INTERCONNECTION FACILITIES STUDY REPORT

GEN-2017-233

Published April 2023

By SPP Generator Interconnections Dept.

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
04/12/2023	SPP	Initial draft report issued.
05/02/2023	SPP	Updated upgrade information and cost for UIDs 156445 & 156471 in Table 3.
07/05/2023	SPP	Cost revisions made for UID 156858 in Table 3.
08/03/2023	SPP	Final report posted.
08/06/2024	SPP	Upgrades revised to reflect latest study.

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SUMMARY

INTRODUCTION

This Interconnection Facilities Study (IFS) for Interconnection Request is for a 215 MW generating facility located in Grady County, OK. The Interconnection Request was studied in the DISIS-2017-002 Impact Study for ERIS. The Interconnection Customer's requested in-service date is December 01, 2026.

The interconnecting Transmission Owner, Oklahoma Gas & Electric Company (OGE), 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 (TOIF), Non-Shared Network Upgrades, Shared Network Upgrades, Contingent 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.

COMPENSATION FOR AMOUNTS ADVANCED FOR NETWORK UPGRADE(S)

FERC Order ER20-1687-000 eliminated the use of Attachment Z2 revenue crediting as an option for compensation. The Incremental Long Term Congestion Right (ILTCR) process will be the sole process to compensate upgrade sponsors as of July 1st, 2020.

INTERCONNECTION CUSTOMER INTERCONNECTION FACILITIES

The Generating Facility is proposed to consist of (108) General Electric 2.0 wind turbines for a total generating nameplate capacity of 215 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;

One 345/34.5 kV 144/192/240 MVA (ONAN/ONAF/ONAF) step-up transformer to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation;

Approx. 25 miles 345 kV line to connect the Interconnection Customer's substation to the Point of Interconnection ("POI") at the 345 kV bus at existing Transmission Owner substation ("Minco 345kV") 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; and,

All necessary relay, protection, control and communication systems required to protect Interconnection Customer's Interconnection Facilities and Generating Facilities and coordinate with Transmission Owner's relay, protection, control and communication systems.

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
Minco 345kV GEN-2017-233 Interconnection (TOIF) (OGE) (143543): Interconnection upgrades and cost estimates needed to interconnect the following Interconnection Customer facility, GEN-2017-233 (215 MW/Wind), into the Point of Interconnection (POI) at Minco 345kV	$795,827	100%	$795,827	20 Months
Total	**$795,827**		**$795,827**	

Table 2: Non-Shared Network Upgrade(s)

Non-Shared Network Upgrades Description	ILTCR	Total Cost Estimate ($)	Allocated Percent (%)	Allocated Cost Estimate ($)	Estimated Lead Time
NA	**NA**	**NA**	**NA**	**NA**	**NA**
Total		NA		NA	

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 Upgrade(s)

Shared Network Upgrades Description	ILTCR	Total Cost Estimate ($)	Allocated Percent (%)	Allocated Cost Estimate ($)	Estimated Lead Time
Minco 345kV Interconnection Expansion (DISIS-2017-002)(143402): Expand the Minco 345kV substation to accommodate the interconnection of GEN-2017-150 and GEN-2017-233	Ineligible	$1,790,448	46.24%	$827,842	20 Months
Build Tolk to Potter County 345 kV Circuit 1 (SPS)(159070): Build approximately 115 miles of 345 kV from Tolk - Potter County with minimum normal/emergency rating of 1195 MVA	Eligible	$240,503,975	26.45%	$63,619,727	36 Months
Total		**$242,294,423**		**$64,447,569**	

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.

