INTERCONNECTION FACILITIES STUDY REPORT

GEN-2017-032

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.
02/28/2022	SPP	Updated draft report issued. Updated Network Upgrade Facility Study from Evergy
03/03/2022	SPP	Updated draft report issued. Updated Network Upgrade Facility Study from Evergy and costs in Tables 3 and 6
03/15/2022	SPP	Final report issued.

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SUMMARY

INTRODUCTION

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2017-032 is for a 200 MW generating facility located in Kiowa County, OK. The Interconnection Request was studied in the DISIS-2017-001 Impact Study and the DISIS-2017-001-1 Impact Restudy for Energy Resource Interconnection Service (ERIS).The Interconnection Customer's requested in-service date is November 1, 2023.

The interconnecting Transmission Owner, Southwestern Public Service (SPS), 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 sixty-six (66) 3.03 MW G.E. Wind Turbines for a total generating nameplate capacity of 200 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;
- One 345/34.5 kV 135/180/225 MVA (ONAN/ONAF/ONAF) step-up transformer to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation;
- An approximately 2 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 ("Finney - Lamar 345 kV") 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
Finney – Lamar 345kV GEN-2017-032 Interconnection (TOIF) (SWPS) (132980): Construct one (1) 345 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.	$1,720,272	100%	$1,720,272	24 Months
Total	**$1,720,272**		**$1,720,272**	

Table 2: Non-Shared Network Upgrade(s)

Non-Shared Network Upgrades Description	ILTCR	Total Cost Estimate ($)	Allocated Percent (%)	Allocated Cost Estimate ($)	Estimated Lead Time
Finney – Lamar 345kV GEN-2017-032 Interconnection (Non-Shared NU) (SWPS) (132981): Construct one (1) greenfield 345kV Hamilton County substation to include rerouting 345kV line into substation, remote end upgrades, communications equipment, and all other associated work and materials.	Not Eligible	$18,758,811	100%	$18,758,811	24 Months
Finney to G17-032 Tap 345kV Rebuild (DISIS-2017-001) (143263): Remove line rating limitations by replacing two structures.	Eligible	$290,519	100%	$290,519	12 Months
Total		**$19,049,330**		**$19,049,330**	

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	59.23%	$9,549,240	23 Months
Smokey Hills to Summit 230kV Rebuild (DISIS-2017-001) (MIDW) (143240): Rebuild 16.1 of the 38.6 miles miles of 230kV circuit with new bundled 795 MCM ASCR Drake phase conductor. At Smokey Hills 230kV, remove the wave trap and install OPGW.	Eligible	$30,041,995	25.26%	$7,588,608	36 Months
Smokey Hills to Summit 230kV Rebuild (DISIS-2017-001) (WERE) (143242): Rebuild 16.4 of the 38.6 miles of 230kV circuit with new bundled 1192 Bunting ASCR line conductor with OPGW static wire. At Summit 230kV, upgrade terminal equipment consisting of two (2) control panels, remove the wavetrap, and add fiber.	Eligible	$27,314,395	25.26%	$6,899,616	48 Months
Total		**$73,478,693**		**$24,037,464**	

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 ($)	Allocated Percent (%)	Allocated Cost Estimate ($)
MISO AFS forDISIS-2017-001: Montezuma 345 kV + 100 MVAR capacitor bank	$6,000,000	12.6%	$758,893
MISOAFS forDISIS-2017-001: Blackhawk 345 kV + 100 MVAR SVC/Statcom	$30,000,000	10.4%	$3,119,266
Total	$36,000,000		$3,878,159

CONCLUSION

After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 200 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)	$1,720,272
Non-Shared Network Upgrade(s)	$19,049,330
Shared Network Upgrade(s)	$24,037,464
Affected System Upgrade(s)	$3,878,159
Total	**$48,685,225**

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)

GEN-2017-032
Total Output: 199.98 MW
Hamilton County, Kansas

Xcel Energy Services, Inc.
Transmission Planning South
Updated 9/9/2021

Executive Summary

The Southwest Power Pool (SPP or Transmission Provider) evaluated the request GEN-2017-032 to interconnect the generation facility to the SPS transmission system in the Definitive Interconnection System Impact Study (DISIS-2017-001).

GEN-2017-032 requested the interconnection of a 199.98 MW wind energy generation facility, located in Hamilton County, Kansas, to the Southwestern Public Service Company (SPS or Transmission Owner) transmission network. To accommodate the Interconnection Customer's (IC) request, SPS will construct a new three breaker ring bus substation. After the substation is complete, the IC will connect to the SPS 345 kV bus. The IC is required to build a 345 kV transmission line from their substation facility to the SPS's new Hamilton County Substation. The IC will be required to maintain a Power Factor between 0.95 lagging and 0.95 leading at the Point of Interconnection(POI).

SPP requires that each generator shall implement automatic Under Frequency Load Shedding (UFLS) according to the SPP UFLS Plan for SPS found in the Xcel Energy interconnection document for "Large Generation Interconnection Guidelines (>20MW)" found at the following link: https://www.transmission.xcelenergy.com/Interconnections

To fulfill this requirement, coordination with Xcel Energy is required during the under-frequency relay-setting phase for the generation. The IC is required to report their generation off-nominal frequency tripping relay settings to SPP and SPS. SPS specifies that generators shall not trip at frequencies above 58.5 Hz unless exceptions in the Transmission Provider Criteria are met. The IC agrees that the energy generating units installed at this interconnection will not be tripped for under-frequency conditions above 58.5 Hz in compliance with Transmission Provider criteria. This means that the generation subject to this Interconnection Agreement may not trip for under-frequency conditions on the transmission system until all under-frequency load shedding relays have operated. SPS will also require that the IC be in compliance with all applicable criteria, guidelines, standards, requirements, regulations, and procedures issued by the North American Electric Reliability Corporation (NERC), SPP, and the Federal Energy Regulatory Commission (FERC) or their successor organizations.

The IC is responsible for all the cost of the Interconnection Facilities, installation of the direct assigned Transmission Owner Interconnection Facilities (TOIF) which are facilities paid for by the IC but are owned, operated and maintained by SPS; inclusive of all construction required for the IC to interconnect at SPS's Hamilton County Substation.

The shared network upgrades will be determined at a later date by SPP and may impact the total overall costs for interconnection of the IC.

It is anticipated that the entire process of building a new 345 kV 3-breaker ring substation at Hamilton County Substation for the acceptance of the IC facility output and the network upgrades allocated to this project will require approximately 24 months to complete after an Interconnection Agreement is signed and an authorization to proceed is received. The IC's cost for the interconnection of this generation facility is shown below in Table 1, with the detailed description of the cost shown in Table 3.

