INTERCONNECTION FACILITIES STUDY REPORT

GEN-2017-018

Published March 2022

By SPP Generator Interconnections Dept.

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
02/18/2022	SPP	Initial draft report issued.
03/09/2022	SPP	Updated draft report issued. Typo corrections made on Page 1 & 2.
03/15/2022	SPP	Final report issued.

CONTENTS

SUMMARY

INTRODUCTION

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2017-018 is for a 189 MW generating facility located in Barber County, KS. The Interconnection Request was studied in the DISIS-2017-001 Impact Study and the DISIS-2017-001-1 Impact Restudy for Network Resource Interconnection Service (NRIS).The Interconnection Customer's requested in-service date is December 31, 2023.

The interconnecting Transmission Owner, ITC-Great Plains (ITC-GP), 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 fifty (50) TMEIC 4.2 MVA Ninja Inverters for a total generating nameplate capacity of 189 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 collectioncircuits;
- 34.5 kV to 345 kV transformation substation with associated 34.5 kV and 345 kV switchgear;
- Two 345/34.5 kV 69/92/115 MVA (ONAN/ONAF/ONAF) step-up transformer to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation;
- An approximately 1 mile overhead mile overhead 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 ("Thistle 345kV Substation") 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 anddesign specificationsdemonstrating how the requirementsare 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
Thistle 345kV Substation GEN-2017-018 Interconnection (TOIF) (ITCGP) (132960): Construct one (1) set of 345kV CCVTs, two (2) paths of OPGW fiber optic cable, one (1) 345kV line relaying panel, and all associated equipment and facilities necessary to accept transmission line from Interconnection Customer's Generating Facility.	$918,132	100%	$918,132	24 Months
Total	**$918,132**		**$918,132**	

Table 2: Non-Shared Network Upgrade(s)

Non-Shared Network Upgrades Description	ILTCR	Total Cost Estimate ($)	Allocated Percent (%)	Allocated Cost Estimate ($)	Estimated Lead Time
Thistle 345kV Substation GEN-2017-018 (Non-Shared NU) (ITCGP) (132961): Construct one (1) 345kV disconnect switch stands, one (1) H-frame line entrance structures, two (2) 345kV CCVT stands, three (3) 345kV surge arrester stands, and all other associated work and materials.	Not Eligible	$1,412,901	100%	$1,412,901	24 Months
Thistle 345kV Substation GEN-2017-018 Interconnection (Non-Shared NU) (OKGE) (143117): Update relay settings and records.	Not Eligible	$30,000	100%	$30,000	6 Months
Thistle 345kV Substation GEN-2017-018 Interconnection (Non-Shared NU) (WERE) (143118): Update relay settings at Buffalo Flats 345kV Substation.	Not Eligible	$13,299	100%	$13,299	17 Weeks
Total		**$1,456,200**		**$1,456,200**	

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
Finney 345kV Reactive Support (DISIS-2017-001) (143263): Expand Finney 345kV Substation from existing 4-breaker ring bus arrangement to a breaker and one-half arrangement. A new rung will be added for four (4) new 50 MVAR capacitor banks. Install a new control house due to existing space limitations.	Eligible	$16,122,303	1.5%	$241,835	23 Months
Total		**$16,122,303**		**$241,835**	

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
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 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 ($)	Allocated Percent (%)	Allocated Cost Estimate ($)
None	$0	N/A	$0
Total	$0		$0

CONCLUSION

After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 189 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 Facilitie Upgrade(s)	$918,132
Non-Shared Network Upgrade(s)	$1,456,200
Shared Network Upgrade(s)	$241,835
Affected System Upgrade(s)	$0
Total	**$2,616,167**

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).

Generation Interconnection Facilities Study Report
For GEN-2017-018 – 189MW Solar Generating Facility
In Barber County, Kansas.
Revised September 7, 2021

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1.0 Overview

ITC Great Plains ("ITCGP") has performed a facility study at the request of Southwest Power Pool ("SPP") for Generation Interconnection request GEN-2017-018 under the SPP Open Access Transmission Tariff. The subject request entails interconnecting 189MW Solar powered generation facilities in Barber County, Kansas. The project will interconnect at Thistle Substation. It is scheduled for completion by December 31, 2024. This date will be revised further into the process.

The ITCGP scope of this Facility Study is to provide a cost estimate for the Customer's interconnection facilities. This study does not directly address any of the Network Upgrades that may be identified in the DISIS 2017-001, the facilities that are being constructed by the interconnection customer, or any potential sub-transmission facilities (if any) that may be required.

1.1 Facility Study Summary

ITCGP estimates the total project cost of the customer's interconnection facilities will be **$ $2,330,224** (+/ - 20 % accuracy) including applicable company overheads in 2021 dollars. It includes **$1,412,091** for Network Upgrades and **$918,132** for Transmission Owner Interconnection Facilities. It is further estimated that the required legal/real estate acquisition and construction activities will require approximately 24 months after the GIA is executed. The attached report contains additional details regarding the estimate as well as results of short circuit studies, review of reactive compensation, and information on Interconnection & Operating requirements.

ITCGP intends to self-fund the network upgrades for this project and will require a Facility Service Agreement to be negotiated in parallel with the GIA for this project.

