INTERCONNECTION FACILITIES STUDY REPORT

GEN-2017-222

Published Jan 2023

By SPP Generator Interconnections Dept.

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
01/20/2023	SPP	Initial draft report issued.
03/02/2023	SPP	Final report issued.
07/24/2023	SPP	Table 5 revised to reflect updated AECI costs.
11/20/2025	SPP	Table 2 revised to reflect new upgrade.

CONTENTS

SUMMARY

INTRODUCTION

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2017-222 is for a 180 MW generating facility located in Crawford County, IA. The Interconnection Request was studied in the DISIS-2017-002 Impact Study for ERIS. The Interconnection Customer's requested in-service date is September 1, 2025.

The interconnecting Transmission Owner, Western Area Power Administration (WAPA), 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 seventy-two (72) 2.5 MW - 116 Wind Turbine Generation Systems for a total generating nameplate capacity of 180 MW.

The Interconnection Customer's Interconnection Facilities to be designed, procured, constructed, installed, maintained, and owned by the Interconnection Customer at its sole expense include:

- 34.5 kV underground cable collection circuits;
- 34.5 kV to 230 kV transformation substation with associated 34.5 kV and 230 kV switchgear;
- Two 230/34.5 kV 60/80/100 MVA (ONAN/ONAF/ONAF) step-up transformer to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation;
- 12 mile overhead kV line to connect the Interconnection Customer's substation to the Point of Interconnection ("POI") at the 230 kV bus at existing Transmission Owner substation ("Denison 230kV") that is owned and maintained by Transmission Owner;
- All transmission facilities required to connect the Interconnection Customer's substation to the POI;
- Equipment at the Interconnection Customer's substation necessary to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 95% lagging and 95% leading in accordance with Federal Energy Regulatory Commission (FERC) Order 827. The Interconnection Customer may use inverter manufacturing options for providing reactive power under no/reduced generation conditions. The Interconnection Customer will be required to provide documentation and design specifications demonstrating how the requirements are met; and,
- All necessary relay, protection, control and communication systems required to protect Interconnection Customer's Interconnection Facilities and Generating Facilities and coordinate with Transmission Owner's relay, protection, control and communication systems.

TRANSMISSION OWNER INTERCONNECTION FACILITIES AND NON-SHARED NETWORK UPGRADE(S)

To facilitate interconnection, the interconnecting Transmission Owner will perform work as shown below necessary for the acceptance of the Interconnection Customer's Interconnection Facilities.

Table 1 and **Table 2** lists the Interconnection Customer's estimated cost responsibility for Transmission Owner Interconnection Facilities (TOIF) and Non-Shared Network Upgrade(s) and provides an estimated lead time for completion of construction. The estimated lead time begins when the Generator Interconnection Agreement has been fully executed.

Table 1: Transmission Owner Interconnection Facilities (TOIF)

Transmission Owner Interconnection Facilities (TOIF)	Total Cost Estimate ($)	Allocated Percent (%)	Allocated Cost Estimate ($)	Estimated Lead Time
Denison 230kV GEN-2017-222 Interconnection (TOIF) (WAPA) (143523): Interconnect the following Interconnection Customer facility, GEN-2017-222 (180 MW/Wind), into the Point of Interconnection (POI) at Denison 230kV	$265,000	100%	$265,000	30 Months
Total	**$265,000**		**$265,000**	

Table 2: Non-Shared Network Upgrade(s)

Non-Shared Network Upgrades Description	ILTCR	Total Cost Estimate ($)	Allocated Percent (%)	Allocated Cost Estimate ($)	Estimated Lead Time
Denison 230kV GEN-2017-222 Interconnection (Non-Shared NU) (WAPA) (143522): Interconnect the following Interconnection Customer facility, GEN-2017-222 (180 MW/Wind), into the Point of Interconnection (POI) at Denison 230kV	Ineligible	$9,960,000	100%	$9,960,000	30 Months
Denison to Boyer 69 kV Terminal Upgrade (DISIS-2017-222) (WAPA) (143686): Upgrade terminal equipment at Denison 69kV to achieve 117 MVA minimum summer rating / 115 MVA minimum winter rating	Eligible	$135,000	100%	$135,000	36 Months

Non-Shared Network Upgrades Description	ILTCR	Total Cost Estimate ($)	Allocated Percent (%)	Allocated Cost Estimate ($)	Estimated Lead Time
MEC J611 POI to Evergy's Maryville 161 kV Line Rebuild and Terminal Upgrades (GEN-2017-222) (GMO) (170714) 300 MVA: Rebuild the existing J611 POI - Maryville 161 kV line and upgrade terminal to achieve a minimum rating of 300 MVA.	Eligible	$24,993,489	100%	$24,993,489	56 Months
Total		**$35,088,489**		**$35,088,489**	