Table 1: Cost Summary[1]

Shared Network Upgrades Total:	**$ See DISIS Report**
Network Upgrades:	**$ 18,758,811**
Transmission Owner Interconnection Facilities:	**$ 1,720,272**
Total:	**$ 20,479,083**

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

General Description of SPS[2] Facilities

1. **Construction at the SPS Hamilton County Substation**: See Appendix A, Figure A-1 for general vicinity location map of the SPSfacility.

    a. **Location**: IC will build a new 345 kV line from their substation to SPS's new 345 kV Hamilton County Substation, in Hamilton County,Kansas.

    b. **Bus Design**: The new 345 kV, three-breaker ring-bus at Hamilton County Substation will be built to accommodate the output from the wind energy facility. Appendix A, Figure A-2, shows a preliminary one-line of the new Hamilton County Substation, while Figure A-3 shows a typical elevation view of the normal Point of Interconnection (POI).

    c. **Revenue Metering**: An individual billing meter will be installed at the SPS substation on the line terminal from the IC's substation, which meets the standards: ANSI C12.1 accuracy class 0.2 (3-PT's IEEE C57.13 accuracy class 0.3 and 3-CT's IEEE C57.13 accuracy class 0.15) for full 3-phase 4-wire metering. Pulses out of the billing meter will be sent via SCADA to the Transmission Owner's Control Center in Amarillo, Texas.
        i. Wind Interconnections: two meters per line terminal will be installed
            1. One will be primary and the other will be a backup
        ii. Solar Interconnections: a single meter per line terminal will be installed
        iii. Coal, Natural Gas, hydro, other:

    d. **Disturbance Monitoring Device**: A Disturbance Fault Recorder (DFR), capable of recording faults, swings, and long term trending, will be installed to monitor and record conditions in the substation and on the transmission lines. The disturbance equipment shall also be equipped with a GPS time synching clock. This equipment will have communication capability with a dedicated communication circuit. The disturbance equipment will have its own dedicated communications circuit.

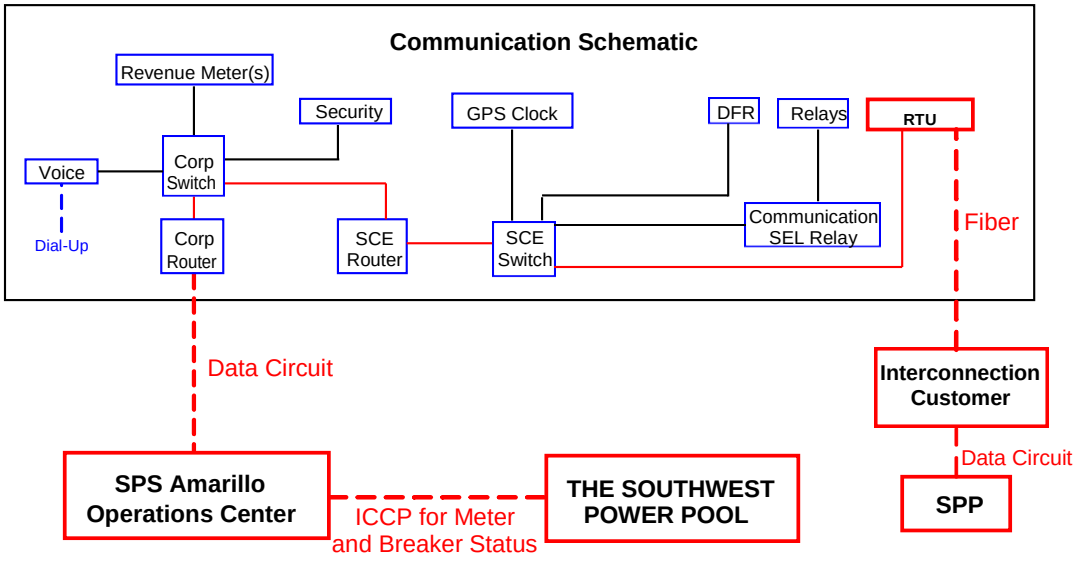
    e. **Remote Terminal Unit (RTU)**: A RTU will be utilized for communications with the new IC facilities. A Communication SEL Relay will be utilized for relay communications and other functions as required; these costs will be directly assigned to the IC. The IC will provide and install a RTU for metering and telemetry at the IC's facility as required by the latest Xcel Energy Interconnection Guidelines.

    f. **Communications**: To meet its Communications obligations, the IC shall be responsible for making arrangements with the local phone company to provide a communication circuit as required by the Transmission Owner. Transmission Owner equipment may include, but is not limited to the following: relay communication equipment, RTU, and disturbance monitoring equipment. Prior to any construction, the IC is required to contact the Transmission Owner substation-engineering department for all communication details and provide detail of the method to be used incommunication.

    The following communications schematic diagram, which includes communication equipment information for the IC, Transmission Provider (Southwest Power Pool) and Transmission Owner (Southwestern Public Service), is provided to assist the Parties as a template.

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

A schematic outlining the proposed communications is provided below:



IC shall be responsible for providing the fiber optic communication circuit installed in the overhead transmission line static wire from the customer substation to the SPS substation for protective relaying and for transmitting metering and status data to SPS. Utilizing this fiber optic connection, SPS will establish a direct connection to the IC's RTU.

SPS will not serve as a proxy for communication from the IC to SPP.

2. Transmission Work – Engineering andConstruction

a. **Coordination**: The Xcel Energy Transmission Engineering and Design groups require an engineering review of the customer's design prior to any construction by the IC or itscontractor on any customer transmission lines, the proposed termination to the SPS substation, or doing work in close proximity to any SPS transmission line. It is the IC's responsibility to initiate the design review in a timely manner before construction of any transmission line begins. If the review has not been made or the design at any of the aforementioned locations is deemed inadequate, the crossing(s) and or termination into the interchange will be delayed until the matters are resolved. SPS will not be held responsible for thesedelays

b. **Fault or Short Circuit Study**: The IC will coordinate with the System Protection Engineering department at SPS on the available fault current at the interconnection location following the acceptance of the Generator Interconnection Agreement (GIA) and prior to final design on the IC's facilities. The table below shows the approximate available fault current at the interconnection location. The fault data does not contain fault current contribution from theIC's facility.

Table 1: Available fault current at interconnection location

Short Circuit Information without contribution from new Generator Facilities				
Fault Location	Fault Current (Amps)		Impedance (Ω)	
	Line-to-Ground	3–Phase	Z_+	Z_0
345 kV Bus	2,770	2,954	6.14739 + j67.1504	12.9093 + j79.6810

3. Right-Of-Way

a. **Permitting**: The IC will be responsible for any permitting and right of way of their substation and their transmission line from their substation to the Point of Interconnection(POI).

4. Construction Power and RetailService

a. **Responsibility**: It is the sole responsibility of the IC to make arrangements for both construction and station power. The IC needs to make arrangements for retail service from the local retail provider. Retail provider and Customer will be responsible for making any necessary transmission service arrangements as required under the SPPOATT.

5. Project and OperatingConcerns:

a. **Collaboration**: Close work between the Transmission group, the IC's personnel and local operating groups will be imperative in order to meet any in-service date that has been established.

b. **Reactive Power Requirements**: The IC will be required to maintain a power factor between 0.95 lagging and a 0.95 leading at the Point of Interconnection (POI). All capacitors required will be installed on the lower voltage bus at IC's substation. This is required to maintain acceptable dynamic voltage rise as per latest revision of the Xcel Energy Interconnection Guidelines for Transmission Interconnection Producer-Owned Generation Greater than 20 MW. If switched reactive devices are used on the IC's system, they need to be switched in stages where the voltage rise is less than 3%.