The GEN-2017-018 interconnection facilities will require Network Upgrades on the ITCGP system to connect the new generation. Network Upgrades consist of the following:

- A new 345 kV breaker associated disconnects at Thistle Substation

In addition to the identified Network Upgrades, there are specific Interconnection Facilities which ITCGP will construct, own, operate, and maintain. These facilities include the new line entrance structure and 345kV disconnect switch on the end of the radial line from GEN-2017-018 at the ITCGP switching station as well as any ITCGP relaying and control equipment required for the protection of the developer's radial line.

The Interconnection Customer is responsible for constructing all sole-use facilities such as the wind farm collector station and the radial 345kV line from the collector station to the new ITCGP switching station. While this report does define Interconnection Customer owned Interconnection Facilities in enough detail to explain basic requirements, it does not define or contain all of the detailed requirements. Additional metering, communications, and operational requirements may be identified as the Interconnection and Operating Agreements are developed and further communications between the Transmission Owner and Interconnection Customer take place. The Interconnection Customer's low voltage system is not defined in this report.

2.0 Voltage Guidelines:

Reactive power, voltage regulation and operating requirements will be as per Transmission Operator (TOP) and Transmission Provider directives. Interconnection Customer will operate the Generating Facility to a voltage schedule of 350 kV (1.014 pu) with a bandwidth of +/- 6 kV (0.017 pu) at the Point of Interconnection (POI) utilizing the Generating Facility's required power factor design capability as indicated in SPP DISIS 2017-001. As per SPP DISIS 2017-001, the Interconnection Customer's required power factor capability is 0.95 lagging to 0.95 leading (at the POI).

For further clarification, the Interconnection Customer may meet the +/- 0.95 power factor requirement by utilizing reactive capability from the wind generators or by adding external reactive compensation. Note that any reactive compensation installed by the Interconnection Customer shall not cause voltage distortion in accordance with Article 9.7.6 Power Quality of the Generation InterconnectionAgreement.

The Interconnection Customer will regulate the Generating Facility's voltage to the specified voltage set point within the defined bandwidth stated above using an automatic voltage controller utilizing the inherent reactive power capability in the wind turbines and if applicable external reactive compensation.

The above voltage schedule is subject to change. If the need for a change is identified, it will be done within the limits of the GIA provisions stated in Section 9.6 and the Generating Facility's power factor design criteria as stated above. If a schedule change is needed, appropriate written documentation of the change will be provided to the Interconnection Customer.

The Interconnection Customer is required to have a generator operator available for 24/7 communication with the TOP. The TOP may, at any time request a variance from the schedule in response to system operating/security requirements.

3.0 Network Upgrades

3.1 New ITCGP GEN-2017-018 interconnection at Thistlesubstation

3.1.1 Project Location:
Thistle Substation

3.1.2 Project Overview:
The purpose of this project is to provide a transmission system interconnection for the GEN-2017-018 Solar Farm

3.1.3 Design Criteria:
The Transmission Owner's standards will be applicable. Where no applicable standards are available, the Transmission Owner will substitute industry standards and other good utility practices.