CONTINGENT NETWORK UPGRADE(S)

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

Table 4: Interconnection Customer Contingent Network Upgrade(s)

Contingent Network Upgrade(s) Description	Current Cost Assignment	Estimated In-Service Date
NTC 210627-Multi - Border - Woodward 345 kV Tap: Tap the existing Border to Woodward 345 kV line 19 miles from the Border station and build a new 345 kV substation or switching station. Build 0.84-miles of new 345 kV line from the new station to Chisholm with a summer emergency rating of 1792 MVA(NTC - 210627/210628)	**$0**	**3/31/2025**
Multi - Minco - Pleasant Valley - Draper 345 kV: Upgrade any necessary terminal equipment at Midwest 138 kV on the Midwest to Franklin 138 kV line to achieve a summer emergency rating of 308 MVA Install terminal equipment at Minco substation 345 kV to support a new 345 kV line from Minco with a summer emergency rating of 1792 MVA Expand the existing Pleasant Valley 138 kV substation to 345 kV with new terminals to accommodate new line from Minco to Pleasant Valley to Draper and terminals to accommodate cut in of existing Cimarron to Draper 345 kV line. Tie into existing Cimarron to Draper 345 kV line. This description is specific to the 345 kV components. Install a new 345/138 kV transformer to achieve a summer emergency rating of 478 MVA Install a new 345/138 kV transformer to achieve a summer emergency rating of 478 MVA Upgrade any necessary terminal equipment on the Cimarron to Draper 345 kV line to achieve a summer emergency rating of 1540 MVA Build 34.8 miles of 345 kV line from Minco to Pleasant Valley 345 kV to achieve a 1792 MVA summer emergency rating. Build a second 13.2-mile 345 kV line from Draper 345 kV substation to Pleasant Valley 345 kV substation with a summer emergency rating of 1792 MVA Install a new line terminal at Draper 345 kV to accommodate new 345 kV line from Pleasant Valley.	**$0**	**1/1/2025**

Expand the existing Pleasant Valley 138 kV substation to 345 kV with new terminals to accommodate new line from Minco to Pleasant Valley to Draper. This description is specific to the 138 kV components. (NTC 210616, 210656)		

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 Contingent 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 either MISO or AECI 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 ($)	Allocated Percent (%)	Allocated Cost Estimate ($)
NA	NA	NA	NA
Total		NA	

CONCLUSION

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

Table 6: Cost Summary

Description	Allocated Cost Estimate
Transmission Owner Interconnection Facilities Upgrade(s)	$795,827
Non-Shared Network Upgrade(s)	$0
Shared Network Upgrade(s)	$64,447,569
Affected System Upgrade(s)	$0
Total	**$65,243,396**

Use the following link for Quarterly Updates on upgrades from this report: https://spp.org/spp-documents-filings/?id=18641

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).

Facilities Study For
Southwest Power Pool (SPP)

DISIS-2017-002
Network Upgrades
Potter Co. to Tolk Station 345 kV Line

Xcel Energy Services, Inc.
Transmission Planning South

August 5, 2024

Executive Summary

Southwestern Public Service Co. ('SPS' or "Transmission Owner") was retained by SPP ("Transmission Provider") to perform a facilities study for the upgrades necessary to install a new 345 kV transmission line from SPS' Potter County Substation to SPS' Tolk Substation for the Definitive Interconnection System Impact Study (DISIS-2017-002).

The straight-line distance between these substations is approximately 115 miles. The estimates in this facility study assumes a total estimated line length of 135 miles. Estimated substation costs, communication costs, transmission line costs and right-of-way/easement costs are included in the estimates for this facility study. [UID 159070]

It is anticipated that the entire process of engineering, procuring, and constructing this project will require approximately 36-48 months to complete after an authorization to proceed is received by all regulatory bodies.

Table 7, - Cost Summary[a]

Description	Cost
Potter Co. Substation 345 kV Expansion	Error! Reference source not found. **7,900,042**
Tolk Station Substation 345 kV Expansion	Error! Reference source not found. **7,180,673**
345 kV Transmission Line	**$ 205,543,489**
Communication	**$ 1,580,835**
ROW/Easements/Land Purchase	**$ 18,258,937**
Total:	**$ 240,503,975**

[a] The cost estimates are 2024 dollars with an accuracy level of ±20%.