6. Estimated Construction Costs andSchedule

a. The projects required for the interconnection of GEN-2017-032 consist of the projects summarized in the table below:

Table 3: Required Interconnection Projects[3]

Project	Description	Estimated Cost
	Shared Network Upgrades:	
1	The current estimated shared network upgrades to be determined (TBD)	**See DISIS Report**
2	**Network Upgrades (at the IC's expense)**	
	New Hamilton County Substation	$ 16,951,961
	Rerouting 345 kV Transmission line into new substation	$ 1,022,471
	Remote End Upgrades	$ 395,415
	Communications	$ 388,964
	Subtotal:	**$18,758,811**
	Transmission Owner Interconnection Facilities (at the IC's expense)	
3	Communications [4]	*$ See footnote*
4	TOIF	$1,720,272
	Subtotal:	**$1,720,272**
	Total Cost	**$20,479,083**

b. **Schedule**: An engineering and construction schedule for this project is estimated at approximately 24 months. Other factors associated with clearances, equipment delays and work schedules could cause additional delays. This is applicable after all required agreements are signed and internal approvals aregranted

c. **Electro-magnetic Transient Program (EMTP) Study:** An EMTP Study will be required after an IA is signed due to the location and voltage of this project. This will finalize any 345 kV or higher voltage shunt reactor sizes, cost, anddelivery.

d. All additional cost for work not identified in this study is the sole responsibility of the IC unless other arrangements aremade.

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

[4] It is the Requester's responsibility to provide both the data circuit and communication circuits, see Section 1.f

Appendix A

Figure A-1: General vicinity location map of the SPS facility

Figure A-2: One-line Diagram at Hamilton County Substation

DIAGRAMS ARE NOT FOR CONSTRUCTION PURPOSES

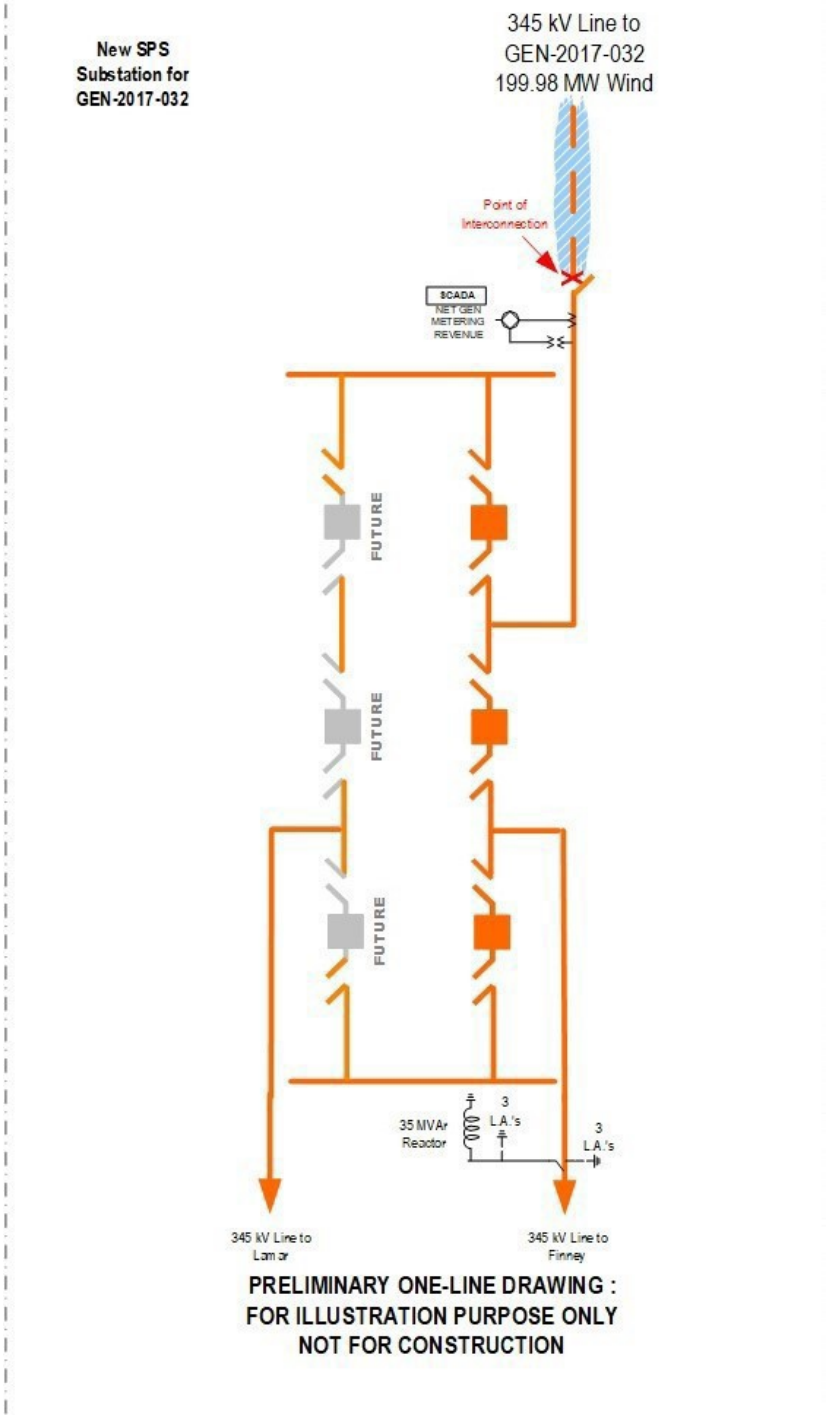
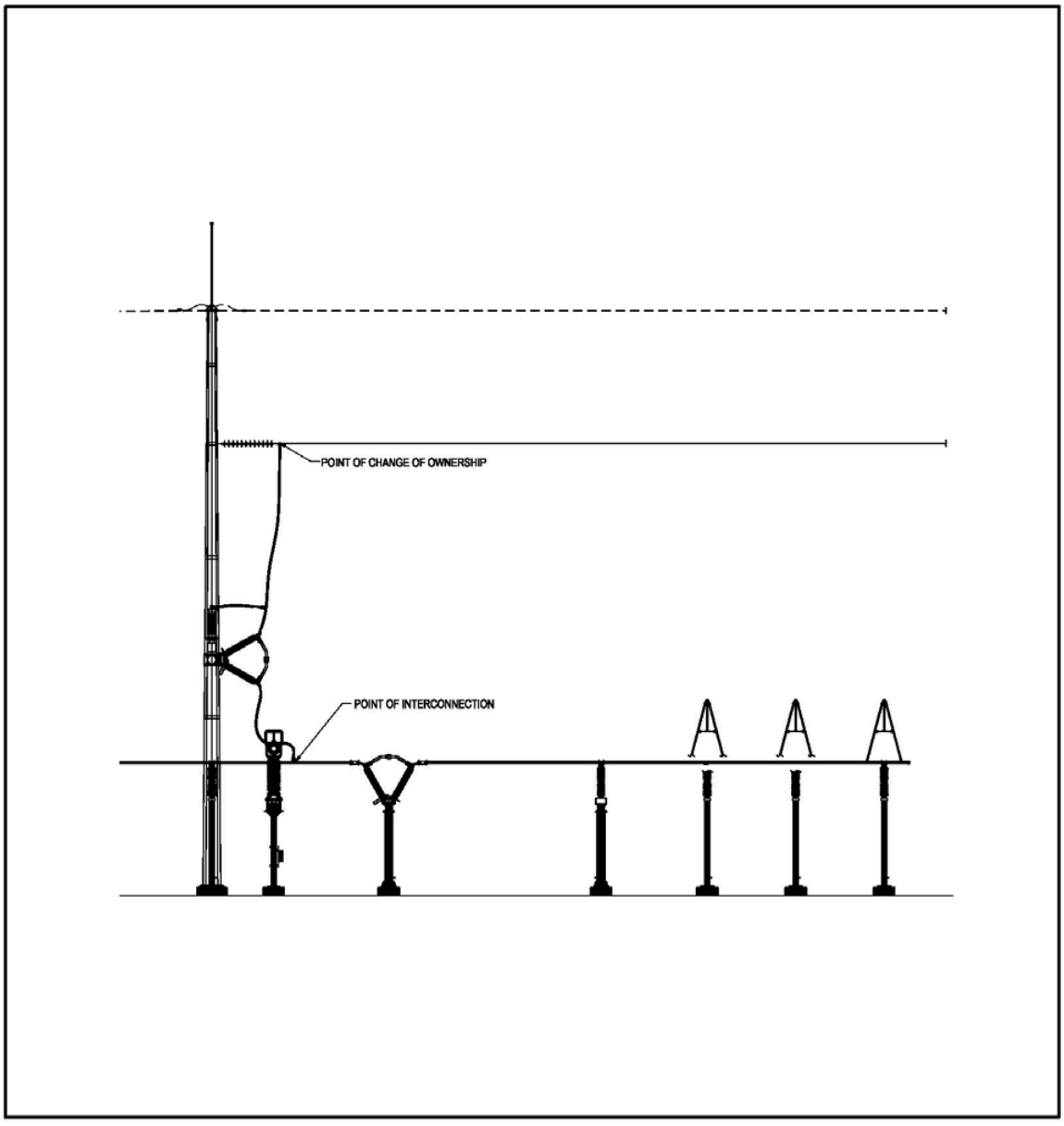


