



INTERCONNECTION FACILITIES STUDY REPORT

GEN-2016-118
(IFS-2016-002-05)

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Generator Interconnections Dept.

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
06/10/2019	SPP	Initial draft report issued.
07/12/2019	SPP	Final report issued.
8/24/2020	SPP	Updated final report issued. Updated Table 5 and Table 6.

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SUMMARY

INTRODUCTION

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2016-118/IFS-2016-002-05 is for a 288.00 MW generating facility located in Kingfisher County, Oklahoma. The Interconnection Request was studied in the DISIS-2016-002 Impact Study for Energy Resource Interconnection Service (ERIS) and Network Resource Interconnection Service (NRIS). The interconnection customer elected not to pursue NRIS in the Facility Study Agreement. The Interconnection Customer's original requested Commercial Operation Date (COD) was 12/1/2019. The COD was revised in the Facility Study Agreement to 9/1/2020.

The interconnecting Transmission Owner, Western Farmers Electric Cooperative (WFECC), performed a detailed IF 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 (TOIF), Non-Shared Network Upgrades, Shared Network Upgrades, Previous Network Upgrades, 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, full 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).

INTERCONNECTION CUSTOMER INTERCONNECTION FACILITIES

The Generating Facility is proposed to consist of one hundred forty four (144) Vestas 2.0 MW wind generators for a total generating nameplate capacity of 288.00 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:

- 34.5kV underground cable collection circuits;
- 34.5kV to 138kV transformation substation with associated 34.5kV and 138kV switchgear;
- Two (2) 138kV/34.5kV 90/120/150 MVA (ONAN/ONAF/ONAF) step-up transformers to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation;
- Approximately ten (10) mile overhead 138kV line to connect the Interconnection Customer's substation to the Point of Interconnection ("POI") at the 138kV bus at existing Transmission Owner substation ("Dover Switchyard") that is owned and maintained by Transmission Owner;
- 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. 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.

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>Transmission Owner's 138kV Dover Switch Interconnection Substation:</u> Construct one 138kV 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.	\$400,000	100%	\$400,000	27 Months
Total	\$400,000	100%	\$400,000	

Table 2: Non-Shared Network Upgrade(s)

Non-Shared Network Upgrades Description	Z2 Type ¹	Total Cost Estimate (\$)	Allocated Percent (%)	Allocated Cost Estimate (\$)	Estimated Lead Time
<u>Transmission Owner's 138kV Dover Switch Interconnection Substation:</u> Construct a new breaker and half configuration, eleven (11) 138kV 2000 continuous ampacity breakers, control panels, line relaying, re-terminate, transferring 138/69 kV autotransformer to the new station, acquire land, disconnect switches, structures, foundations, conductors, insulators, and all other associated work and materials.	non-creditable	\$6,100,000	100%	\$6,100,000	27 Months
<u>Oklahoma Gas & Electric (OKGE):</u> Dover - Hennessey 138kV CKT 1 Upgrade terminal equipment from 800A CT to 1200A CT.	creditable	\$142,965	100%	\$142,965	2 Months

¹ Indicates the method used for calculating credit impacts under Attachment Z2 of the Tariff.

Non-Shared Network Upgrades Description	Z2 Type ¹	Total Cost Estimate (\$)	Allocated Percent (%)	Allocated Cost Estimate (\$)	Estimated Lead Time
<u>OKGE's Network Upgrades:</u> Update relay settings	non-creditable	\$10,000	100%	\$10,000	TBD
Total		\$6,252,965		\$6,252,965	

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	Z2 Type	Total Cost Estimate (\$)	Allocated Percent (%)	Allocated Cost Estimate (\$)	Estimated Lead Time
None	N/A	\$0	N/A	\$0	N/A
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.

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.

Table 4: Interconnection Customer Previous Network Upgrade(s)

Previous Network Upgrade(s) Description	Current Cost Assignment	Estimated In-Service Date
None	\$0	N/A

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 Previous 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 5** displays the current impact study costs 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 (\$)
<u>Associated Electric Cooperative, Inc. (AECI) Affected System Study Cycle</u> Projects: Rebuild the 11.4-mile-long Linden to Phelps 69 kV line to 336 ACSR Need Date: 2021 Year in Service: 2021	\$4,708,000	2.7%	\$128,492
<u>AECI Affected System Study Cycle</u> Projects: Rebuild the 18-mile-long Hamburg to Northboro 69 kV line to 336 ACSR. Need Date: 2021 Year in Service: 2021	\$7,434,000	2.5%	\$188,638
<u>AECI Affected System Study Cycle</u> Projects: Rebuild the 4.4-mile-long Phelps to Rockport 69 kV line to 336 ACSR. Need Date: 2021 Year in Service: 2021	\$1,817,000	2.5%	\$46,086