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
N/A	N/A	N/A	N/A	N/A	N/A
Total		**N/A**		**N/A**	

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
N/A	N/A	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 ($)	Allocated Percent (%)	Allocated Cost Estimate ($)
NA	NA	NA	NA
Total	**NA**		**NA**

CONCLUSION

After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 180 MW can be granted. Full Interconnection Service will be delayed until the TOIF, Non-Shared NU, Shared NU, Contingent NU, Affected System Upgrades that are required for full interconnection service are completed. The Interconnection Customer's estimated cost responsibility for full interconnection service is summarized in the table below.

Table 6: Cost Summary

Description	Allocated Cost Estimate
Transmission Owner Interconnection Facilities Upgrade(s)	$265,000
Non-Shared Network Upgrade(s)	$35,088,489
Shared Network Upgrade(s)	$0
Affected System Upgrade(s)	$0
Total	**$35,353,489**

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).

Interconnection Facilities Study Report

Southwest Power Pool, Inc. (SPP) Generator Interconnection Request GEN-2017-222

Network Upgrade Request GEN-2017-222

(DISIS-2017-002)

Western Area Power Administration

Upper Great Plains Region (WAPA-UGP)

January 2023

1.0 Background:

The Western Area Power Administration Upper Great Plains Region (WAPA-UGP[1]) received a request for an Interconnection Facilities Study in accordance with the Southwest Power Pool Inc. (SPP) Open Access Transmission Tariff (Tariff) for interconnection of a Generating Facility in Crawford and Carroll Counties, Iowa to the 230-kV bus at WAPA-UGP's Denison Substation. SPP generator interconnection request GEN-2017-222 represents a 180 MW nameplate wind generation facility. A subsequent request for a Network Upgrade Facilities Study was received by WAPA-UGP for a Network Upgrade of a Denison 69-kV Terminal. This Network Upgrade is 100% allocated to GEN-2017-222. Both Facilities Study requests are evaluated with results provided in this report.

The wind generator's collector substation will be located approximately 12 miles northeast of the Denison Substation. The collector station will consist of two (2) 230/34.5-kV transformer and multiple 34.5-kV deliveries to interconnect the individual wind turbines. The Interconnection Customer will construct, own, and maintain approximately 12 miles of radial 230-kV transmission line between the collector substation and the Denison Substation. The Point of Interconnection will be at the 230-kV bus at the Denison Substation. The Point of Change of Ownership between Interconnection Customer and WAPA-UGP will be at the points where Interconnection Customer's 230-kV conductors, jumpers, and insulators connect to WAPA-UGP's 230-kV take-off structure and the rigid bus underhung from the 230-kV take-off structure at the Denison Substation, as illustrated in Attachment B.

This Facilities Study does not address transmission service or any delivery component of transmission service; only the interconnection requirements and operating impacts of the interconnection service component of the Generating Facility.

2.0 Study Requirements:

This Facilities Study includes an evaluation of the following:

2.1 Prepare/develop a substation layout, perform a preliminary bus design, and determine all electrical equipment requirements to accommodate the Request. Develop/compile cost estimates for all WAPA-UGP labor, overheads, equipment additions, modifications, etc. to accommodate the generator interconnection.

2.2 Review and document any other interconnection/control area requirements. Document these additional requirements (such as indication/metering, monitoring, control, relaying) and include these in the cost estimate.

2.3 Determination of need to develop an Operating Guide for WAPA-UGP's Dispatch to document the conditions under which the new Generating Facility must be operated to protect against unacceptable pre- or post-contingent transient voltage and loading conditions.

[1] WAPA-UGP is also referred to as "Western-UGP" in the SPP Tariff.

2.4 Develop an overall time schedule for completion of the necessary addition/modifications.

3.0 <u>Study Results:</u>

The following results document the analysis of the addition of the Generating Facility to WAPA-UGP's transmission system and fulfill the tasks outlined in Section 2.0 above:

3.1 Required Facility Additions by WAPA-UGP:

WAPA-UGP has determined that following additions are required to maintain a safe and reliable interconnection to WAPA-UGP's transmission system:

- Addition of a new 230-kV bay at Denison Substation requiring associated yard expansion
- Conversion of the existing 230-kV, 4-breaker ring bus at Denison Substation to a breaker and half configuration to accommodate the 230-kV bay addition
- Addition of a new control building and 230-kV panels to accommodate the 230-kV bus conversion and bay addition
- Replacement of current transformers, bus, and jumpers on the 69-kV NIPCO line terminal to achieve the required rating

