

AFFECTED SYSTEM INTERCONNECTION FACILITIES STUDY REPORT ASGI-2016-009

Published January 2020

By SPP Generator Interconnections Dept.

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
1/2/2020	SPP	Initial draft report issued.

CONTENTS

Revision Historyi
Summary
Introduction1
Phase(s) of Interconnection Service1
Credits/Compensation for Amounts Advanced for Network Upgrade(s)1
Interconnection Customer Interconnection Facilities2
Transmission Owner Interconnection Facilities and Non-Shared Network Upgrade(s)2
Shared Network Upgrade(s)3
Previous Network Upgrade(s)4
Affected System Upgrade(s)5
Conclusion5
Appendices
A: Transmission Owner's Affected System Interconnection Facilities Study Report and Network Upgrades Report(s)

SUMMARY

INTRODUCTION

This Affected System Interconnection Facilities Study (ASIFS) for Interconnection Request <u>ASGI-2016-009</u> is for a <u>3</u> MW generating facility. The Affected System Interconnection Request was studied in the <u>DISIS-2016-002</u> Impact Study and <u>Restudies</u> for <u>Energy Resource Interconnection Service (ERIS)</u>. The Interconnection Customer's requested in-service date is <u>April 30, 2018</u>.

The Transmission Owner for the generating facility is South Plains Electric Cooperative, Inc. (SPEC). The impacting Transmission Owner(s), <u>Oklahoma Gas & Electric (OG&E)</u>, <u>American Electric Power (AEP)</u> and <u>Southwestern Power Service (SPS)</u> performed a detailed ASIFS 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).

Southwest Power Pool, Inc.

INTERCONNECTION CUSTOMER INTERCONNECTION FACILITIES

The Generating Facility is proposed to consist of wind turbine generators for a total generating nameplate capacity of <u>3 MW</u>.

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 Facilities Construction 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
None	\$0	N/A	\$0	N/A
Total	\$0		\$0	

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
None	N/A	\$0	N/A	\$0	N/A
Total		\$0		\$0	

Affected System Interconnection Facilities Study Report ASGI-2016-009

¹ 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.

Shared Network Upgrades Description	Z2 Type	Total Cost Estimate (\$)	Allocated Percent (%)	Allocated Cost Estimate (\$)	Estimated Lead Time
OKGE: Border 345 kV Capacitive Reactive Support: Install +275 Mvar Capacitor Bank(s) at Border 345kV	creditable	\$5,929,000	0.5%	\$29,018	24 Months
AEP: Oklaunion 345 kV Capacitive Reactive Support: Install +200 Mvar Capacitor Bank(s) at Oklaunion 345kV.	creditable	\$9,453,182	0.5%	\$44,922	24 Months
SPS: Crossroads 345 kV Capacitive Reactive Support: Install +100 Mvar Capacitor Bank(s) at Crossroad 345 kV	creditable	\$7,075,779	0.02%	\$1,425	12/2020
SPS: Deaf Smith-Plant X 230 kV Rebuild: Rebuild line to achieve minimum system emergency rating of 430 MVA	creditable	\$4,578,401	0.3%	\$13,145	12/2020
SPS: Newhart-Plant X 230 kV CKT 1 Rebuild: Rebuild line to achieve minimum system intact/emergency rating of 456 MVA	creditable	\$697,514	0.5%	\$1,321	12/2020
SPS: Tuco 230 kV Capacitive Reactive Power Support: Install +100 MVar at Tuco 230 kV Substation	creditable	\$5,943,138	0.5%	\$29,087	06/2021
Total		\$33,677,014		\$118,918	

Table 3: Interconnection Customer Shared Network Upgrade(s)

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
SPP NTC 200309 Hobbs - Yoakum 345 kV CKT 1: Construct new 52-mile 345 kV line from Hobbs to Yoakum.	\$87,349,796	6/1/2020
SPP NTC 200395 Tuco - Yoakum 345 kV CKT 1 : Construct new 107-mile 345 kV line from Tuco to Yoakum. Install any necessary 345 kV terminal equipment at Yoakum associated with new 345/230 kV transformer.	\$123,902,322	6/1/2020
SPP NTC 210484 Yoakum 345/230 kV CKT 1 Transformer: Install new 345/230 kV 640 MVA transformer at Yoakum substation. Install any necessary 230 kV terminal equipment.	\$4,703,455	6/1/2019
SPP NTC 210507 Eddy County - Kiowa 345 kV CKT 1: Build new 34 mile 345 kV line from Eddy County to Kiowa.	\$63,730,259	11/15/2020