3.1.4 One-Line Diagrams:
See Figure 1 for Transmission Owner One-Line.

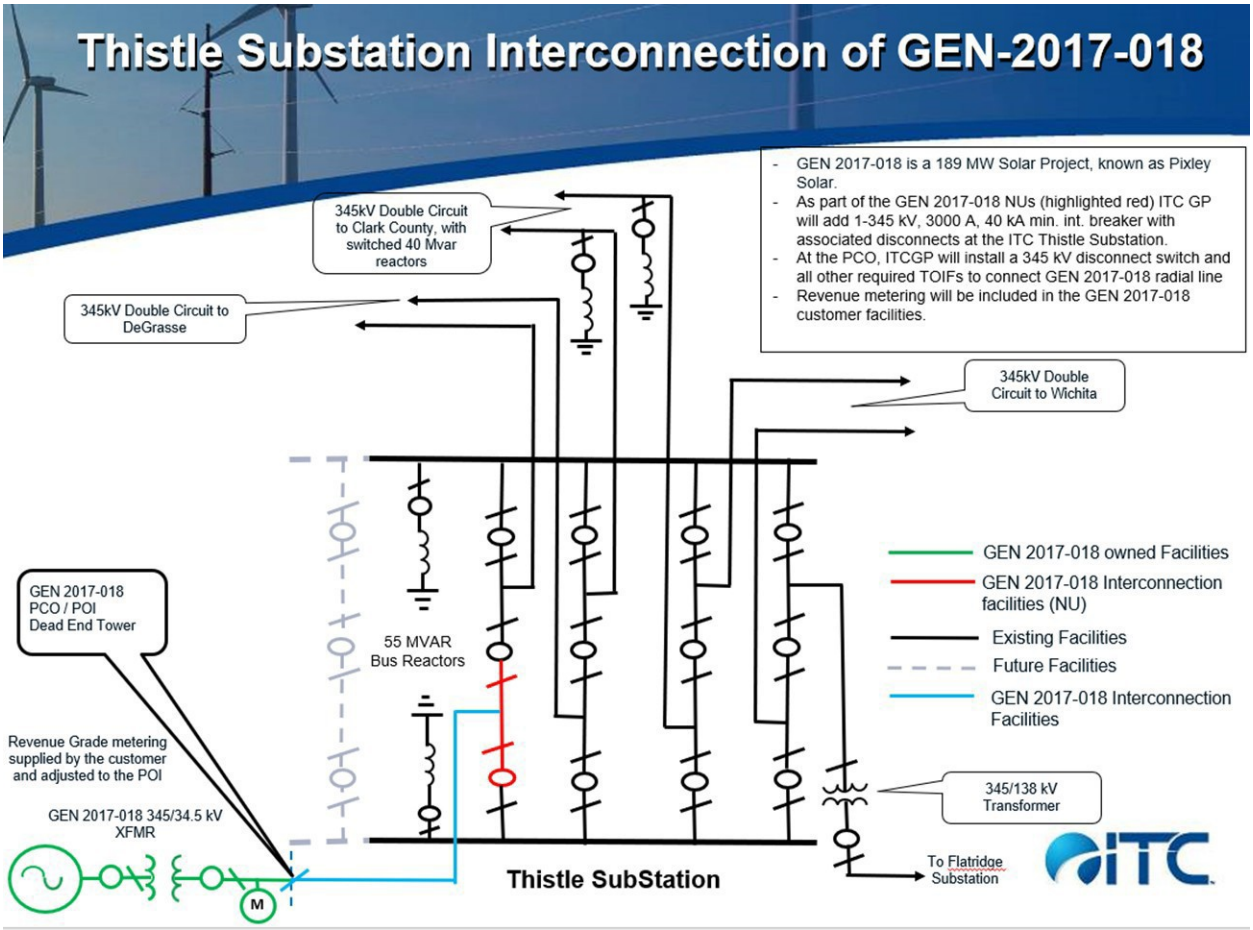

Figure 1 GEN-2017-018 Interconnection Substation One Line

3.1.5 Route Information: N/A

3.1.6 Right-of-Way Information:
It is assumed that the interconnection customer will be responsible for building the 345 kV line required to connect the ITCGP Switching Station at the POI with the customer's substation. As such, the interconnection costs contained herein do not include any costs for extending the ITCGP transmission line. Please see section 6 for generalguidelines.

3.1.7 Permitting:
The Interconnection Customer will be responsible for satisfying all community or governmental site plan or zoning approval requirements which may include wetland or flood plain permits. The Transmission Owner will be responsible for the control center building permit and the KDHE storm water construction permits associated with the Transmission Owner portions of the construction.

3.1.8 Metering & Ownership Demarcation:
Covered in section 4.1.9

3.1.9 Protection & ControlOverview:
One set of 345kV CCVTs will be installed.

One 345kV breaker control panels with microprocessor-based relays will be installed. Breaker failure protection, automatic reclosing supervised by synchronism check will be provided.

One 345kV line relaying panels with microprocessor-based relays will be installed.

3.1.10 Insulation Coordination:
345kV, 1050kV BIL

3.1.11 Short Circuit Study Results - Bus FaultLevels:
ITCGP calculated bus fault levels for the interconnection substation and adjacent substations to determine if the added generation will cause fault currents to exceed interrupting ratings for existing equipment and for use in sizing future equipment. Calculations are based on data for the interconnection transformer and installed solar supplied by the Interconnection Customer. Variance from supplied data could materially change calculated short circuit values. Results are displayed in Table 1.

Table 1 – Short Circuit Results

Fault Location	Maximum Fault Current (Amps)	
	Phase	Ground
Thistle 345 kV Bus	15300	12082
GEN-2017-018 345 kV Bus	6098	500

Fault currents shown in Table 1 are within the circuit breaker interrupting capabilities with the addition of 189 MW contributed by GEN-2017-018.

3.1.12 Reactive Compensation:
ITCGP evaluated the impact of the proposed interconnection on the reactive compensation equipment presently planned or in service at the Thistle Substation facilities. ITCGP studies concluded that no additional reactive compensation is required for interconnection of GEN-2017-018 at this time. ITCGP may review the need for reactive compensation at a future time during which the size of a reactor would be further refined with additional studies after the GIA is signed.

3.1.13 Other Equipment & Materials:

- Gas Circuit Breakers (GCB): three (1) 345 kV, 3000A rated, 63kA IC.
- Disconnect Switch: eight (2) 345 kV, 3000A rated, 1050 kV BIL.
- CCVTs: one (1) 345kV, 3-winding, 1550kV BIL.
- Control Cable: Control cables per Transmission Owner standards will be installed in direct buried PVC conduits, above grade LFMC conduits and in pre-cast cable trench. All control cables from the yard will be terminated at the relaying control panels. The control building will have overhead cable trays for necessary cable runs and inter-panel connections.

3.1.14 Relaying, Control, & SCADA:
Panel Requirements

- 1 – RD3024 – Tie Breaker Control (SEL-351S)
- 2 – RD3070 – "A" Line Relaying, Carrier (SEL-421 & UPLC)

3.1.15 Grounding System:
The grounding system will be designed and installed per Transmission Owner's standards. These standards follow the IEEE 80 standards.

3.1.16 Lightning Shielding Design:
Lightning shielding will be provided per Transmission Owner's standards. Multiple H-frame structures along with shield wire will be used for lightning protection.

3.1.17 Yard Lighting:
Yard lighting will be installed to be sufficient for visual indication of the disconnect switch positions or egress of personnel, and will not serve as task lighting.

3.1.18 Structures:
The required new outdoor steel structures listed below will be hot-dipped galvanized wide flange structures or tubular steel:

- Eight (1) 345 kV disconnect switch stands
- One (1) H-frame line entrance structures
- Two (2) 345kV CCVT stands
- Three (3) 345kV surge arrester stands

3.1.19 Foundations:
Foundations and slabs will be designed and installed in accordance with the owner's standards and specifications. The minimum design depth to firm bearing is contingent upon soil borings at the site.

