	100%	\$1,502,000	
Total	\$8,400,000	100%	\$8,400,000	

SHARED NETWORK UPGRADE(S)

The Interconnection Customer's share of costs for Shared Network Upgrades is estimated in **Table 3** below.

Table 3: Interconnection Customer Shared Network Upgrades

Shared Network Upgrades Description	Total Cost Estimate (\$)	Allocated Percent (%)	Allocated Cost Estimate (\$)
Currently None	\$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.

Table 4: Interconnection Customer Other Network Upgrade(s)

Other Network Upgrade(s) Description	Current Cost Assignment	Estimate In-Service Date
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 100.00 MW can be granted. Interconnection Service will be delayed until the Transmission Owner Interconnection Facilities and Non-Shared Network Upgrade(s) are completed. The Interconnection Customer's estimated cost responsibility for Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades is summarized in the table below.

Table 5: Cost Summary

Description	Allocated Cost Estimate
Transmission Owner Interconnection Facilities	\$700,000
Network Upgrades	\$8,400,000
Total	\$9,100,000

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.

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 100.00 MW wind facility in Le Flore County, Oklahoma to the transmission system of American Electric Power Oklahoma Transmission Company, Inc. (AEPOK). The generator facility, GEN-2016-028, is comprised of fifty (50) 2.0 MW Vestas V110 VCSS wind generators for a total generating nameplate capacity of 100.00 MW.

2. Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades

The cost for the Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades is listed below in Table 1 and Table 2. GEN-2016-028/IFS-2016-001-38 is planned to interconnect at the AEPOK owned 138 kV bus located at existing Clayton Substation. The estimated lead time for Transmission Owner Interconnection Facilities and Network Upgrades is thirty (30) months after a fully executed Generator Interconnection Agreement (GIA). The one-line diagram is shown in **Figure 1**.

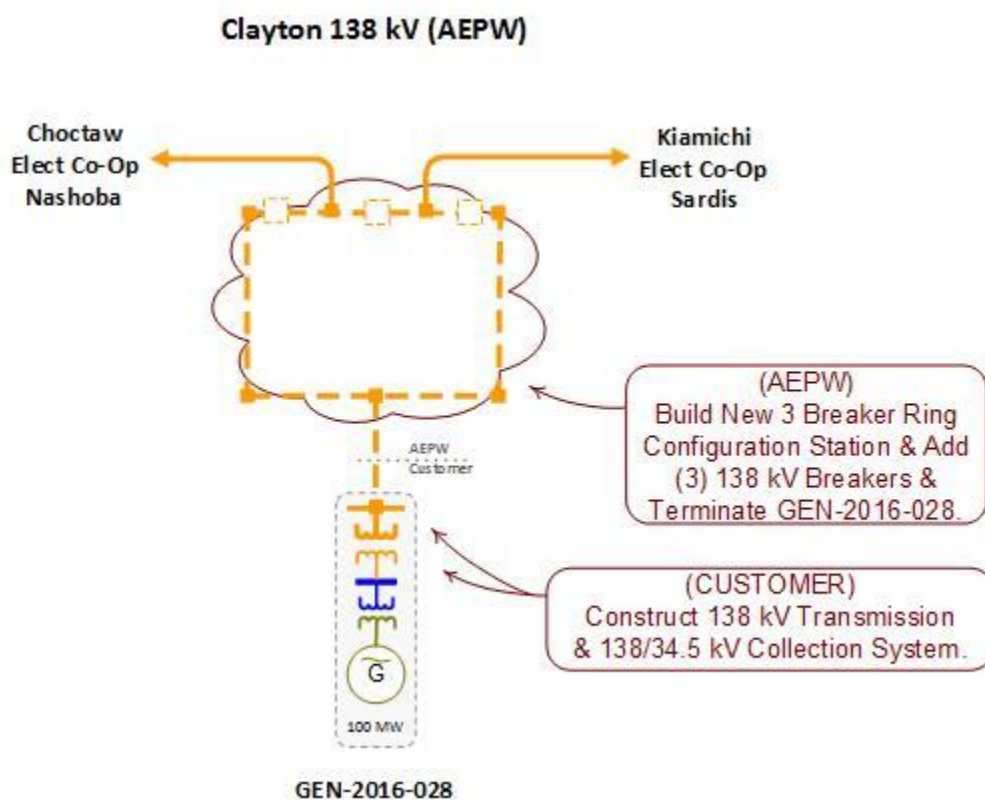
Table 1: Required Transmission Owner Interconnection Facilities

Description	Total Project Cost	Allocated Cost
<u>AEPOK Clayton Interconnection Substation: Transmission Owner Interconnection Facilities</u> 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.	\$700,000	\$700,000
Total:	\$700,000	\$700,000

Table 2: Non Shared Network Upgrades

Description	Total Project Cost	Allocated Cost
<u>AEPOK Clayton Interconnection</u> <u>Substation - Non-Shared Network</u> <u>Upgrades</u> Construct a three breaker ring bus, three (3) 138 kV 2000 continuous ampacity breakers, control panels, line relaying, cut in transmission line and re-terminate, acquire land, disconnect switches, structures, foundations, conductors, insulators, and all other associated work and materials.	\$6,898,000	\$6,898,000
<u>AEPOK Lone Oak – Broken Bow 138kV</u> <u>Substation - Non-Shared Network</u> <u>Upgrades</u> Install turning structures and replace relay panels at Lone Oak.	\$1,502,000	\$1,502,000
Total:	\$8,400,000	\$8,400,000

Figure 1: Interconnection Configuration for GEN-2016-028



2.1. Interconnection Customer Facilities – The Interconnection Customer will be responsible for its Generating Facility and its one (1) 138/34.5 kV transformers 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 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, 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 Shared Network Upgrades are estimated at \$9,100,000.