Table 4: Interconnection	Customer	Previous	Network	Upgrade	(s)

Depending upon the status of higher- or equally-queued customers, the Affected System 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. 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 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	\$0	N/A	\$0
Total	\$0		\$0

CONCLUSION

After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 3 MW can be granted. Full Interconnection Service will be delayed until the TOIF, Non-Shared NU, Shared NU, Previous NU and Affected System Upgrades that are required for full interconnection service are completed. The Interconnection Customer's estimated cost responsibility for TOIF, Non-Shared NU and Shared NU that are required for full interconnection service is summarized in the table below.

Table 6: Cost Summary

Description	Allocated Cost Estimate
Transmission Owner Interconnection Facilities	\$0
Network Upgrades	\$118,918
Total	\$118,918

A draft Facilities Construction Agreement will be provided to the Interconnection Customer consistent with the final results of this IFS report. The Transmission Owner and Interconnection Customer will negotiate the terms of the agreement consistent with the SPP Open Access Transmission Tariff (OATT).



A: TRANSMISSION OWNER'S AFFECTED SYSTEM INTERCONNECTION FACILITIES STUDY REPORT AND NETWORK UPGRADES REPORT(S)

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



FACILITY STUDY

for

IFS-2016-002-2 Network Upgrades For DISIS-2016-002-2

New 275 Mvar Capacitor Bank at Border Substation In Beckham County Oklahoma

November 20, 2019

Adam Snapp, P.E. Lead 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 for Network Upgrades to satisfy the Facility Study Agreement executed by the requesting customer for SPP DISIS-2016-002-2 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 6-345kV switches, one 345kV breaker, one 345kV 275 Mvar capacitor bank consisting of 6 steps, and associated relay and control equipment in Border substation. The total cost for OKGE to complete these upgrades is \$5,929,000.

Table of Contents

Table of Contents	3
Introduction	4
Interconnection Facilities	5
Interconnection Costs	6
One-Line diagram of Interconnection	7

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 275 Mvar capacitor bank at Border substation in Beckham county Oklahoma.

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 275 Mvar capacitor bank at Border substation on the OG&E transmission system to accommodate generator interconnection requests identified in SPP-GI DISIS-2016-002-2. These 345kV network upgrades shall be constructed and maintained by OKGE.

The total cost for OKGE to install six 345kV switches, one 345kV 275 Mvar capacitor bank, one 345kV capacitor breaker, and associated relay and control equipment in Border substation is estimated at \$5,929,000.

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 275 Mvar capacitor 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-2016-002-2 Network Upgrade.

Table 1: Required Interconnection Network Upgrade Facilities

Facility	ESTIMATED COST
OKGE – Network Upgrades Install 1-345kV 275 Mvar Capacitor Bank, 6-345kV Switches, 1-345kV Capacitor Breaker and associated relay and control	\$5,929,000.
Total	\$5 929 000

Prepared by: Adam Snapp, P.E. Lead Engineer, Transmission Planning Email snappad@oge.com

November 20, 2019

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BOUNDLESS ENERGY™

Interconnection Facilities Study for Oklaunion 345 kV Capacitor Network Upgrade

December 2019

Table of Contents

Table of Contents	2
Summary	3
Interconnection Facilities	4
Interconnection Costs/Project Lead Time	5
One-line Diagram of Oklaunion Transmission Facility	6

Summary

American Electric Power Southwest Transmission Planning (AEP) performed the following study at the request of the Southwest Power Pool (SPP) for SPP Generation Interconnection request DISIS-2016-002. Per the SPP Generator Interconnection Procedures (GIP), SPP requested that AEPW perform an Interconnection Facilities Studies (IFS) for Network Upgrade(s) in accordance with the Scope of Interconnection Facilities Study in GIP 8.10 and the Interconnection Facilities Study Procedures in accordance with GIP 8.13 for the following Network Upgrades:

- Oklaunion 345 kV
 - Install a minimum of + 200 MVAR of capacitor banks

Interconnection Facilities (See Figure 1)

Oklaunion 345 kV Substation

A new 345 kV, 200 MVAR minimum capacitor bank will be added at Oklaunion Station for the generation interconnection. This will consist of two 345 kV capacitor banks and associated breakers, microprocessor relays, circuit disconnects, and other associated equipment.