<u>AECI Affected System Study Cycle</u> Projects: Rebuild the 4.136-mile-long Bevier to Macon Lake 69 kV line to 477 ACSR. Need Date: 2021 Year in Service: 2021	\$2,938,000	3%	\$87,892
<u>AECI Affected System Study Cycle</u> Projects: Rebuild the 2.2-mile-long Macon Lake to Axtell to Macon Tap 69 kV line to 477 ACSR; operate at 69 kV. Need Date: 2021 Year in Service: 2021	\$1,562,000	2.9%	\$45,289
<u>AECI Affected System Study Cycle</u> Projects: Upgrade 10.92 mile section of Neosho to Sweetwater 69 kV line to 336 ACSR. Need Date: 2021 Year in Service: 2021	\$6,273,000	5.1%	\$318,190
<u>AECI Affected System Study Cycle</u> Projects: Add 0.08 p.u. series reactor on Washburn to Seligman 69 kV line Need Date: 2021 Year in Service: 2021	\$675,000	4.7%	\$32,006
Total	\$15,399,300		\$846,594

*Refer to [AECI AFS of DISIS-2016-002](#) Report for specific upgrade details.

CONCLUSION

After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 288.00 MW can be granted. Full Interconnection Service will be delayed until the TOIF, Non-Shared Network Upgrades, Shared Network Upgrades, Previous Network Upgrades, Affected System Upgrades that are required are completed. The Interconnection Customer's estimated cost responsibility for TOIF, Non-Shared Network Upgrades and Affected System Upgrades are summarized in the table below.

Table 6: Cost Summary

Description	Allocated Cost Estimate
Transmission Owner Interconnection Facilities	\$400,000
Network Upgrades	\$6,252,965
Affected System Upgrades	\$846,594
Total	\$7,499,559

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 AND NETWORK UPGRADES REPORT(S)

See next page for the Transmission Owner's Interconnection Facilities Study Report and Network Upgrades Report(s).



FACILITY STUDY

for

Generation Interconnection Request 2016-118

288MW Wind Generation in Kingfisher County near Hennessey, OK.

April 2019

SUMMARY

Pursuant to the tariff and at the request of the Southwest Power Pool (SPP), Western Farmers Electric Cooperative (WFEC) performed the following facility Study to satisfy the Facility Study agreement executed by the requesting customer for SPP Generation Interconnection request Gen-2016-118. The request for interconnection was placed with SPP in accordance with SPP's Open Access Transmission Tariff, which covers new generation interconnections on SPP's transmission system. The requirements for interconnection consist of rebuilding WFEC Dover Switch Station from a ring bus to a breaker-and-half configuration to support an additional 138kV terminal. The total cost for WFEC to expand Dover Switch Station to accommodate the interconnection request is \$6,500,000.

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Introduction

The Southwest Power Pool has requested a facility Study for the purpose of interconnecting 288MW of wind generation within the service territory of WFEC in Kingfisher County, Oklahoma. The proposed 138kV interconnection is at Dover Switch Station, this station is owned by WFEC.

The cost for reconfiguring Dover Switch and adding a 138kV terminal to the switch station, the required interconnection facility, is estimated at \$6,500,000.

SPP's DISIS-2016-002 identified network upgrades required on WFEC's system associated with GEN-2016-118. Cost for those upgrades are not included in this Facility Study as only stand-alone interconnection cost are considered, and the allocated cost of network upgrades to the customer may fluctuate depending on withdrawal of higher queued projects.

Network constraints within WFEC, OG&E, and AEP may be verified with a transmission service request and associated studies.

Interconnection Facilities

The primary objective of this study is to identify interconnection facilities. The existing Dover Switch Station has reached the recommended limits for the number of terminals served from a ring bus configuration (6). Figure 1 below shows the current running arrangement of Dover Switch 138kV.