Figure A-3: Point of Interconnection & Change of Ownership Elevation (Typical)

DIAGRAMS ARE NOT FOR CONSTRUCTION PURPOSES



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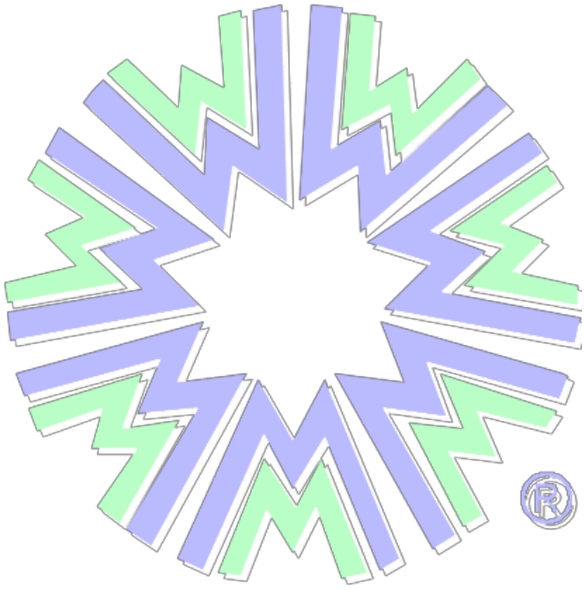
Midwest Energy Inc.

Network Upgrade Study for DISIS-2017-001-3



February 9, 2022

Contents

Summary

At the request of the Southwest Power Pool (SPP), Midwest Energy (MIDW) performed a facility study for network upgrades identified in the Definitive Interconnection System Impact Study (DISIS-2017-001-3) in accordance with the SPP Generator Interconnection Procedures (GIP) Section 8.11 for the following Network Upgrades:

- Rebuild Smoky Hill – Summit 230 kVLine

Network Upgrade Scope

The study performed by SPP for DISIS-2017-001-3 showed the Smoky Hill – Summit 230 kV facility overloaded in a non-contingency state. MIDW owns 16.1 miles of the 38.6-mile line (shown in Figure 1 below), and the provided estimate only applies to the portion of the line owned by MIDW. The MIDW portion of this line is currently at the full Normal rating of its 927.2 MCM AAC 'Solar' conductor. The current wood structures are inadequate to reconductor this line with a larger conductor therefore it will be necessary to tear down and rebuild the line. The provided estimate includes rebuilding the line with steel monopole structures and bundled 795 MCM ACSR 'Drake' phase conductor to increase the capacity to 656/797 (Summer Normal/Emergency) MVA. The wave trap at Smoky Hill will be removed and OPGW will be installed. Because of the remote locations and rugged terrain this line runs through, these estimated costs include the development of temporary access roads for construction as well as additional consideration for transmission line easement.

Figure 1: Midwest Section of the Smoky Hill-Summit 230 kV line

Upgrade Costs

Network Upgrade	Cost (2022 Dollars)
Rebuild MIDW portion of Smoky Hill - Summit 230 kV line (Estimated Cost includes materials, equipment, labor, engineering, contingency costs, and taxes)	$30,041,995

Project Lead Time

Project in-service date is projected to be 36 months after the issuance of an NTC from SPP.

Interconnection Facilities Study

Network Upgrades associated with DISIS-2017-001

February 2022

Introduction

This report summarizes the scope of the Interconnection Facilities Analysis for Network Upgrade(s) to determine costs related to the addition of the SPP-GI DISIS-2017-001 Interconnection Request(s).

Southwest Power Pool Generation Interconnection Request:

Per the SPP Generator Interconnection Procedures (GIP), SPP has requested that Evergy perform an Interconnection Facilities Study (IFS) for Network Upgrade(s) 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 for the following Interconnection Request(s):

Upgrade Type	UID	Upgrade Name	DISIS Cost	DISIS Lead Time
Network Upgrade	122705	Hoyt - JEC 345kV Rebuild (DISIS-2017-001) (EKC)	$49,962,001	48 Months
Network Upgrade	143242	Smokey Hills to Summit 230kV Rebuild (DISIS-2017-001) (EKC)	$27,314,395	36 Months
Network Upgrade	143699	Mullin Creek-St Joseph 345kV New Line and St Joseph 345kV Breaker and Half (DISIS-2017-001) (EMW)	$108,513,897	48 Months
Network Upgrade	143731	Mullin Creek 345kV Terminal Upgrades (DISIS-2017-001) (TMO)	$7,040,333	36 Months
Network Upgrade	144266	St. Joe to Cooper 345kV Rebuild (DISIS-2017-001) (EMW)	$83,208,129	36 Months
Network Upgrade	144268	St. Joe to Nashua 345kV Line Rebuild (DISIS-2017-001) (EM)	$31,517,643	36 Months
Network Upgrade	144269	St. Joe to Nashua 345kV Line Rebuild (DISIS-2017-001) (EMW)	$50,677,806	36 Months

Hoyt – Jeffrey EC 345kV Rebuild

345kV Transmission Line

The estimated cost is for 24.3 miles of 345kV circuit with new bundled 1590 Lapwing ACSR line conductor with OPGW static wire, steel dead end structures, steel tangent structures, steel running angle structures, and no distribution underbuild.

345kV Substation

At Hoyt 345kV substation, the estimated cost is for two (2) control panels, as well as removal of the wavetrap, replace line arrestors, add fiber, and upgrade groundmat.

At Jeffrey EC 345kV substation, the estimated cost is for two (2) control panels, as well as removal of the wavetrap, replace line arrestors, and add fiber.