The design and construction of the new terminals will meet all AEP specifications for stations. Bus work and disconnect switches will be designed to accommodate the loading requirements, and circuit breakers will be rated to ensure adequate load and fault interrupting capability. AEP will own, operate and maintain the station.

Short Circuit Fault Duty Evaluation

It is standard practice for AEP 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.

In the AEP system, no breakers were found to exceed their interrupting capability after the addition of the generation and related facilities. Therefore, there are no short circuit upgrade costs associated with the GEN-2015-020 and 056 interconnections.

Interconnection Costs

Listed below are the associated costs.

SYSTEM IMPROVEMENT	COST (2019 DOLLARS)
Install a minimum of +200Mvar of Capacitor Bank(s) at Oklaunion 345 kV Including all metering, protection, and SCADA	\$9,453,182
TRANSMISSION INTERCONNECTION FACILITY TOTAL COSTS	\$9,453,182

TABLE 1

Project Lead Time

Project in-service date is projected to be 24 months after the issuance of a NTC from the Southwest Power Pool.



FIGURE 1



Facility Study for Network Upgrades as Requested by Southwest Power Pool (SPP)

DISIS 2016-002-2 Group 6

Xcel Energy Services, Inc. Transmission Planning South Updated 12/18/2019

Executive Summary

The Southwest Power Pool (SPP or Transmission Provider) evaluated the generation facilities requesting to interconnect to the SPS transmission system in the Definitive Interconnection System Impact Study (DISIS-2016-002-2), which was completed in December 2019. The requests for interconnection were placed with SPP in accordance with SPP's Open Access Transmission Tariff (OATT).

To accommodate the Interconnection Customer's (IC) requests, SPP identified multiple network upgrades required as part of the DISIS study results. Southwestern Public Service Company (SPS or Transmission Owner) performed this Facility Study for the Network Upgrades to identify costs associated with the identified network upgrades. Below are the projects identified by SPP:

Upgrade Name

Crossroads - Tolk 345 kV Circuit #1 Rating Increase (956 MVA)
Crossroads - Eddy County 345 kV Circuit #1 Rating Increase (956 MVA)
Tolk 345/230 kV Transformer #2
Deaf Smith - Plant X 230 kV Circuit #1 Rating Increase (430 MVA)
Newhart - Plant X 230 kV Circuit #1 Rating Increase (456 MVA)
Curry County- Deaf Smith 115 kV Circuit #1 Rebuild (90 MVA)
Tolk East - Tuco 230 kV Circuit #1 Rating Increase (478 MVA)
Crossroads 345 kV Capacitive Reactive Power Support (100 MVAR)
Tuco 230 kV Capacitive Reactive Power Support (100 MVAR)
Deaf Smith 115 kV Capacitive Reactive Power Support (100 MVAR)
Tolk West - Plant X 230 kV Circuit #1 Rating Increase (796 MVA)*
Tolk East - Plant X 230 kV Circuit #2 Rating Increase (796 MVA)*

*Note: Rating increase identified by SPP DISIS Report is already being completed by SPS

General Description of Network Upgrades

The Objective of this study is to identify the network upgrades and the costs associated with them. Below is a high level description of the different projects and the scoping level costs¹ associated with each. All costs identified below are without escalation. All design and construction of the following projects will meet SPS standards and align with SPS standard equipment sizing. SPS will own, operate, and maintain all equipment identified in this report.

NOTE: All scopes, projects, schedules, and costs below are subject to change as detailed engineering moves forward. Outages, resource availability, federal and state approvals, etc. can impact the costs and schedules.