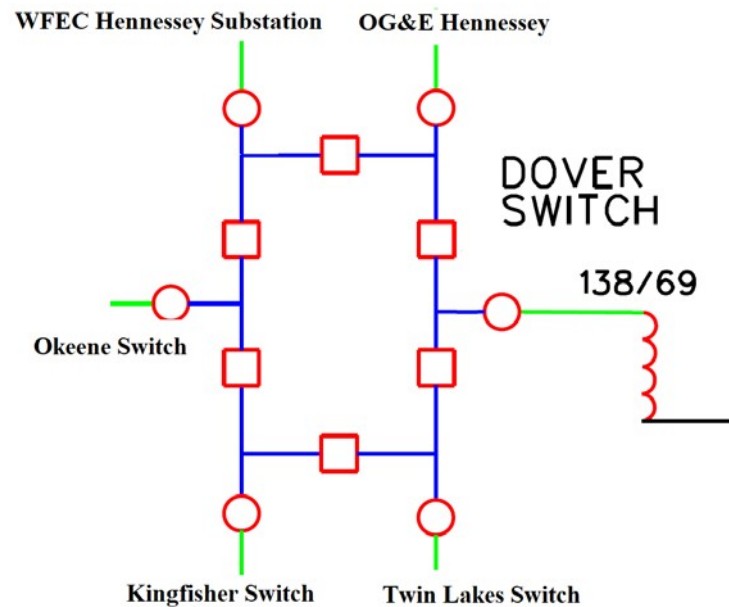


Figure 1: Existing WFEH Dover Switch Station

To accommodate a 7th 138kV terminal into Dover Switch for GEN 2016-118 WFEH will reconfigure the station from a Ring bus to a breaker-and-half arrangement, as shown below in Figure 2. The customer will construct a new 138kV transmission line from their wind farm collector sub to the WFEH Dover Switch Station. WFEH will require the customer to install OPGW for communications from Customer's wind farm collector sub to WFEH's switch station.

The total cost for WFEH to add a new 138kV terminal in the switch station for the interconnection is estimated at \$6,500,000. This cost does not include the construction of the 138kV line from the customer substation into the new terminal at Dover Switch Station. The customer is responsible for this

138kV line up to the point of interconnection. This cost does not include the Customer's 138/34.5kV substation and this cost estimate should be determined by the Customer.

This facility study does not guarantee the availability of transmission service necessary to deliver additional generation to any specific point inside or outside of the SPP transmission system. The transmission network facilities may not be adequate to deliver any additional generation output to the system. If the customer requests firm transmission service under the SPP open access transmission tariff at a future date, Network Upgrades or other new construction may be required to provide the service requested under the SPP OATT.

The costs of interconnecting the facility to the WFEC transmission system are listed in Table 1 below.

Short Circuit Fault Duty Evaluation:

It is standard practice for WFEC to recommend replacing a circuit breaker when the current through the breaker for a potential fault exceeds 100% of its interrupting rating, as determined by the ANSI/IEEE standard C37-010-2016 breaker rating methods.

WFEC has evaluated the potential maximum fault current in this area and no issues with short circuit duty ratings are expected on existing WFEC breakers with the proposed interconnection of 288MW at Dover Switch 138kV.

Interconnection Cost

Table 1: Required Interconnection Facilities

Facilities	Estimated Cost (2019 Dollars)
Transmission Owner Interconnection Facilities (TOIF) WFEC Dover Switch Interconnection Substation: Construct one (1) 138 kV line terminal connection terminal 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.	\$400,000
Non-Shared Network Upgrades WFEC Dover Switch Interconnection Substation: Construct a new breaker and half configuration, eleven (11) 138 kV 2,000 continuous ampacity breakers, control panels, line relaying, re-terminate, transferring 138/69 kV autotransformer to the new station, acquire land, disconnect switches, structures, foundations, conductors, insulators, and all other associated work and materials.	\$6,100,000
	\$6,500,000