3.1.21 Scheduling Requirements:
Legal/Real Estate Procurement 9 weeks
Material Procurement / Design 52 weeks
Substation Construction 32 weeks
Closeout Activities 4 weeks

3.1.20 Site Work:
NA

3.1.21 Total Cost: $1,412,092
Total Cost Estimate Accuracy: +/- 20%

Note that the cost estimate provided is expressed in 2021 terms and includes applicable company overheads.

4.0 Transmission Owner InterconnectionFacilities

4.1 GEN-2017-018 – InterconnectionFacilities

4.1.1 Project Location:
Thistle Substation

4.1.2 Project Overview:
A new line entrance structure will be added at the ITCGP GEN-2017-018 interconnection for Thistle for termination of the line from the collector substation. A disconnect switch will be installed beneath this structure for isolation of the developer's line. Line relaying will be added to protect the line. A set of CCVT's and surge arresters will be added to the line terminal.

4.1.3 Design Criteria:
The Transmission Owner's standards will be applicable. Where no applicable standards are available, the Transmission Owner will substitute industry standards and other good utility practices.

4.1.4 One-Line Diagrams: See Figure 1

4.1.5 Site Plan: See Figure 2.

4.1.6 Route Information: N/A

4.1.7 Right-of-Way Information: N/A

4.1.8 Permitting: Same as that covering section 3.1.8

4.1.9 Metering & Ownership Demarcation:
The Interconnection Customer or others will provide, own, operate and maintain revenue metering. The specifics of the revenue metering will be defined during the detailed engineering phase of the project. The customer must cooperate with the Transmission Provider and Local Transmission Owner requirements in the metering design. Revenue metering equipment will be required at customer's project substation with loss compensation to the Point of Interchange in the Transmission Owner's substation.

The ownership demarcation will be at first substation steel H-frame within the security fence of the Transmission Owner substation.

The Interconnection Customer will be required to provide enough conductor to terminate on the H-frame and extend down to reach grade level.

4.1.10 Protection & Control Overview:

- One set of 345kV CCVTs will be installed on the GEN-2017-018line.
- Two paths of fiber optic cable (OPGW) will be required for line protection. They will be supplied by the Interconnection Customer.
- One 345kV line relaying panel with microprocessor-based relays will beinstalled.

4.1.11 Insulation Coordination:
345kV, 1050kV BIL

4.1.12 Short Circuit Study Results - Bus Fault Levels: See Section 3aabove

4.1.13 Other Equipments & Materials:

- Disconnect Switch: One (1) 345 kV, 3000A rated, 1050 kVBIL.
- CCVTs: Three (3) 345 kV, 3-winding, 1550kVBIL.
- Surge Arresters: Three (3) 345 kV, vertical mount, 209 kV MCOV,polymer.
- Control Cables: Control cables per Transmission Owner standards will be installed in direct buried PVC conduits, above grade LFMC conduits and in pre-cast cable trench. All control cables from the yard will be terminated at the relaying control panels. The control building will have overhead cable trays for necessary cable runs and inter-panelconnections.

4.1.14 Relaying, Control, & SCADA:
Panel Requirements: One RD3048 Panel – Fiber optic current differential (SEL 311L Relays)

4.1.15 Grounding System:
The grounding system will be designed and installed per Transmission Owner's standards. These standards follow the IEEE 80standards.

4.1.16 Lightning Shielding Design:
The attachment of the OPGW shield wire from the developer's line to the H-frame will provide lightning protection for the Interconnection Facility equipment at GEN-2017-018 interconnection substation.

4.1.17 Yard Lighting:
NA
4.1.18 Structures:
The required new outdoor steel structures listed below will be hot-dipped galvanized wide flange structures or tubular steel:

- One (1) 345 kV disconnect switch stand
- Two (2) H-frame line entrancestructures
- Three (3) 345 kV CCVT stands
- Three (3) 345 kV surge arresterstands

4.1.19 Foundations:

Foundations will be designed and installed in accordance with the owner's standards and specifications. The minimum design depth to firm bearing is contingent upon soil borings at the site.

4.1.20 Conductors, Shield Wires, & OPGW: N/A

4.1.21 Insulators: N/A

4.1.22 Removal of Existing Facilities: N/A

4.1.23 Site Work: N/A

4.1.24 Total Cost: $**918,132**
Total Cost Estimate Accuracy: +/- 20%
Total Project cost (Network Upgrades and Interconnection facilities): $2,330,224

Note that the cost estimate provided is expressed in 2021 terms and includes applicable company overheads and potential tax gross ups.

5.0 Interconnection Customer Interconnection Facilities

5.1 GEN-2017-018 Interconnection facilities

All facilities within the Interconnection Customer's collector substation and between the Interconnection Customer's substation and ITCGP's new GEN-2017-018 interconnection substation are not included in this report and are the sole responsibility of the Interconnection Customer. Some of the key facilities are briefly mentioned below. The Point of Interconnection (POI) and the Point of Change of Ownership (PCO) are shown in Figure.

The Interconnection Customer shall construct the 345 kV radial line from the wind farm collector station to ITCGP's new GEN-2017-018 interconnection substation. Installation of OPGW shield wire on the radial line from GEN-2017-018 containing at least 12 single mode fibers will be required for ITCGP relaying and communication purposes.