Crossroads - Tolk 345 kV Circuit 1 Rating Increase (956 MVA)

This existing line rating is currently limited by clearance issues. Approximately 2 structures will have to be replaced to increase the line rating to the required value. Cost: \$184,650.00 Tentative Schedule: 12/2020

Crossroads - Eddy County 345 kV Circuit 1 Rating Increase (956 MVA)

This existing line rating is currently limited by clearance issues. Approximately 2 structures will have to be replaced to increase the line rating to the required value. Cost: \$210,533.00 Tentative Schedule: 12/2020

Tolk 345/230 kV Transformer #2

The existing Tolk substation will have a 2nd 345/230 kV 560 MVA transformer installed. The existing 345 kV yard will be expanded to a ring bus configuration. The 345 kV line from Tolk to Crossroads will have to be reterminated into a new position. Three breakers and 14 switches will be installed on the 345 kV portion and two breakers and four switches will be installed on the 230 kV portion. Relaying upgrades will be required at Crossroads.

Cost: \$14,055,360.00 Tentative Schedule: 3/2022

Deaf Smith - Plant X 230 kV Circuit 1 Rating Increase (430 MVA)

This existing line rating is currently limited by clearance issues. Approximately 100 structures will have to be replaced to increase the line rating to the required value. Cost: \$4,578,401.00 Tentative Schedule: 12/2020

Newhart - Plant X 230 kV Circuit 1 Rating Increase (456 MVA)

This existing line rating is currently limited by clearance issues. Approximately 12 structures will have to be replaced to increase the line rating to the required value. Cost: \$697,514.00 Tentative Schedule: 12/2020

Curry County - Deaf Smith 115 kV Circuit 1 Rebuild (90 MVA)

The existing conductor cannot meet the required rating identified by SPP so the line will be rebuilt in the existing corridor. The line is approximately 13 mile long, with 8.3 miles of the line double circuited with a 69 kV line.

Cost: \$4,852,215.00 Tentative Schedule: 12/2021

Tolk East - Tuco 230 kV Circuit 1 Rating Increase (478 MVA)

¹ The cost estimates are 2019 dollars with an accuracy level of $\pm 20\%$.

This existing line rating is currently limited by clearance issues. Approximately 20 structures will have to be replaced to increase the line rating to the required value. Cost: \$968,567.00 Tentative Schedule: 12/2020

Crossroads 345 kV Capacitive Reactive Power Support (100 MVAR)

The existing Crossroads substation ring bus will be expanded to a breaker and a half configuration and 4 new 345 kV breakers will be installed. There will be two switchable capacitor banks at 50 MVAR each. Each capacitor bank will have its own breaker. The substation footprint will be expanded to the east. Cost: \$7,075,779.00 Tentative Schedule: 12/2020

Tuco 230 kV Capacitive Reactive Power Support (100 MVAR)

The existing Tuco substation breaker and a half configuration will be expanded to incorporate the proposed new 100 MVAR capacitor banks. Two new 230 kV breakers will be installed. There will be two switchable capacitor banks at 50 MVAR each. Each capacitor bank will have its own breaker. A pending EMTP study is still required to be run and the results may change the proposed scope. Cost: \$5,943,138 Tentative Schedule: 6/2021

Deaf Smith 115 kV Capacitive Reactive Power Support (100 MVAR)

SPS has a planned project to rebuild the existing Deaf Smith 115 kV bus at a new location called Tierra Blanca substation. The capacitor banks identified by SPP will be installed at this new location. The Tierra Blanca substation will be built in a breaker and a half configuration. Current proposal is to install 3 x 40 MVAR capacitor banks. Four new 115 kV breakers and four new switches will be installed. A pending EMTP study is still required to be run and the results may change the proposed scope. Cost: \$3,318,137.00 Tentative Schedule: 11/2021

Tolk West - Plant X 230 kV Circuit 1 Rating Increase (796 MVA)

This rating will be already met with an existing SPS project Cost: \$0 Tentative Schedule: N/A

Tolk East - Plant X 230 kV Circuit 2 Rating Increase (796 MVA)

This rating will be already met with an existing SPS project Cost: \$0 Tentative Schedule: N/A

- END OF REPORT -