



INTERCONNECTION FACILITIES STUDY REPORT

GEN-2016-020
(IFS-2016-001-27)

Published February 2019

By SPP Generator Interconnections Dept.

REVISION HISTORY

| DATE OR VERSION NUMBER | AUTHOR | CHANGE DESCRIPTION |
|---------------------------|--------|-------------------------------------------------------------------------------------------------|
| 06/06/2018 | SPP | Initial draft report issued. |
| 12/18/2018 | SPP | Final report issued. Added relay settings upgrade in Table 2 and updated total cost in Table 6. |
| 02/14/2019 | SPP | Updated costs, dates, and configuration of interconnection facilities. |

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SUMMARY

INTRODUCTION

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2016-020/IFS-2016-001-27 is for a 150.00 MW generating facility located in Woodward County, OK. The Interconnection Request was studied in the DISIS-2016-001 Impact Study for Energy Resource Interconnection Service (ERIS) and Network Resource Interconnection Service (NRIS) and DISIS-2016-001-1 Impact Restudy for ERIS only. The Interconnection Customer's requested in-service date is December 31, 2018.

The interconnecting Transmission Owner, Western Farmers Electric Cooperative (WFEC), 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, Non-Shared Network Upgrade(s), Previous 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 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 seventy-five (75) 2.0 MW V110 Vestas wind generators for a total generating nameplate capacity of 150.00 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;
- Two (2) 138 kV/34.5 kV 60/80/100 MVA (ONAN/ONAF/ONAF) step-up transformers to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation;
- A two and a half (2.5) 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 WFEC substation ("Mooreland") that is owned and maintained by WFEC;
- All transmission facilities required to connect the Interconnection Customer's substation to the POI; and,
- 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% leading and 95% lagging, in accordance with Federal Energy Regulatory Commission (FERC) Order 827. Additionally approximately 3.9 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-2016-020 as studied in the DISIS-2016-001 Impact Study and restudy.

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>WFEC Mooreland Interconnection Substation:</u> Construct one (1) 138 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 | 100% | \$400,000 | 19 Months |
| Total | \$400,000 | 100% | \$400,000 | |

Table 2: Non-Shared Network Upgrade(s)

| Non-Shared Network Upgrades Description | Z2 Type² | Total Cost Estimate (\$) | Allocated Percent (%) | Allocated Cost Estimate (\$) | Estimated Lead Time |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------------------------|------------------------------|-------------------------------------|----------------------------|
| <u>WFEC Mooreland Interconnection Substation:</u> Install two (2) 138 kV 2000 continuous ampacity breakers, control panels, line relaying, disconnect switches, structures, foundations, conductors, insulators, and all other associated work and materials. | non-creditable | \$5,600,000 | 100% | \$5,600,000 | 19 Months |
| <u>Oklahoma Gas and Electric (OKGE) Interconnection Substation:</u> Update relay settings and records. | non-creditable | \$10,000 | 100% | \$10,000 | 2 Months |
| Total | | \$5,610,000 | 100% | \$5,610,000 | |

² Indicates the method used for calculating credit 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.

Table 3: Interconnection Customer Shared Network Upgrades

| Shared Network Upgrades Description | Z2 Type | Total Cost Estimate (\$) | Allocated Percent (%) | Allocated Cost Estimate (\$) | Estimated Lead Time |
|-------------------------------------|---------|--------------------------|-----------------------|------------------------------|---------------------|
| <u>None</u> | N/A | \$0 | N/A | \$0 | N/A |
| 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.

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 | Estimate In-Service Date |
|---------------------------------------------------------------------------------------|--------------------------------|---------------------------------|
| Cimarron – Draper Lake 345 kV CKT 1 assigned in 2015 ITP10 per SPP NTC-200416. | \$1,500,000 | 4/1/2019 |
| Cleo Corner – Cleo Plant Tap 138 kV CKT 1 assigned in DISIS-2015-002. | \$61,890 | 6/14/2019 |

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

CONCLUSION

After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 150.00 MW can be granted. Interconnection Service will be delayed until the Transmission Owner Interconnection Facilities, Non-Shared Network Upgrade(s), and Previous Network Upgrade(s) are completed. The Interconnection Customer's estimated cost responsibility for Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades are summarized in the table below.