General Description of SPS[b] Facility Upgrades

1. **Potter County Substation Expansion**:

    - Expand 345kV portion of the substation to the west.
    - Add one additional "rung" to the breaker and one-half arrangement.
    - A 30 MVAR Switchable Shunt Line Reactor was estimated. *

2. **Tolk Substation Expansion**:

    - Expand 345kV portion of the substation to the west.
    - Add one additional "rung" to the double-bus/double-breaker arrangement.
    - A 30 MVAR Switchable Shunt Line Reactor was estimated. *

3. **345kV Transmission Line:**

    - Straight-line mileage from substation to substation is approximately 115 miles; This estimate assumes a total length of approximately 135 miles.
    - Weathered steel transmission structures were estimated throughout.
    - Phase conductors (2 per phase) of 795 ACSS "Drake" along with 48 count OPGW and 3/8" EHS steel shield conductors were estimated.

4. **Communications:**

    - Install AR-15 communications equipment at Potter County, Tierra Blanca and Tolk substations.
    - Tierra Blanca substation is used as a repeater station for OPGW communications.
    - Upgrade communication equipment at Potter County and Tolk substations.

5. **Siting and Land Rights:**

    - Purchase additional property at Potter County for substation expansion.
    - Secure ROW, easements and CCN costs for 345kV transmission line.

*** NOTE:** In addition, an engineering EMT[c] study will need to be completed. Costs for any mitigation steps taken due to EMT study results will need to be added to this facility study's estimate. The 30 MVAR line reactors were estimated as a "placeholder" in this facility study. The EMT study results will determine the actual size of the line reactors needed for this project, and the estimates will be adjusted accordingly.

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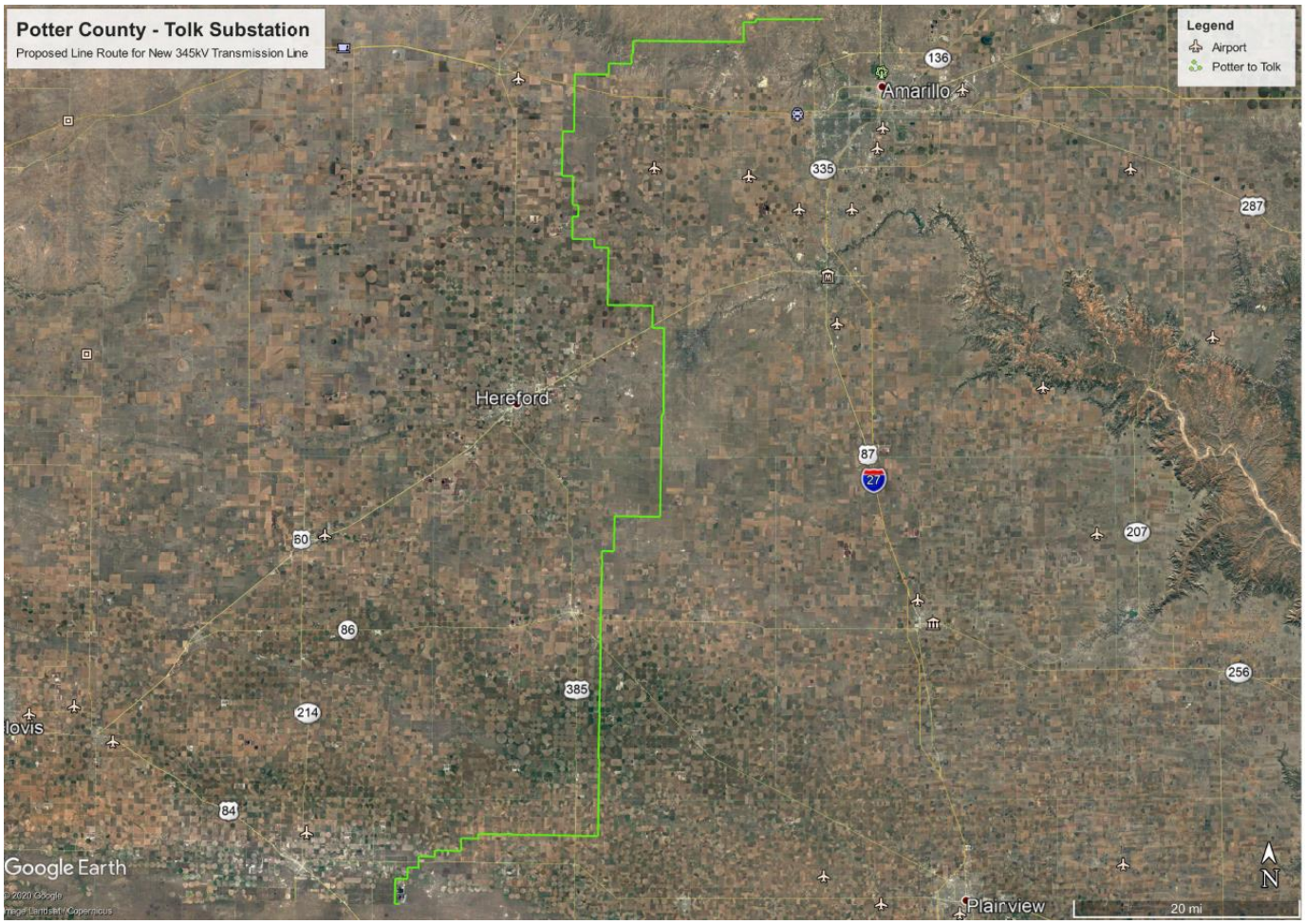
[b] All modifications to SPS facilities will be owned, maintained, and operated by SPS.