The customer's step-up transformer between the wind farm's 34.5 kV collector network and the 345 kV facilities will require a high side breaker capable of interrupting a transformer high side winding fault.

All Interconnection Customer owned 345 kV apparatus as well as the revenue metering equipment located in the Interconnection Customer's substation shall comply with ITCGP standards and will be subject to ITCGP approval. ITCGP will provide the Interconnection Customer with standards during detailed design or upon request. The Interconnection Customer is solely responsible for the SCADA and telecommunications facilities necessary to operate and monitor its facility.

Necessary trip and close signal interlocks will be provided by ITCGP to the Interconnection Customer's generation facility for the safe operation of the system. Interconnection Customer will provide breaker status and current transformer signals to ITCGP for system operation and protection.

Total Project Cost: N/A
Total Cost Estimate Accuracy: N/A

6.0 Right of Way Requirements

The Interconnection Customer shall obtain easements from the Transmission Owner to work in or drive through the Transmission Owner's transmission line right-of-way. The Transmission Owner and Interconnection Customer will also cooperatively negotiate any easements required for the Interconnection Customer's transmission lines and structures. The Transmission Owner agrees to not unreasonably withhold easements.

For the Network Upgrades and any Transmission Owner Interconnection facilities identified in this report, the Transmission Owner agrees to obtain all necessary easements/right-of-way as required to construct those facilities that will be owned and operated by ITCGP.

FACILITY STUDY

for

Generation Interconnection Request 2017-018

190 MW Solar Generating Facility
In Pixley, KS

August 17, 2020

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 to satisfy the Facility Study Agreement executed by the requesting customer for SPP Generation Interconnection request GEN-2017-018. 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 190 MW solar facility to a Point of Interconnection to be established by GEN-2017-018. The new generation facility will interconnect with ITC Thistle. ITC Thistle substation is interconnected to OG&E Degrasse substation by two 345kV transmission lines. No new or additional facilities on the OG&E system are necessary to accommodate the additional generation. The new generating facility will require updated relay settings and electrical modeling work at OG&E Degrasse substation estimated at$30,000.

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Introduction

The Southwest Power Pool has requested a Facility Study for the purpose of interconnecting a solar generating facility within the service territory of ITC Great Plains near Pixley, Kansas. The generator will require settings updates at OG&E Degrasse substation on the lines connecting it and ITC Thistle. The cost for updating relay settings at OG&E Degasse and electrical modeling work is estimated at $30,000

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. There are no OG&E requirements for the Transmission Owner Interconnection Facilities since the substation is owned by ITC.

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 SPPOATT.

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.

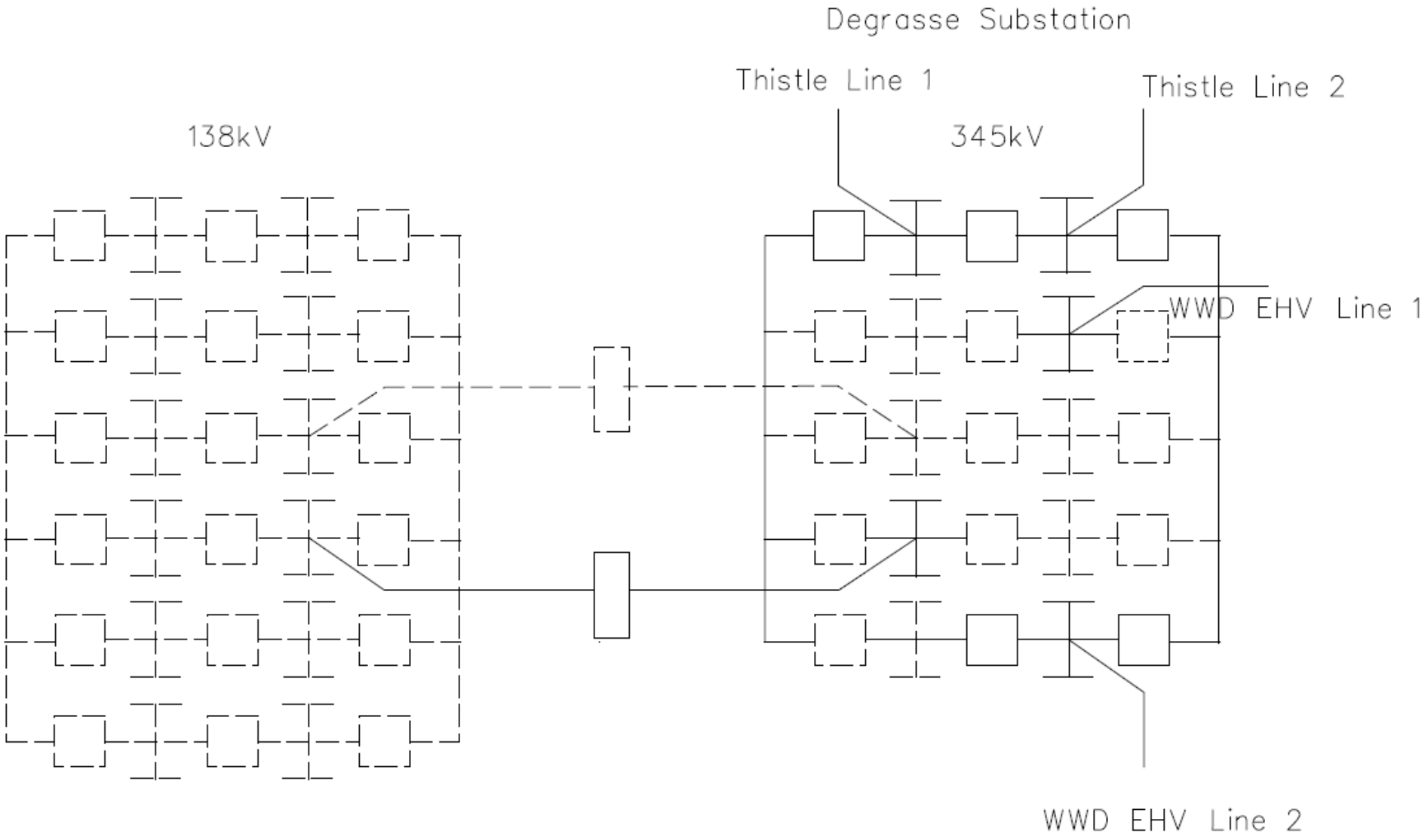
For this generator interconnection, no breakers were found to exceed their interrupting capability after the addition of the Customer's 190 MW generation and related facilities. OG&E found no breakers that exceeded their interrupting capabilities on their system. Therefore, there is no short circuit upgrade costs associated with the Gen-2017-018 interconnection.