Table 6: Cost Summary

| Description | Allocated Cost Estimate |
|-----------------------------------------------|--------------------------------|
| Transmission Owner Interconnection Facilities | \$400,000 |
| Network Upgrades | \$5,610,000 |
| Total | \$6,010,000 |

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.



A Touchstone Energy® Cooperative 

FACILITY STUDY

for

Generation Interconnection Request
2016-020

150MW Wind Generation in Woodward County near Mooreland, OK.

February 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-2016-020. 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 adding two circuit breakers and a line terminal to Mooreland Switch Station. The total cost for WFEC to expand Mooreland Switch Station to accommodate the interconnection request is \$6,000,000.

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Introduction

The Southwest Power Pool has requested a facility Study for the purpose of interconnecting 150MW of wind generation within the service territory of WFEC in Woodward County, Oklahoma. The proposed 138kV interconnection is a Mooreland Switch Station in Woodward County, Oklahoma. This station is owned by WFEC.

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

SPP's DISIS-2016-001 identified network upgrades required on WFEC's system associated with GEN-2016-020. 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 Mooreland Switch Station is an aged facility arranged in a Main and Transfer design. Due to equipment that has reached the end of its lifespan as well as overdutied circuit breakers it is in the WFEC Construction Work Plan to rebuild the station to the more reliable breaker and a half arrangement with higher interrupting rated breakers. A new connection to the existing Mooreland Switch Station before these upgrades are complete cannot be accommodated due to limited space in the existing yard and the increase in fault current before overdutied breakers are replaced.

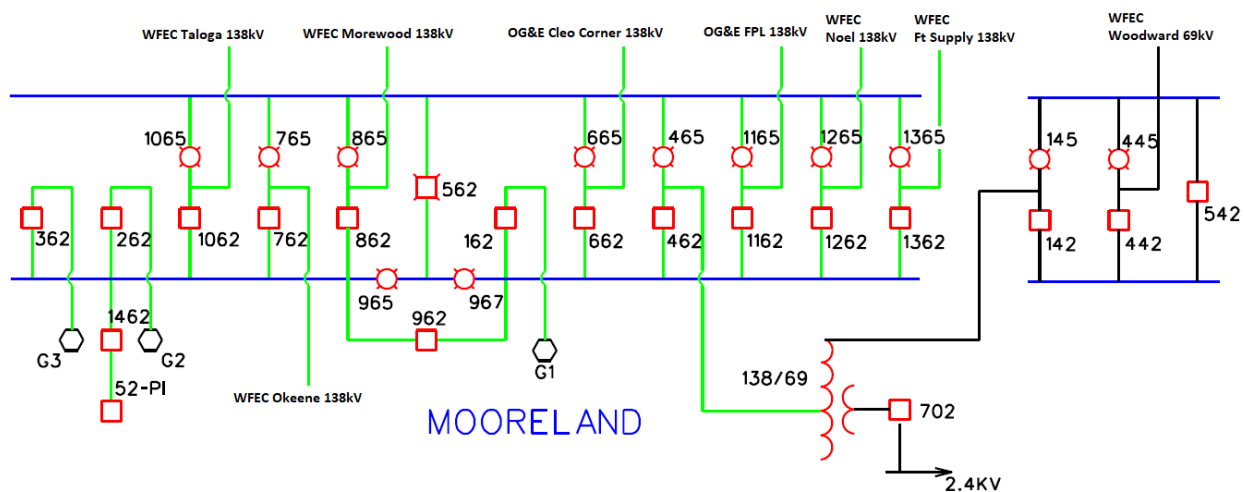


Figure 1: Existing WFEC Mooreland Switch Station

WFEC will expand the scope of the Mooreland Switch Station rebuild to include an additional 138kV terminal for GEN 2016-020, as shown below in Figure 2. The customer will construct a new 138kV transmission line from their wind farm collector sub to the WFEC Mooreland Switch Station. WFEC will require the customer to install OPGW for communications from Customer's wind farm collector sub to WFEC's switch station.