Total Cost

The total cost estimate for this Network Upgrade is:

$	49,140,588	345kV Transmission Line
$	675,327	345kV Substation
$	146,086	AFUDC
$	0	Contingency
$	49,962,001	Total

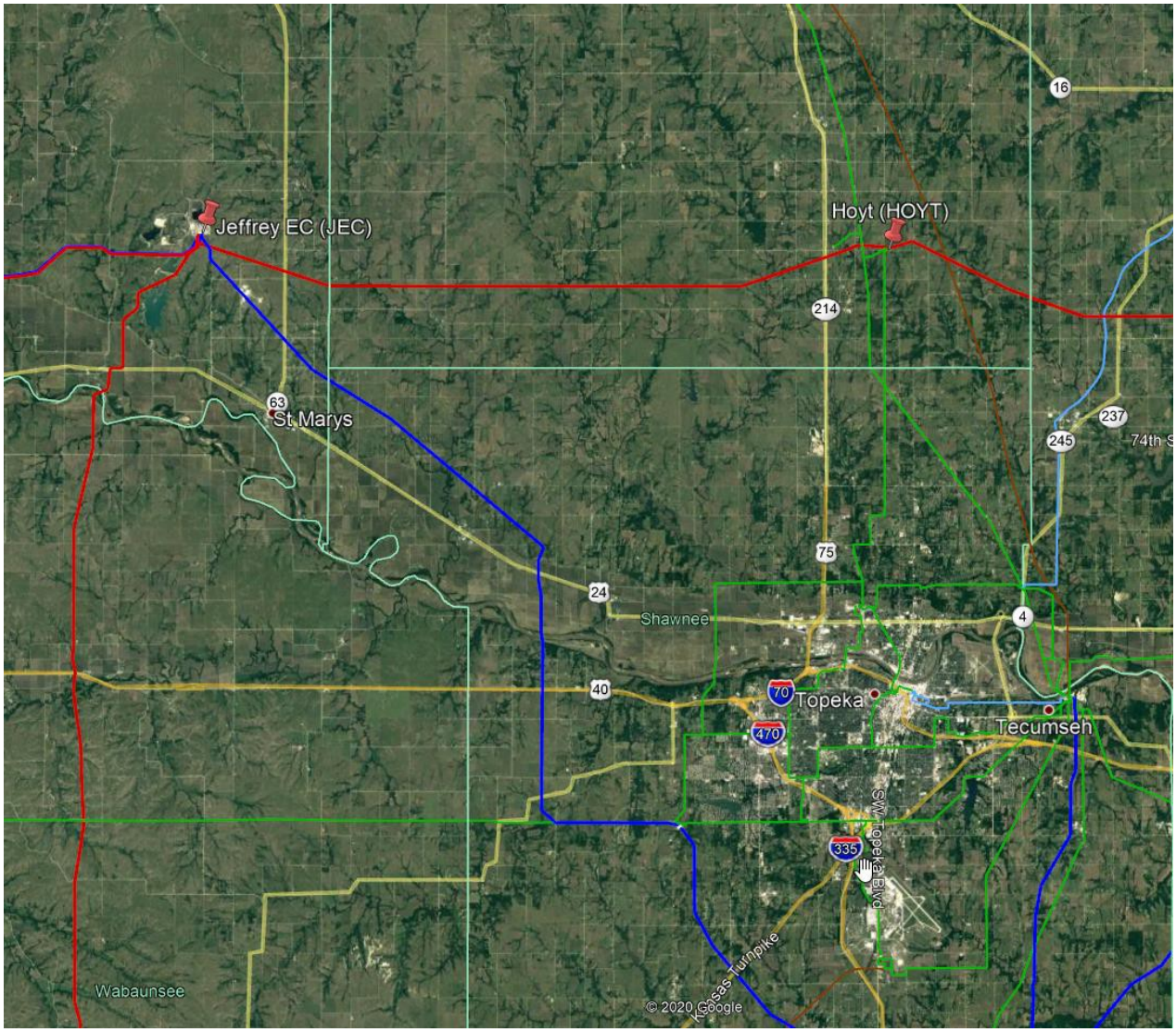
This estimate is accurate to +/- twenty (20) percent, based on current prices, in accordance with Attachment A of Appendix 4 of the Interconnection Facilities Study Agreement. However, recent cost fluctuations in materials are very significant and the accuracy of this estimate at the time of actual settings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

Time Estimate

Time estimates are based on current version of the project schedule and some processes of each category run concurrently.

Engineering Time	12-18	Months
Procurement Time	12-18	Months
Construction Time	12	Months
Total Project Length	36-48	Months

Figure 1 – Hoyt-Jeffrey EC 345kV Line



Smoky Hills - Summit 230kV Rebuild

230kV Transmission Line

The estimated cost is for 16.4 miles of 230kV circuit with new bundled 1192 Bunting ACSR line conductor with OPGW static wire. There is 6.0 miles of this line with newer construction out of Summit that meets the rating requested, and 16.1 miles is owned by Midwest Energy.

230kV Substation

At Summit 230kV substation, the estimated cost is for upgrading the existing 230kV terminal equipment consisting of two (2) control panels, as well as removal of the wavetrap and add fiber.

Total Cost

The total cost estimate for this Network Upgrade is:

$	27,183,000	230kV Transmission Line
$	49670	230kV Substation
$	81,725	AFUDC
$	0	Contingency
$	27,314,395	Total

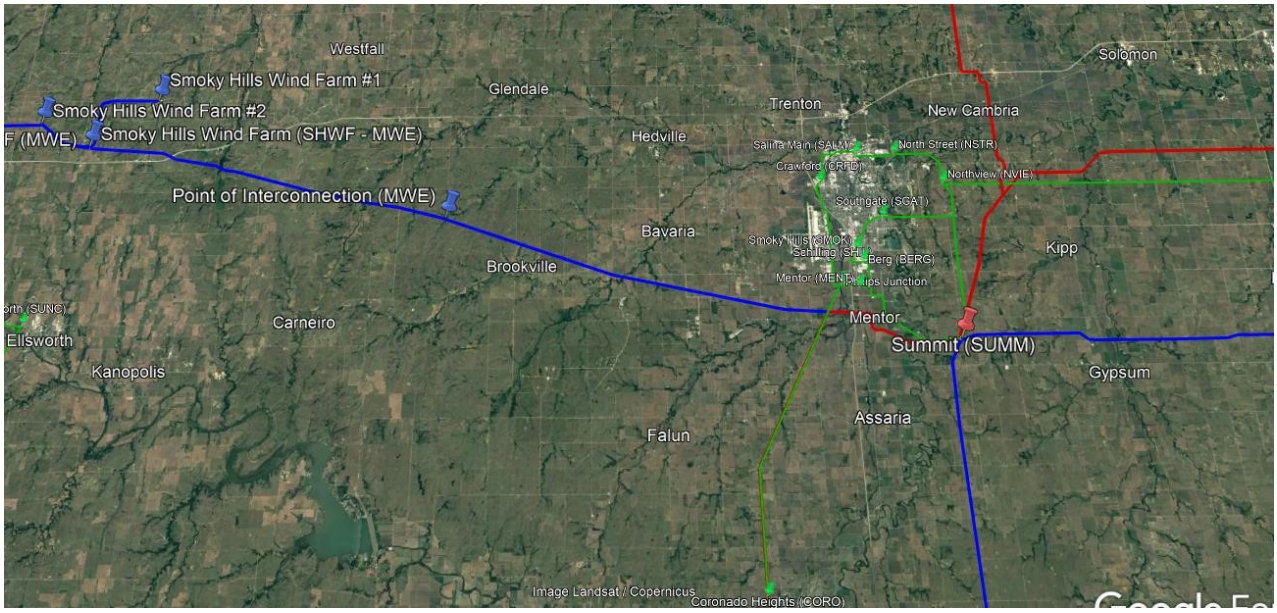
This estimate is accurate to +/- twenty (20) percent, based on current prices, in accordance with Attachment A of Appendix 4 of the Interconnection Facilities Study Agreement. However, recent cost fluctuations in materials are very significant and the accuracy of this estimate at the time of actual settings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

Time Estimate

Time estimates are based on current version of the project schedule and some processes of each category run concurrently.