Addition of a new 230-kV bay and the required conversion of the existing 230-kV bus to a breaker and half configuration at the Denison Substation will require four (4) 230-kV power circuit breakers, eight (8) 230-kV disconnect switches, three (3) 69-kV current transformers, associated control and protection equipment, high voltage bus, one (1) transmission line take-off-structure, and conductor. The bay addition and bus conversion will require yard expansion and a new control building to accommodate the additional 230-kV control panels required for the breaker and half bus configuration. WAPA-UGP's estimated cost for labor, overhead, equipment, construction, and other miscellaneous costs for the 230-kV bay addition, 230-kV bus conversion and associated work at Denison Substation is $9,960,000.

The Denison-NIPCO 69-kV line terminal upgrades will require three 69-kV metering current transformers and bus materials to accommodate achieve a required rating of 117 MVA as specified in the DISIS-2017-002 restudy. WAPA-UGP's estimated cost for labor, overhead, equipment, construction, and other miscellaneous costs for the 69-kV terminal upgrades at Denison Substation is $135,000.

3.1.1 Transmission Owner's Interconnection Facilities: Equipment installed by WAPA-UGP for the sole purpose of this interconnection, such as the Transmission Owner's Interconnection Facilities, which includes equipment between of the Point of Interconnection and Point of Change of Ownership, interrogation, and communication equipment, are considered direct assignment facilities and not subject to inclusion as Network Upgrades. The direct assigned costs for such equipment are estimated at $265,000 based upon WAPA-UGP's understanding

of the SPP Tariff provisions and are included in the total cost estimate provided in Attachment A.

3.1.2 Non-Shared Network Upgrades constructed by Transmission Owner: Non-Shared Network Upgrades to be designed, procured, constructed, installed, and owned by WAPA-UGP are the cost responsibility of the Interconnection Customer. This includes the conversion of the existing 230-kV, 4-breaker ring bus to a breaker and half configuration; the addition of a new 230-kV bay; 69kV line terminal bus upgrades; and replacement of 69-kV current transformers at Denison Substation. The cost estimate for the Network Upgrades constructed by the Transmission Owner associated with the 230-kV upgrades is $9,960,000. Based on WAPA-UPG's understanding of the SPP Tariff, these Non-Shared Network Upgrades are considered Non-Capacity Network Upgrades. These Upgrades would not be subject to the transmission service credits described in Article 11.5 of the SPP Generator Interconnection Agreement (GIA).

3.1.3 Network Upgrades constructed by Transmission Owner: The cost estimate for the Network Upgrades constructed by the Transmission Owner associated with the NIPCP 69-kV line terminal upgrades is $135,000.

3.2 Contractual Agreements:

Pursuant to the SPP Tariff, SPP and WAPA-UGP will need to execute a GIA (or initially an Interim GIA, if applicable, with a subsequent execution of a GIA) with the Interconnection Customer for the interconnection of the Generating Facility. The GIA will address specific funding requirements and provide an advanced payment schedule for facility additions and upgrades to address WAPA-UGP's requirements. The GIA, which discusses the construction and interconnection aspects of this project, will need to be developed and offered by SPP, pursuant to their obligations and procedures under the SPP Tariff, and forwarded to the Interconnection Customer for review and signature. A schedule for payment(s) based on design, procurement, and construction activities will be included in the GIA consistent with the SPP Tariff provisions.

3.3 Other Interconnection, Metering Requirements:

Basic indication, monitoring, control, and relaying requirements due to a generator interconnection are included in the cost estimate. A list of specific needs will be provided by WAPA-UGP's Operations Office and WAPA-UGP's South Dakota Maintenance Office once design has progressed.

Interconnection Customer shall install metering at their 230/34.5-kV collector substation in accordance with SPP and WAPA-UGP metering requirements. WAPA-UGP's generation metering requirements, as an SPP Transmission Owner, must be also met, unless specific SPP metering requirements are more restrictive, in accordance with the most current ***Western Area Power Administration Meter Policy*** posted at the "WAPA Meter Policy" link at the following page: http://www.oasis.oati.com/WAPA/WAPAdocs/Western-Common-Business-Practices.html

Any WAPA-UGP specific implementation of more restrictive SPP metering requirements are also posted on WAPA-UGP's OASIS home page under the "Effective Business Practices" folder at the "UGP Meter Policy Modifications" link at the following URL:
http://www.oasis.oati.com/wapa/index.html