The total cost for WFEC to add a new 138kV terminal in the switch station for the interconnection is estimated at \$6,000,000. This cost does not include the construction of the 138kV line from the customer substation into the new terminal at Mooreland 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 C37.5-1979, C37.010-1979 & C37.04-1979 breaker rating methods.

There are currently WFEC breakers at Mooreland Switch Station that have reached their short circuit rating. These breakers have reached their short circuit rating before considering fault current contribution from the new wind farm, therefore the cost for these breaker replacements were not considered in this study. However, the customer will not be able to connect until these upgrades at Mooreland are complete, expected in-service date for these upgrades is October 2020.

Interconnection Cost

Table 1: Required Interconnection Facilities

| Facility | Estimated Cost (2018 Dollars) |
|-----------------------------------------------------------------------------------------------------------------------|-------------------------------|
| WFEC - Interconnection Facilities Install new steel structures, switches, buss work, breakers and relaying. | 6,000,000 |

One-Line diagram of Interconnection

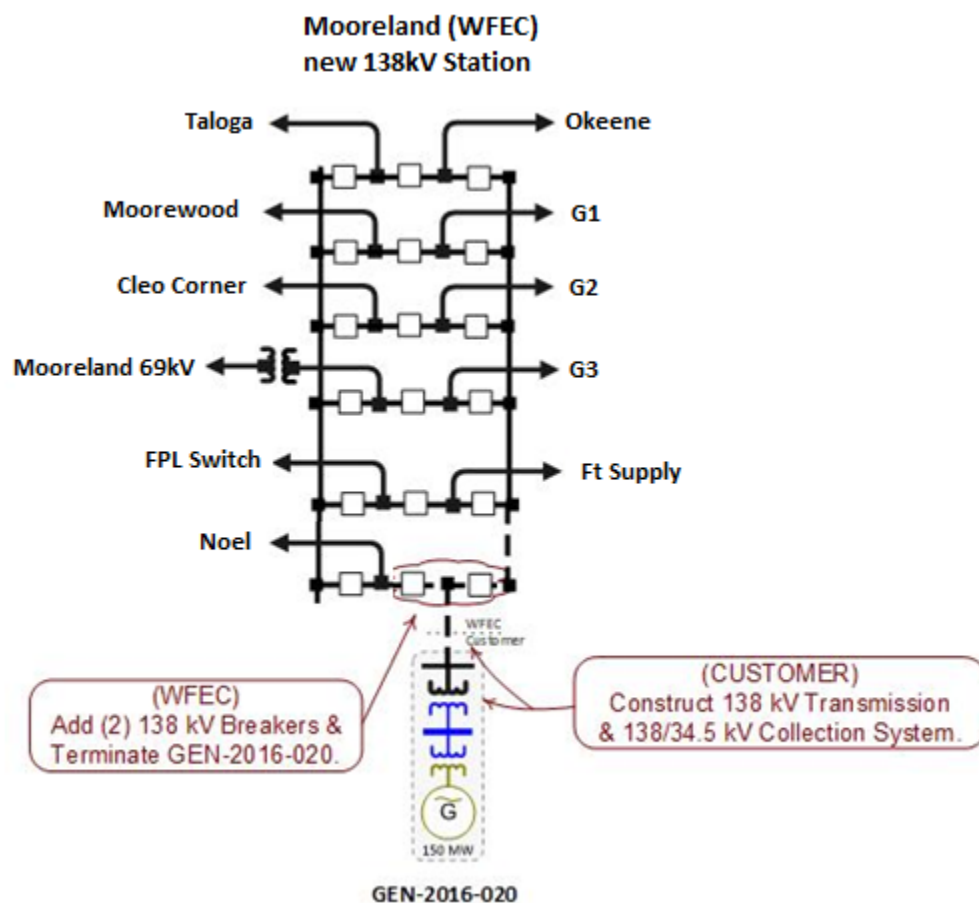


Figure 2: Proposed WFEC Mooreland Switch Station