Table 1: Required Interconnection Network Upgrade Facilities

Facility	ESTIMATED COST (2020 DOLLARS)
Lead Time	6 months
OKGE – **Interconnection Facilities**- No new interconnection facilities necessary	$0
OKGE – **Network Upgrades** Update relay settings and records.	$30,000
OKGE – Land or ROW	No Additional ROW
Total	**$30,000**

Prepared by Adam Snapp, PE — August 17, 2020
Lead Engineer, Transmission Planning
OG&E Electric Services

Reviewed by:
Steve M. Hardebeck, P.E. — September 11, 2020
Manager, Transmission Planning


Degrasse Substation
Thistle Line 1
Thistle Line 2
138kV
345kV
WWD EHV Line 1
WWD EHV Line 2

Generation Interconnection Facility Study

For

Generation Interconnection Request GEN-2017-018

September 2021

Introduction

This report summarizes the scope of the Generation Interconnection Facility Study to evaluate the Generation Interconnection Request for GEN-2017-018. GEN-2017-018 is proposing to build a 189 MW solar-powered generation facility which will interconnect at ITC's Thistle 345 kV substation in south Kansas with an expected commercial operation date of December 31,2023.

Southwest Power Pool Generation Interconnection Request:

Southwest Power Pool (SPP) GI requested Evergy to perform an Interconnection Facility Study (IFS).

GI Request #	UID	Upgrade Name	Point of Interconnection	Capacity (MW)	Fuel Type
GEN-2017-018	133118	Thistle 345 kV Substation GEN-2017-018 Interconnection(Non-Shared NU) (WERE)	Thistle 345 kV (ITC)	189.0	Solar

Estimated Costs for Network Upgrades

345 kV Substation Work / Network Upgrades

The estimated cost includes review relay settings and apply adjusted settings at Buffalo Flats 345kV substation.

The total cost estimate for relay settings work:

$	**0**	**TOIF**
$	**13,260**	**Network upgrades associated with Buffalo Flats 345kV substations**
$	**39**	**AFUDC**
$	**13,299**	**Total**

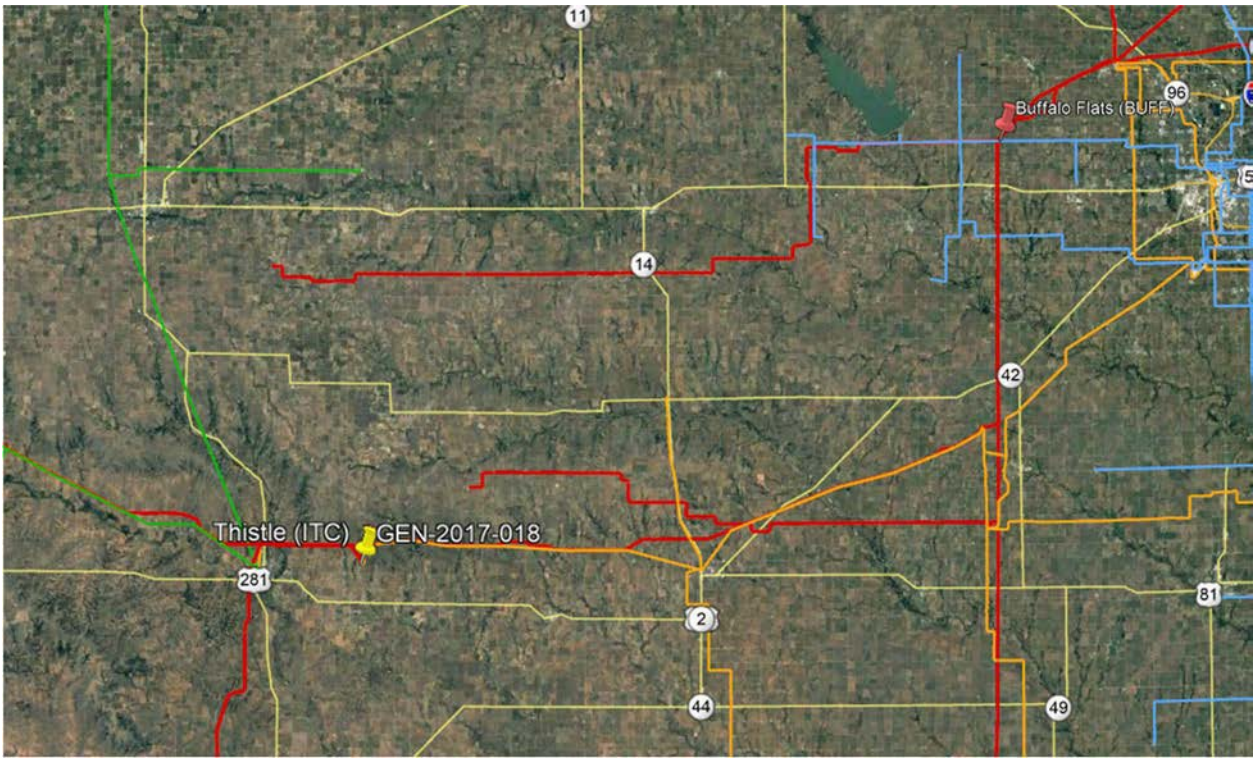
This estimate is accurate to +/- twenty (20) percent, based on current prices, in accordance with Attachment A of Appendix 4 of the Interconnection Facilities Study Agreement. However, recent cost fluctuations in materials are very significant and the accuracy of this estimate at the time of actual settings cannot be assured.