One-Line diagram of Interconnection

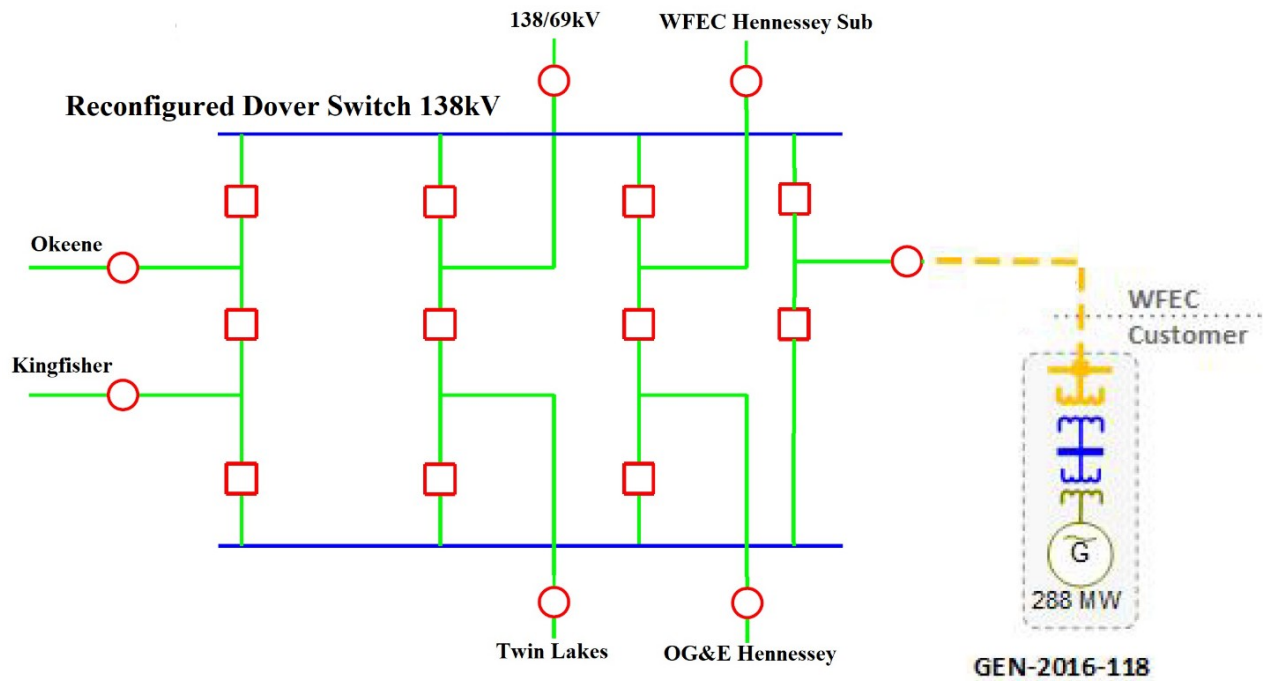


Figure 2: Proposed WFEC Dover Switch Station 138kV



FACILITY STUDY

for

Generation Interconnection Request 2016-118

288 MW Wind Generating Facility
In Kingfisher County
Oklahoma

April 11, 2018

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OG&E Electric Services

Summary

Pursuant to the tariff and at the request of the Southwest Power Pool (SPP), Oklahoma Gas and Electric (OG&E) performed the following Facility Study to satisfy the Facility Study Agreement executed by the requesting customer for SPP Generation Interconnection request Gen-2016-118. The request for interconnection was placed with SPP in accordance SPP's Open Access Transmission Tariff, which covers new generation interconnections on SPP's transmission system. The request is for adding a new 288 MW wind facility whose Point of Interconnection is at an adjacent substation to OG&E's Hennessey substation. No new or additional facilities are necessary to accommodate the additional generation. The new generating facility will require updated relay settings estimated at \$10,000.

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Introduction

The Southwest Power Pool has requested a Facility Study for the purpose of interconnecting 288 MW of new wind generation to an existing Point of Interconnection adjacent to the service territory of OG&E Electric Services (OKGE) in Kingfisher County Oklahoma. The proposed 138kV point of interconnection is at the existing Dover Switchyard Substation in Kingfisher County. This substation is owned by WFEC.

Network Constraints in the American Electric Power West (AEPW), OKGE and Western Farmers Electric Cooperative (WFEC) systems may be verified with a transmission service request and associated studies.

Interconnection Facilities

The primary objective of this study is to identify attachment facilities. There are no requirements for additional interconnection facilities at OG&E's Hennessey substation.

This Facility Study does not guarantee the availability of transmission service necessary to deliver the additional generation to any specific point inside or outside the Southwest Power Pool (SPP) transmission system. The transmission network facilities may not be adequate to deliver the additional generation output to the transmission system. If the customer requests firm transmission service under the SPP Open Access Transmission Tariff at a future date, Network Upgrades or other new construction may be required to provide the service requested under the SPP OATT.

The costs of interconnecting the facility to the OKGE transmission system are listed in Table 1.

Short Circuit Fault Duty Evaluation

It is standard practice for OG&E to recommend replacing a circuit breaker when the current through the breaker for a fault exceeds 100% of its interrupting rating with recloser de-rating applied, as determined by the ANSI/IEEE C37.5-1979, C37.010-1979 & C37.04-1979 breaker rating methods.

For this generator interconnection, no breakers were found to exceed their interrupting capability after the addition of the Customer's 288 MW generation and related facilities. OG&E found no breakers that exceeded their interrupting capabilities on their system. Therefore, there is no short circuit upgrade costs associated with the Gen-2016-118 interconnection.

Table 1: Required Interconnection Network Upgrade Facilities

Facility	ESTIMATED COST (2018 DOLLARS)
OKGE – Interconnection Facilities - No new interconnection facilities necessary	\$0
OKGE – Network Upgrades Update relay settings	\$10,000
OKGE - Right-of-Way for 345kV terminal addition	No Additional ROW
Total	\$10,000

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April 11, 2018

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Dover Switchyard Substation (WFEC)