[c] Electro-Magnetic Transient

6. Engineering and Construction:

An engineering and construction schedule for this project is estimated at approximately 36-48 months. Other factors associated with transmission work clearances, Texas Public Utility requirements, equipment delays, and work schedules could cause additional delays. This work is applicable after all required agreements are signed and internal approvals are granted.



Approximate Transmission Line Route

– END OF REPORT –

FACILITY STUDY

for

Generation Interconnection Request 2017-233

215 MW Wind Generating Facility
Grady County
Oklahoma

February 28, 2023

Benjamin Sasu
Senior Engineer
Transmission Planning
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-2017-233. 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 requirements for interconnection consist of adding a breaker and a new line terminal for a new Wind Farm at Minco 345kV Substation to be established by this GIA request as well as Gen-2017-150. Since these two requests will share the same Gen-tie line and are a part of the same DISIS study group, costs for the total project will be divided equally among the two projects. If one GIA request is withdrawn or delayed for whatever reason, the GIA request that moves forward will be assumed to cover the remaining costs of the project. The total cost for OKGE to add a breaker, and a new line terminal for a new Wind Farm at Minco 345kV substation, the interconnection facility, is estimated at $3,382,103.

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Introduction

The Southwest Power Pool has requested a Facility Study for the purpose of interconnecting a Wind generating facility within the service territory of OG&E Electric Services (OKGE) in Grady County Oklahoma. The proposed 345kV point of interconnection is at Minco Substation in Grady County. This substation is owned by OKGE. The cost for adding a new 345kV terminal to Minco Substation, the required interconnection facility, is estimated at $1,591,654.

Network Constraints in the Southwest Public Service (SPS), OKGE and Western Farmers Electric Cooperative (WFEC) systems may be verified with a transmission service request and associated studies.

Other Network Constraints in the American Electric Power West (AEPW), Southwest Public Service (SPS), 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. The requirements for interconnection consist of adding a new 345kV terminal at Minco substation. This 345kV addition shall be constructed and maintained by OKGE. It is assumed that obtaining all necessary right-of-way for the line into Minco substation will be performed by the interconnection customer.