Western's ***General Requirements for Interconnection*** must also be met in accordance with the *General Requirements for Interconnection* document posted at the "General Requirements for Interconnection (GRI)" link at the following page:
http://www.oasis.oati.com/WAPA/WAPAdocs/Western-Common-Business-Practices.html

3.4 Operating Guide/Operating Agreement:

Prior to energization, an Operating Guide will need to be developed by WAPA-UGP in coordination with SPP, if necessary, to outline any required operating restrictions under which the generation interconnection must be energized (or de-energized) to protect against unacceptable system stability limits and/or pre-contingent and post-contingent voltage and loading conditions. The Operating Guide will be developed by WAPA-UGP's Transmission System Planning Division in coordination with SPP Staff. In addition, an Operating Agreement will be developed by WAPA-UGP's Operations Office, jointly with the Interconnection Customer and SPP, if necessary, as will be set forth in the GIA to outline the necessary operations coordination and requirements not otherwise set forth in the GIA.

3.5 Schedule:

Attachment A outlines WAPA-UGP's estimated schedule for planning, design and construction of the facilities required to accommodate the Interconnection Customer's Request. WAPA-UGP anticipates the new 230-kV bay addition and breaker and half conversion at the Denison Substation would be completed by June 1, 2026. This schedule is based on the GIA (or Interim GIA) being executed prior to June 1, 2023, and issuance of the NEPA Finding of No Significant Impact or Record of Decision by June 1, 2024.

3.6 Environmental Review:

The Environmental Review for this project, as described in Attachment V, Sections 3.3.5, and 8.6.1, and any other applicable sections of the SPP Tariff, is being coordinated between WAPA-UGP and Interconnection Customer. The Environmental Review is performed at the Interconnection Customer's expense, and those costs are considered direct assigned costs and are ineligible for credits under the SPP Tariff.

4.0 Facilities Study Cost:

WAPA-UGP will audit the Interconnection Facilities Study costs and provide a summary of costs once the study is completed or the interconnection request is withdrawn.