Engineering Time	12-18	Months
Procurement Time	12-18	Months
Construction Time	12	Months
Total Project Length	36-48	Months

Figure 2 – Smoky Hills-Summit 230kV Line



Mullin Creek-St Joseph 345kV New Line

345kV Transmission Line

The estimated cost is for 27 miles of 345kV with new bundled 1192.5 Grackle ACSS/TW line conductor with OPGW static wire, steel dead end structures, steel tangent structures, steel running angle structures, and no distribution underbuild.

345kV Substation

At St Joseph 345kV substation, the estimated cost is for a rebuild of the existing 345kV to breaker-and-a-half configuration consisting of eleven (11) breakers, twenty-eight (28) switches, four (4) wavetraps, and twenty-one (21) control panels, as well as dismantling of the existing equipment.

Total Cost

The total cost estimate for this Network Upgrade is:

$	79,026,603	345kV Transmission Line
$	27,133,920	345kV Substation
$	2,353,374	AFUDC
$	0	Contingency
$	108,513,897	Total

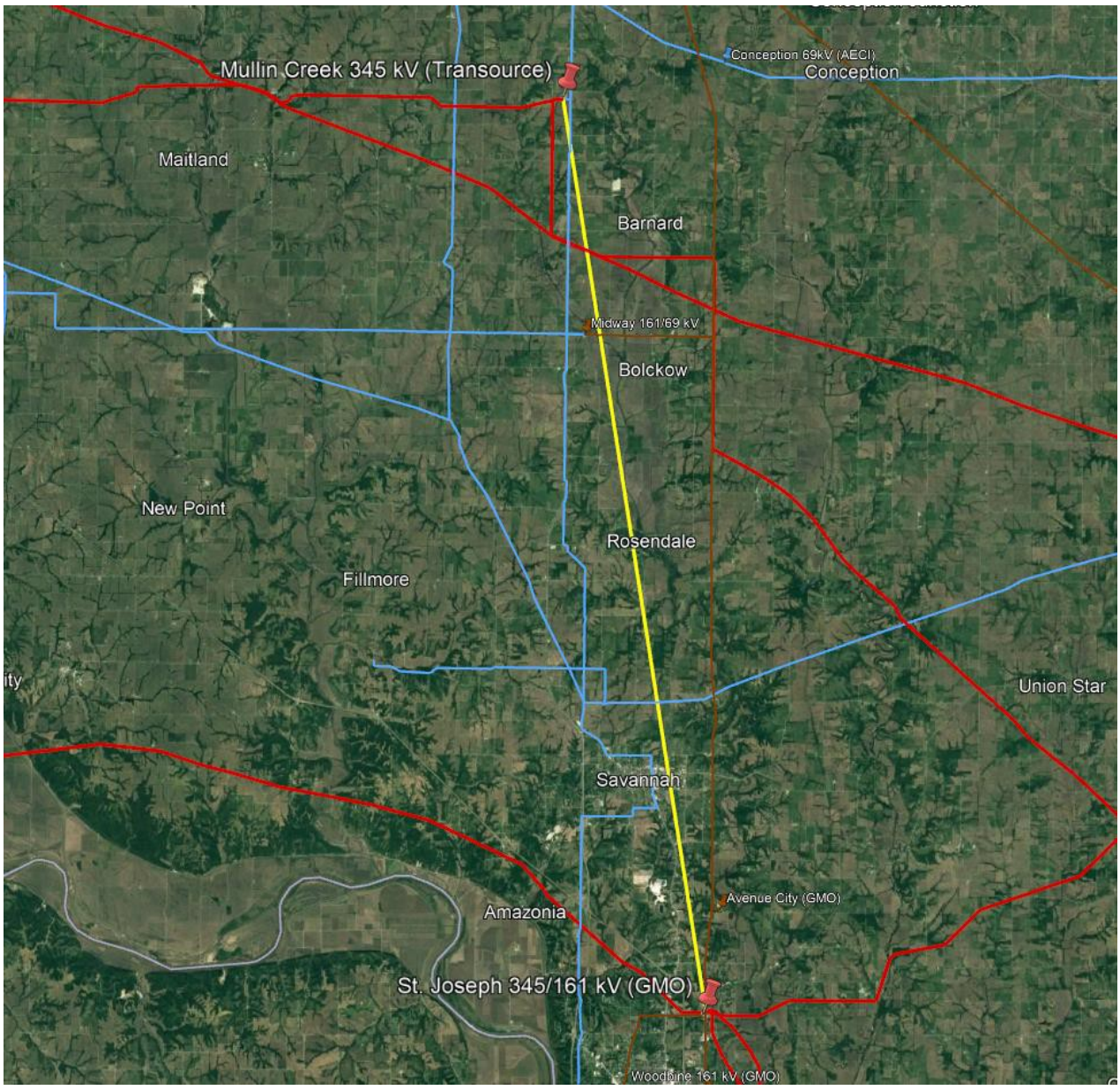
This estimate is accurate to +/- twenty (20) percent, based on current prices, in accordance with Attachment A of Appendix 4 of the Interconnection Facilities Study Agreement. However, recent cost fluctuations in materials are very significant and the accuracy of this estimate at the time of actual settings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

Time Estimate

Time estimates are based on current version of the project schedule and some processes of each category run concurrently.

Engineering Time	12-18	Months
Procurement Time	12-18	Months
Construction Time	12	Months
Total Project Length	36-48	Months

Figure 3 – Mullin Creek-St Joseph 345kV New Line



Mullin Creek 345kV Terminal Upgrades

345kV Substation

At Mullin Creek 345kV substation, the estimated cost is for a rebuild of the existing 345kV to breaker-and-a-half configuration consisting of two (2) breakers, four (4) switches, and three (3) control panels.

Total Cost

The total cost estimate for this Network Upgrade is:

$	0	345kV Transmission Line
$	7,019,275	345kV Substation
$	21,057	AFUDC
$	0	Contingency
$	7,040,332	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 estimates are based on current version of the project schedule and some processes of each category run concurrently.

Engineering Time	6	Months
Procurement Time	12	Months
Construction Time	6	Months
Total Project Length	18-24	Months

St Joseph-Cooper 345kV Line Rebuild

345kV Transmission Line

The estimated cost is for 38.6 miles of 345kV with new bundled 1192.5 Grackle ACSS/TW line conductor with two (2) OPGW static wire, nine (9) steel dead end structures, two-hundred sixteen (216) steel tangent structures, thirteen (13) steel running angle structures, and no distribution underbuild.

345kV Substation

At St Joseph 345kV substation, the estimated cost is for one (1) breaker, five (5) switches, removal of the wavetrap, and one (1) control panel.