The total cost for OKGE to add a new 345kV terminal to Minco Substation, the interconnection facility, is estimated at $3,382,103. This cost does not include building the 345kV line from the Customer substation into Minco Substation. The Customer is responsible for this 345kV line up to the point of interconnection. This cost does not include the Customer's 345-34.5kV substation and the cost estimate should be determined by the Customer.

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 re-closer 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 215MW 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-2017-233 interconnection.

Table 1: Required Interconnection Network Upgrade Facilities

Facility	ESTIMATED COST (2023 DOLLARS) Shared Costs Gen-2017-233 and Gen-2017-150	PERCENTAGE RESPONSIBLE
Lead Time	20 Months	
OKGE – **Interconnection Facilities**- Add one 345kV line terminals to Minco Substation. one dead end structures, line switch, line relaying, revenue metering including CTs and PTs	$1,591,654	50%
OKGE – **Network Upgrades** at Minco sub, install One-345kV 3000A breaker, line relaying, disconnect switches, and associated equipment.	$1,790,448	50%
OKGE - Right-of-Way for 345kV terminal addition	No Additional ROW	
Total Cost for Gen-2017-233	**$1,691,052**	

Prepared by Benjamin Sasu
Senior Engineer, Transmission Planning
OG&E Electric Services

February 28, 2023

Reviewed by:
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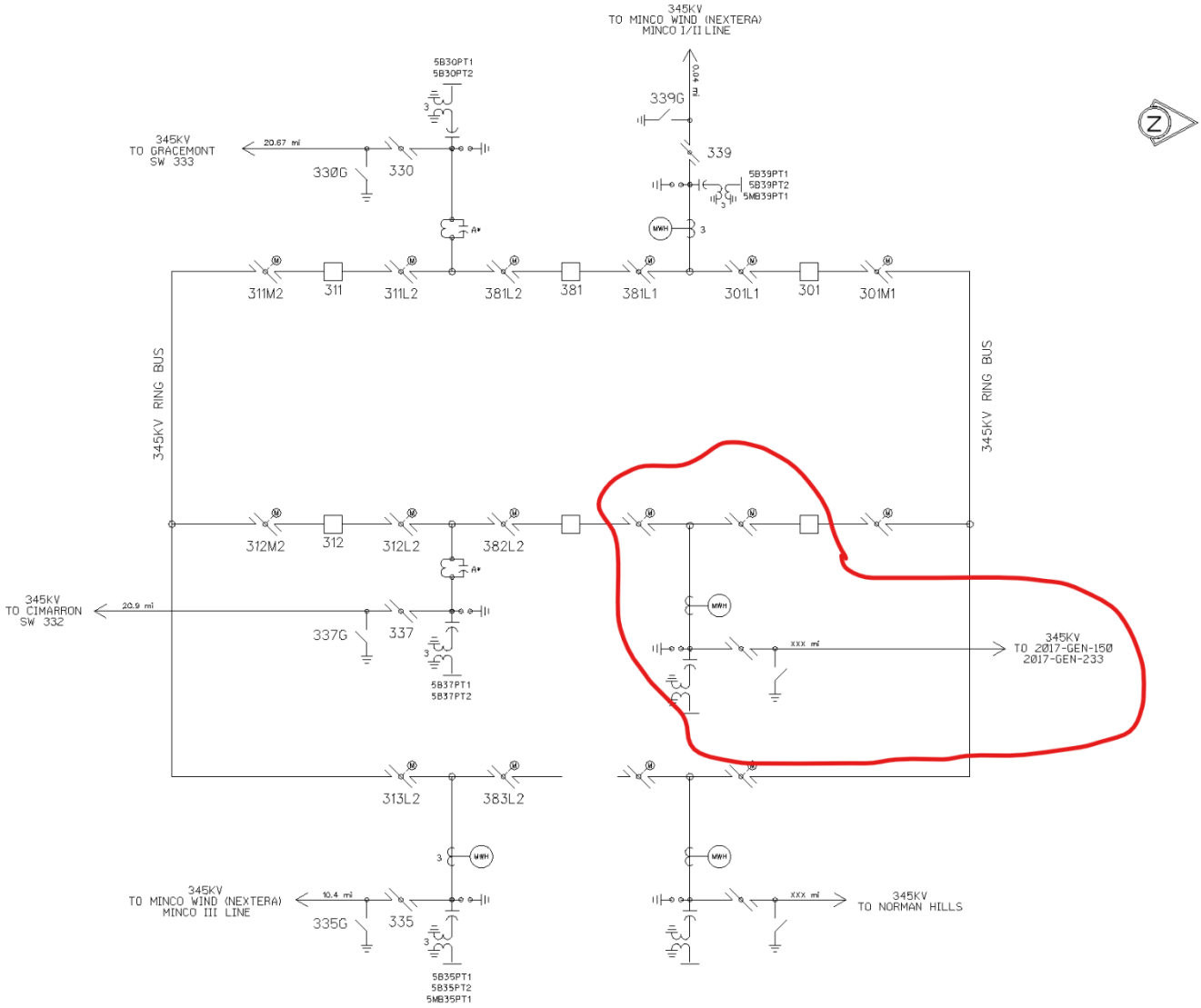
MINCO Substation