ATTACHMENT A

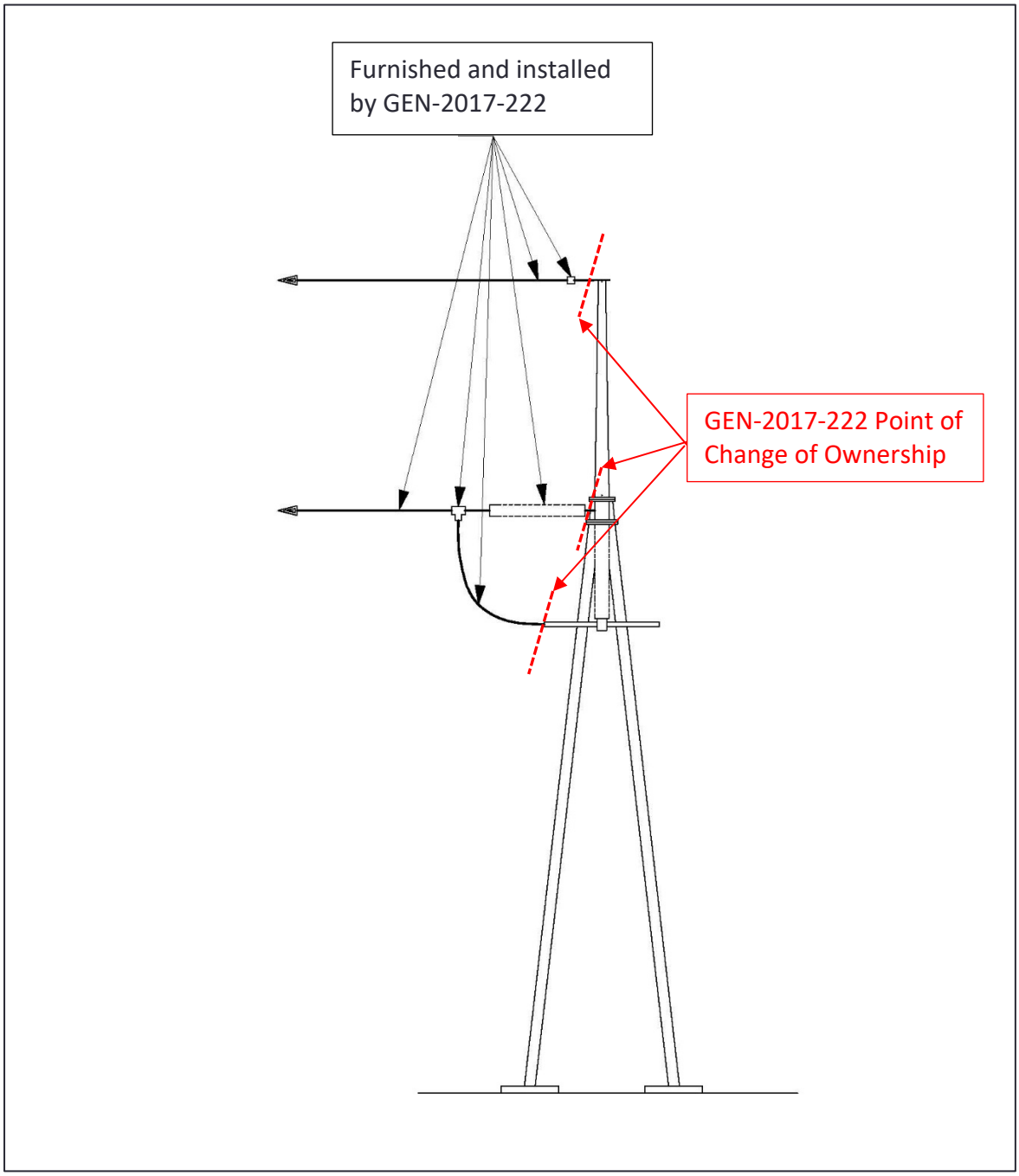
DENISON SUBSTATION 230-kV SWITCHYARD
MODIFICATIONS AND ADDITIONS

PROJECT ACTIVITY	ESTIMATED START DATE	ESTIMATED COST, MILESTONE PAYMENT DUE
Preconstruction activities – planning, project management, etc.	30 Calendar Days Following GIA Execution*	$450,000
Provide staff and other resources to engineer, design, and plan construction	30 Calendar Days Following GIA Execution*	$710,000
Procure equipment, parts, and control equipment necessary to construct	October 15, 2023	$2,450,000
Development & Solicitation of Construction Contract(s)	July, 2024	$100,000
WAPA-UGP Construction Activities	October 15, 2024	$5,900,000
Commissioning, Energization, and construction supervision	March 1, 2026	$750,000
In-Service (Estimated Completion Date)	June 1, 2026	
TOTAL ESTIMATED COSTS		$10,360,000**

*Assumes Execution of GIA NLT June 1, 2023.

**Includes Transmission Owner Interconnection Facilities costs estimated at $265,000, Non-Shared Network Upgrades constructed by Transmission Owner costs estimated at $9,960,000 and Network Upgrades constructed by Transmission Owner costs estimated at $135,000.

ATTACHMENT B



Current Study

Costs associated with DISIS-2017-222 Rebuild Maryville-Braddyville 161kV Line and Terminal Upgrades to 300 MVA November 2025

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-2017-002 Interconnection Request(s). Evergy, as a TO, is receiving an unprecedented amount of GI interconnect requests. The cost estimates and interconnect information supplied are based on current system configuration. There are many cases of multiple GI's requesting POIs at the same substation. Ongoing changes in Evergy's transmission system configuration could affect the required system upgrades and costs necessary to meet any particular GI interconnect request in the future.

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 Estimate	DISIS Lead Time
Current Study	170714	MEC's J611 POI to Evergy's Maryville 161 kV Line Rebuild and Terminal Upgrades (GEN-2017-222) (GMO) 300 MVA	$ 24,993,489.00	56 Months

MEC's J611 POI to Evergy's Maryville 161 kV Line Rebuild and Terminal Upgrades (GEN-2017-222) (GMO)

161kV Line

Network Upgrades to rebuild the Evergy portion of the MEC's J611 POI to Evergy's Maryville 161kV Line and Terminal Upgrades to at least 300 MVA. This upgrade includes terminal upgrades at Maryville 161kV substation and line rebuild from the POI with MEC to the Maryville 161kV substation for GEN-2017-222. The 161kV substation terminal upgrades include Engineering and material necessary to achieve a 300 MVA rating. The transmission line estimates assume H-frame construction with direct embed galvanized steel poles to fit either Grackle ACSS/TW or bundled ACSR. UID 170714.

Total Cost

The total cost estimate for this Network Upgrade is:

$	24,124,464	Transmission Line
$	746,724	Substation
$	55,514	AFUDC
$	66,787	Contingency
$	24,993,489	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	48-56	Months
Procurement Time	48-56	Months
Construction Time	48-56	Months
Total Project Length	48-56	Months

Figure 1 – MEC's J611 POI to Evergy's Maryville 161 kV Line Rebuild and Terminal Upgrades