Total Cost

The total cost estimate for this Network Upgrade is:

$	79,478,223	345kV Transmission Line
$	1,039,295	345kV Substation
$	2,690,611	AFUDC
$	0	Contingency
$	83,208,129	Total

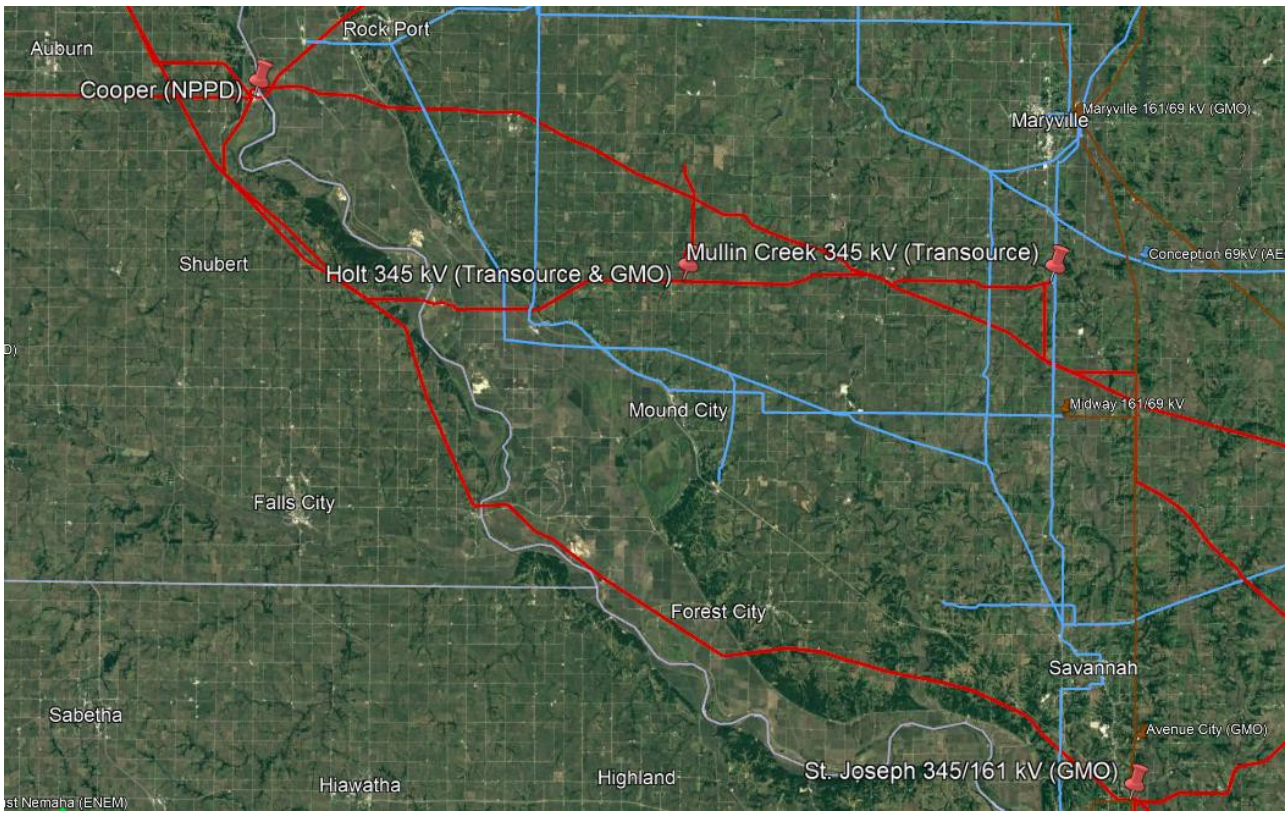
This estimate is accurate to +/- twenty (20) percent, based on current prices, in accordance with Attachment A of Appendix 4 of the Interconnection Facilities Study Agreement. However, recent cost fluctuations in materials are very significant and the accuracy of this estimate at the time of actual settings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

Time Estimate

Time estimates are based on current version of the project schedule and some processes of each category run concurrently.

Engineering Time	12-18	Months
Procurement Time	12-18	Months
Construction Time	12	Months
Total Project Length	36-48	Months

Figure 4 – St Joseph-Cooper 345kV Line Rebuild



St Joseph-Nashua 345kV Line Rebuild (Evergy Metro)

345kV Transmission Line

The estimated cost is for 14.6 miles of the 38.6 miles of 345kV with new bundled 1192.5 Grackle ACSS/TW line conductor with two (2) OPGW static wire, three (3) steel dead end structures, eighty-seven (87) steel tangent structures, one (1) steel running angle structures, and no distribution underbuild.

345kV Substation

At Nashua 345kV substation, the estimated cost is consists of one (1) control panel, as well as removal of the wavetrap.

Total Cost

The total cost estimate for this Network Upgrade is:

$	29,354,123	345kV Transmission Line
$	215,541	345kV Substation
$	1,947,979	AFUDC
$	0	Contingency
$	31,517,643	Total

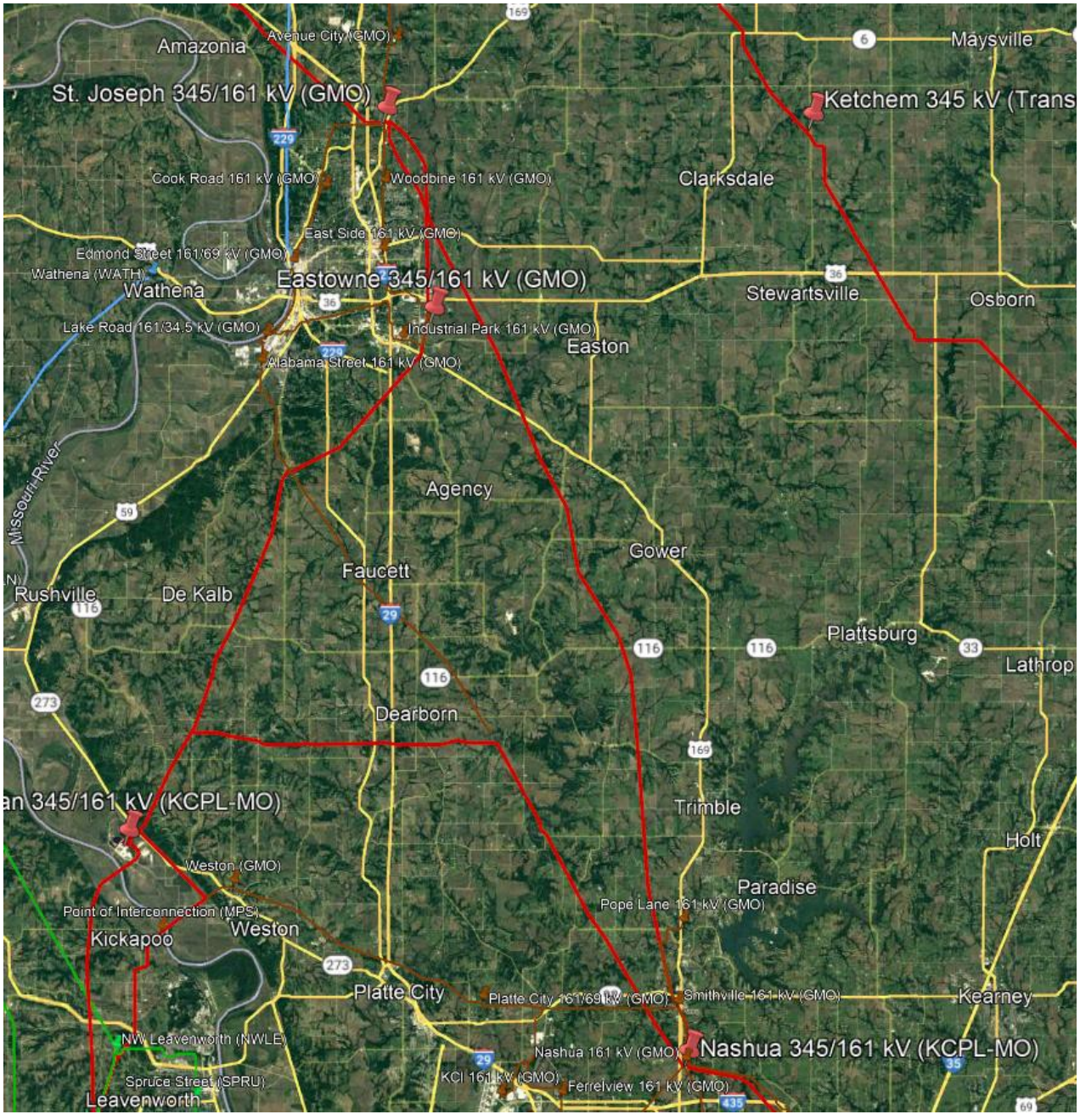
This estimate is accurate to +/- twenty (20) percent, based on current prices, in accordance with Attachment A of Appendix 4 of the Interconnection Facilities Study Agreement. However, recent cost fluctuations in materials are very significant and the accuracy of this estimate at the time of actual settings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