Time Estimate

Time estimate is based on current version of the project schedule.

Engineering Time	17	Weeks
Total Project Length	**17**	**Weeks**

Interconnection Map



Thistle 345kV point of interconnection and Buffalo Flats 345kV affected system.

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

DISIS 2017-001

Xcel Energy Services, Inc.
Transmission Planning South
Updated 2/2/2022

Executive Summary

The Southwest Power Pool (SPP or Transmission Provider) evaluated the generation facilities requesting to interconnect to the Southwestern Public Service Company (SPS or Transmission Owner) transmission system in the Definitive Interconnection System Impact Study (DISIS-2017-001-1), which was completed in December 2021. The requests for interconnection were placed with SPP in accordance with the Scope of Interconnection Facilities Study GIP Section 8.10 and the Interconnection Facilities Study Procedures in accordance with GIP Section 8.11.

To accommodate the Interconnection Customer's (IC) requests, SPP identified multiple network upgrades required as part of the DISIS study results. SPS performed this Facility Study for the Network Upgrades. The table below identifies the specific transmission elements impacted and addressed in this Facility Study along with the projected project duration for completing the specific upgrade.

Table 1: TO Estimate Costs

Upgrade Name	SCERT UID	TO Estimated Cost	Project Time Estimate
Finney 345kV Reactive Support (DISIS-2017-001-1)	143263	$16,122,303	23
Finney to G17-032 Tap 345kV Rating Increase (DISIS-2017-001-1)	143228	$58,652,255	30

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 description of the different projects and the scoping level costs[1] associated with each. All costs identified below are without escalation. All projects, routes, and costs are subject to change.

Finney 345kV Reactive Support
New 200MVAR capacitor bank at Finney 345kV.

Transmission Line Details
No transmission line work identified for this network upgrade.

Substation Details
Expand Finney Substation from existing 4-breaker ring bus arrangement to a breaker and one-half arrangement. A new rung will be added for 4 new 50MVAR capacitor banks. The existing control house lacks the space required for the additional relaying so a new 27X55 house will be installed to contain the new relaying for the cap banks, bus differential relaying, and breaker control relay panels.

Total Cost
The total cost estimate for this Network Upgrade is:

$	0	Transmission Line
$	14,627,961	Substation
$	182,085	AFUDC
$	1,312,257	Contingency
$	16,122,303	Total Cost

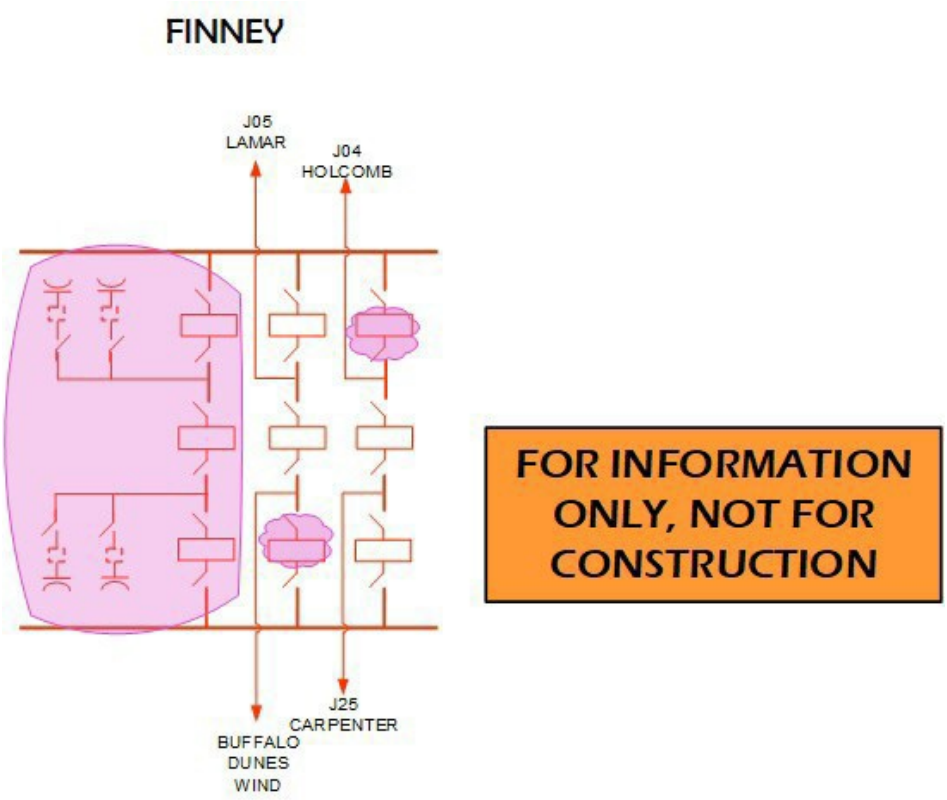
The estimate is accurate to +/- 20%

Project Time Estimate
From date of execution of agreement to project in-service date.