FACILITY STUDY

for

IFS-2017-002-156496 Network Upgrades
For
DISIS-2017-002

Switch Out Border Line Reactor
In Beckham County
Oklahoma

March 21, 2023

Chris Rich, P.E.
Transmission Planning Engineer
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 for Network Upgrades to satisfy the Facility Study Agreement executed by the requesting customer for SPP IFS-2017-002-1 for Network Upgrades. 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 requirements for the Network Upgrade are to install one 345kV Reactor breaker/switch, and associated relay and control equipment in Border substation. The total cost for OKGE to complete these upgrades is $1,790,448.

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Introduction

The Southwest Power Pool has requested a Facility Study for Network Upgrades within the service territory of OG&E Electric Services (OKGE) in Beckham County Oklahoma. The proposed Network Upgrade Facilities are for the addition of a 345kV breaker for the existing 50 Mvar reactor at Border substation in Beckham County, Oklahoma to allow for remote switching.

Network Constraints in the Southwest Public Service (SPS), OKGE and Western Farmers Electric Cooperative (WFEC) systems may be verified with a transmission service request and associated studies.

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

Network Upgrade Facilities

The primary objective of this study is to identify network upgrades. The requirements for this Network Upgrade consist of installing a 345kV breaker for the existing 50 Mvar reactor at Border substation on the OG&E transmission system to allow for remote switching and to accommodate generator interconnection requests identified in SPP-GI DISIS-2016-002-1. These 345kV network upgrades shall be constructed and maintained by OKGE.

The total cost for OKGE to install one 345kV reactor breaker, and associated relay and control equipment to allow an existing 50 Mvar Reactor in Border substation to be remotely switched is estimated at $1,790,448.

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 re-closer de-rating applied, as determined by the ANSI/IEEE C37.5-1979, C37.010-1979 & C37.04-1979 breaker rating methods.

For this Network Upgrade, no breakers were found to exceed their interrupting capability after the addition of the one breaker 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 this DISIS-2017-002 Network Upgrade.

Table 1: Required Interconnection Network Upgrade Facilities

Facility	ESTIMATED COST (2023 DOLLARS)
Lead time	20 months
OKGE – **Network Upgrades** at Border Sub. Install 1-345kV Reactor Breaker/switch and associated relay and control equipment.	$1,790,448
Total	**$1,790,448**

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March 21, 2023

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March 27, 2023

Border Substation