Time Estimate

Time estimates are based on current version of the project schedule and some processes of each category run concurrently.

Engineering Time	12-18	Months
Procurement Time	12-18	Months
Construction Time	12	Months
Total Project Length	36-48	Months

Figure 5 – St Joseph-Nashua 345kV Line Rebuild



St Joseph-Nashua 345kV Line Rebuild (Evergy Missouri West)

345kV Transmission Line

The estimated cost is for 24.0 miles of the 38.6 miles of 345kV with new bundled 1192.5 Grackle ACSS/TW line conductor with two (2) OPGW static wire, eight (8) steel dead end structures, one hundred twenty-eight (128) steel tangent structures, thirteen (13) steel running angle structures, and no distribution underbuild.

345kV Substation

At St Joseph 345kV substation, the estimated cost is for five (5) switches and removal of the wavetrap.

Total Cost

The total cost estimate for this Network Upgrade is:

$	48,462,701	345kV Transmission Line
$	583,578	345kV Substation
$	1,631,527	AFUDC
$	0	Contingency
$	50,677,806	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 estimates are based on current version of the project schedule and some processes of each category run concurrently.

Engineering Time	12-18	Months
Procurement Time	12-18	Months
Construction Time	12	Months
Total Project Length	36-48	Months

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

DISIS 2017-001

Xcel Energy Services, Inc.
Transmission Planning South
Updated 3/2/2022

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), 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 (Months)
Finney 345kV Reactive Support (DISIS-2017-001)	143263	$16,122,303	23
Finney to G17-032 Tap 345kV Rating Increase (DISIS-2017-001)	143228	$290,519	12

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:

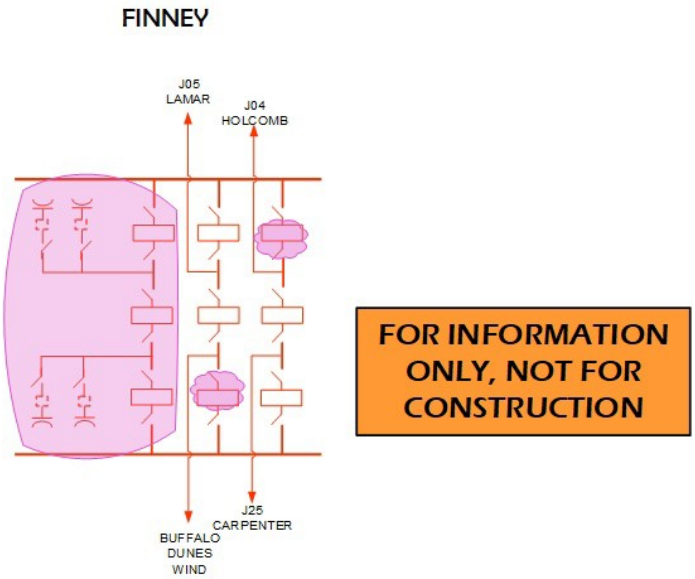
$	0	Transmission Line
$	14,627,961	Substation
$	182,085	AFUDC
$	1,312,257	Contingency
$	16,122,303	Total Cost

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 the line rating on the existing 345 kV line J05 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 line rating limitations to 79 miles of 345kV circuit J05. The proposed network upgrade will replace two existing structures on the line.

Substation Details
No substation work identified for this network upgrade.

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

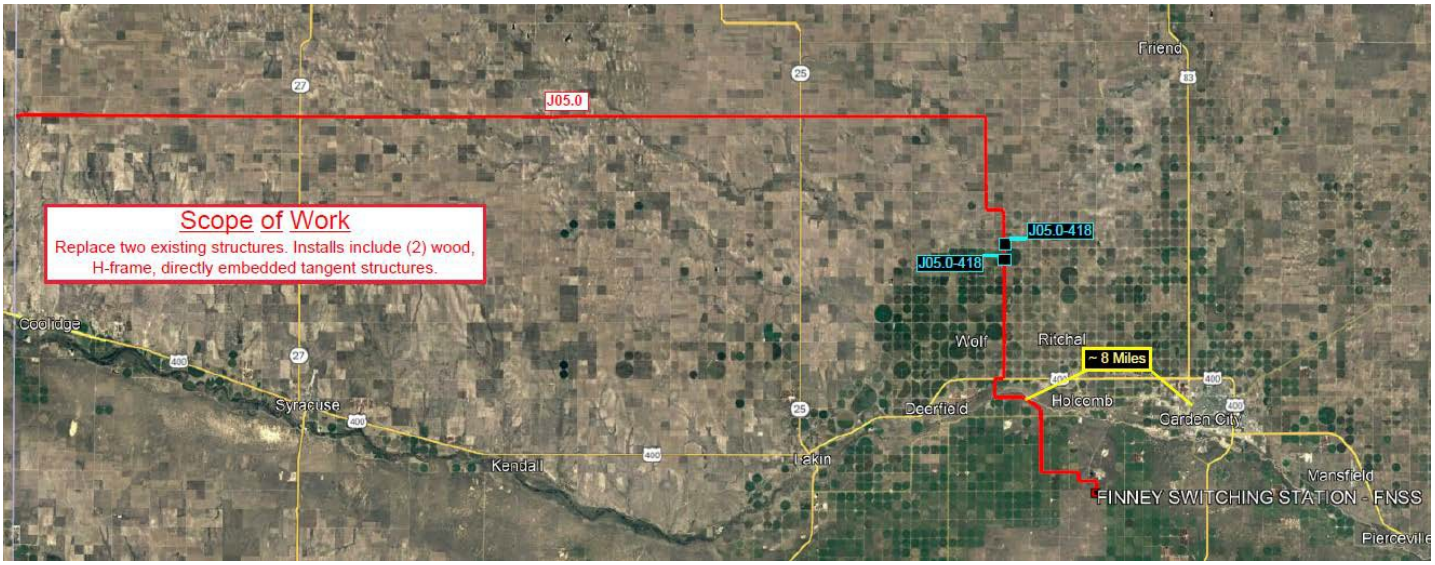
$	257,343	Transmission Line
$	0	Substation
$	9,963	AFUDC
$	23,213	Contingency
$	290,519	Total Cost

The estimate is accurate to +/- 20%

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

Total Project Duration	12	Months

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



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