Total Project Duration	23	Months

Figure 1 – Oneline Diagram expanding Finney Substation from 4-breaker ring to breaker-and-a-half

[1] The cost estimates are 2021 dollars with an accuracy level of ±20%.



Finney to G17-032 Tap 345kV Rating Increase (425 MVA)
Increase rating to the existing J05 345 kV line from Finney to the Point of Interconnection of GEN 2017-032 to achieve a minimum Summer/Emergency rating of 425 MVA.

Transmission Line Details
The estimated cost is to remove rating limitations to 79 miles of 345kV circuit. The proposed network upgrade will replace a total of three hundred eighty-seven (387) structures in order to upgrade the capacity of the J05 line to 425 MVA. New bundled 795 ACSS “Drake” will also be installed.

Substation Details
No substation work identified for this network upgrade.

Total Cost
The total cost estimate for this Network Upgrade is:

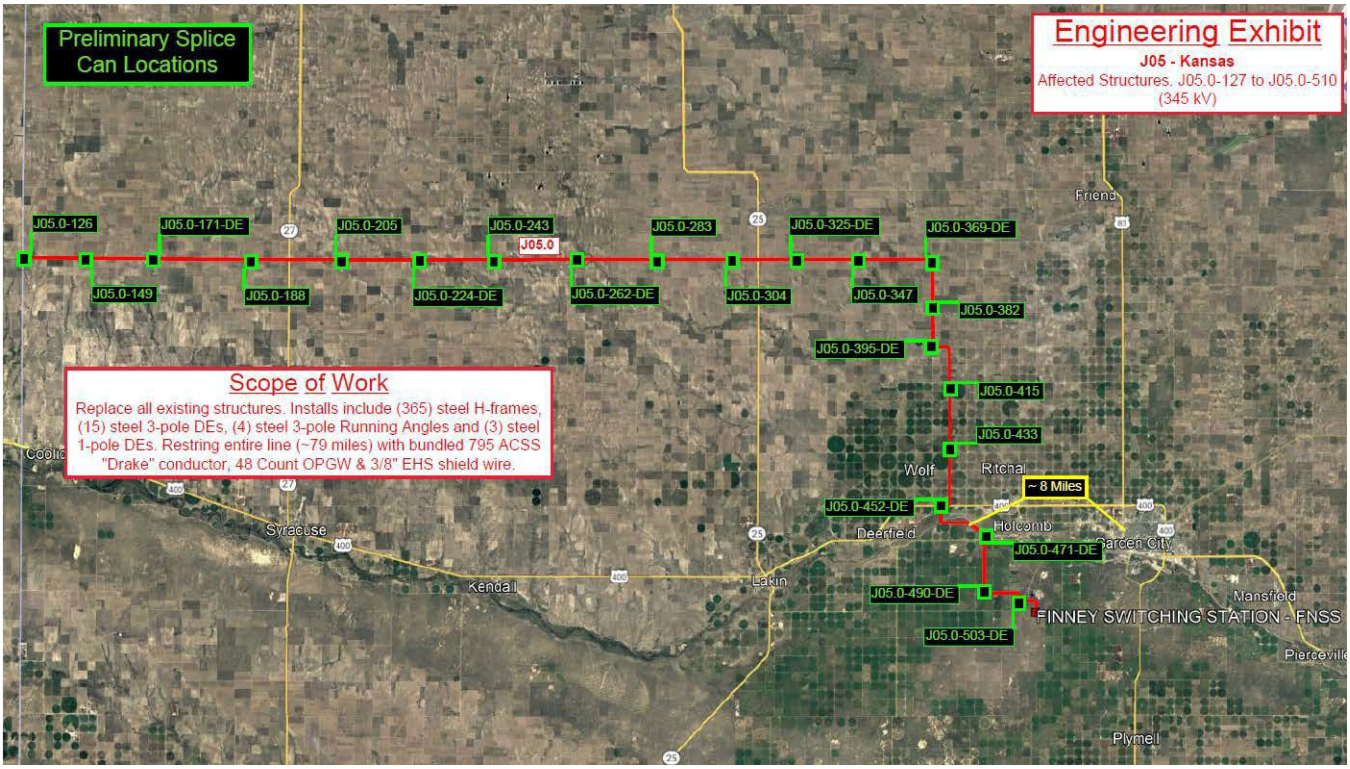
$	52,478,125	Transmission Line
$	0	Substation
$	4,883,369	AFUDC
$	1,290,761	Contingency
$	58,652,255	Total Cost

The estimate is accurate to +/- 20%

Project Time Estimate
From date of execution of agreement to project in-service date.

Total Project Duration	30	Months

Figure 2 – Aerial image of 345kV line J05 Finney to Lamar



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