INTERCONNECTION FACILITIES STUDY REPORT

GEN-2021-076

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By SPP Generator Interconnections Dept.

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
November 19, 2025	SPP	Initial draft report issued.
December 2, 2025	SPP	Final report issued.

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SUMMARY

INTRODUCTION

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2021-076 is for a 113 MW generating facility located in Ellis, KS. The Interconnection Request was studied in the DISIS-2021-001 Impact Study for ERIS/NRIS. The Interconnection Customer's requested in-service date is 12/31/2026.

The interconnecting Transmission Owner, ITC Great Plaines (ITCGP), 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 thirty-one (31) 3.64 MW TMEIC Ninja 5 PCS inverters for a total generating nameplate capacity of 113 MW.

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

- 34.5 kV underground cable collection circuits;
- 34.5 kV to 345 kV transformation substation with associated 34.5 kV and 345 kV switchgear;
- One 345 kV/34.5 kV 130/130/130 MVA (ONAN/ONAF/ONAF) step-up transformer to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation;
- An approximately 0.04 mile overhead 345 kV line to connect the Interconnection Customer's substation to the Point of Interconnection ("POI") at the 345 kV bus at existing Transmission Owner substation ("ITC Post Rock 345 kV 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 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** list 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 ($)	Allocated Percent (%)	Allocated Cost Estimate ($)
Transmission Owner's Post Rock 345 kV Substation GEN-2021-076 Interconnection (TOIF) (UID 157076): Interconnection upgrades and cost estimates needed to interconnect the following IC facility, GEN-2021-076 (113/Solar), into the Point of Interconnection (POI) at Post Rock 345 kV Substation. Estimated Lead Time: 36 Months	$1,268,386	100.00%	$1,268,386
Total	**$1,268,386**		**$1,268,386**

Table 2: Non-Shared Network Upgrade(s)

Non-Shared Network Upgrades Description	ILTCR	Total Cost Estimate ($)	Allocated Percent (%)	Allocated Cost Estimate ($)
Transmission Owner's Post Rock 345 kV Substation GEN-2021-076 Interconnection (Non-shared NU) (UID 157077): Interconnection upgrades and cost estimates needed to interconnect the following IC facility, GEN-2021-076 (113/Solar), into the Point of Interconnection (POI) at Post Rock 345 kV Substation. Estimated Lead Time: 36 Months	Ineligible	$4,928,075	100.00%	$4,928,075
NPPD's Rebuild AXTELL7 to KEARNEY7 115 kV line 1 (UID 170654): Rebuild the AXTELL7 to KERANEY7 115kV line CKT1 (10.74 miles) to a minimum rating of 254 MVA. Estimated Lead Time: 60 Months	Eligible	$15,600,000	100.00%	$15,600,000

Non-Shared Network Upgrades Description	ILTCR	Total Cost Estimate ($)	Allocated Percent (%)	Allocated Cost Estimate ($)
MIDW's Build a new North Hays to Chelotalah 115 kV line 1 (UID 170652): Build a new NorthHays to Chelotalah 115kV line CKT1 (8 miles) to a minimum rating of 206/239. Estimated Lead Time: 30 Months	Eligible	$15,250,816	100.00%	$15,250,816
Total		$35,778,891		$35,778,891

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 ($)	Allocated Percent (%)	Allocated Cost Estimate ($)
Evergy's Build a new 50 MVAR cap bank at Viola 138 kV (UID 170643): Build a new 50 MVAR cap bank at VIOLA 138 kV. Estimated Lead Time: 48 Months	Eligible	$1,270,333	1.70%	$21,571
NPPD's Build a new AXTELL 345/115 kV Transformer 2 (UID 170653): Build a new AXTELL 345/115 kV Transformer 2 to a minimum rating of 336 MVA. Estimated Lead Time: 60 Months	Eligible	$26,200,000	22.60%	$5,919,938
NPPD & ITCGP's Switch out Axtell to G16-050-TAP 345 kV line reactor at Axtell (50 MVAR) (170651, 170655): Switch out Axtell to G16-050-TAP 345 kV line reactor at Axtell (50 MVAR). Estimated Lead Time: 0 Months	Ineligible	$0	16.69%	$0
Total		**$27,470,333**		**$5,941,509**

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
NA		

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			
Total	**$0**		**$0**

CONCLUSION

After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 113 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)	$1,268,386
Non-Shared Network Upgrade(s)	$35,778,891
Shared Network Upgrade(s)	$5,941,509
Affected System Upgrade(s)	$0
Total	**$42,988,786**

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-2021-076
In Ellis County, Kansas.
Revised July 27, 2025

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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-2021-076 under the SPP Open Access Transmission Tariff. The subject request entails interconnecting 113MW Solar powered generation facilities in Ellis County, Kansas. The project will interconnect at Post Rock Substation. It is scheduled for completion by December 31, 2028. 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 2021-001, 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 **$6,196,461** (+/ - 20 % accuracy) including applicable company overheads in 2025 dollars. It includes **: $4,928,075** for Network Upgrades and **$1,268,386** for Transmission Owner Interconnection Facilities. It is further estimated that the required legal/real estate acquisition and construction activities will require approximately 36 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. If a commercial operation date is required in a timeframe sooner than 36 months, ITCGP highly recommends that the customer and ITCGP enter into an E&P agreement as soon as possible to allow for the long lead time materials to be procured.

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-2021-076 interconnection facilities will require Network Upgrades on the ITCGP system to connect the new generation. Network Upgrades consist of the following:

- 3 new 345 kV breaker associated disconnects at Post Rock Substation
- 5 new 345kV disconnect switches
- Associated equipment (instrument Transformer, Bus, Cables, Stands etc.)

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-2021-076 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 solar farm collector station and the radial 345kV line from the collector station to the ITCGP Post Rock substation. 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 2021-001. As per SPP DISIS 2021-001, 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 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 Interconnection Agreement.

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, 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 GEN-2021-076 interconnection at Post Rock substation

3.1.1 Project Location:
Post Rock Substation

3.1.2 Project Overview:
The purpose of this project is to provide a transmission system interconnection for the GEN-2021-076 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.

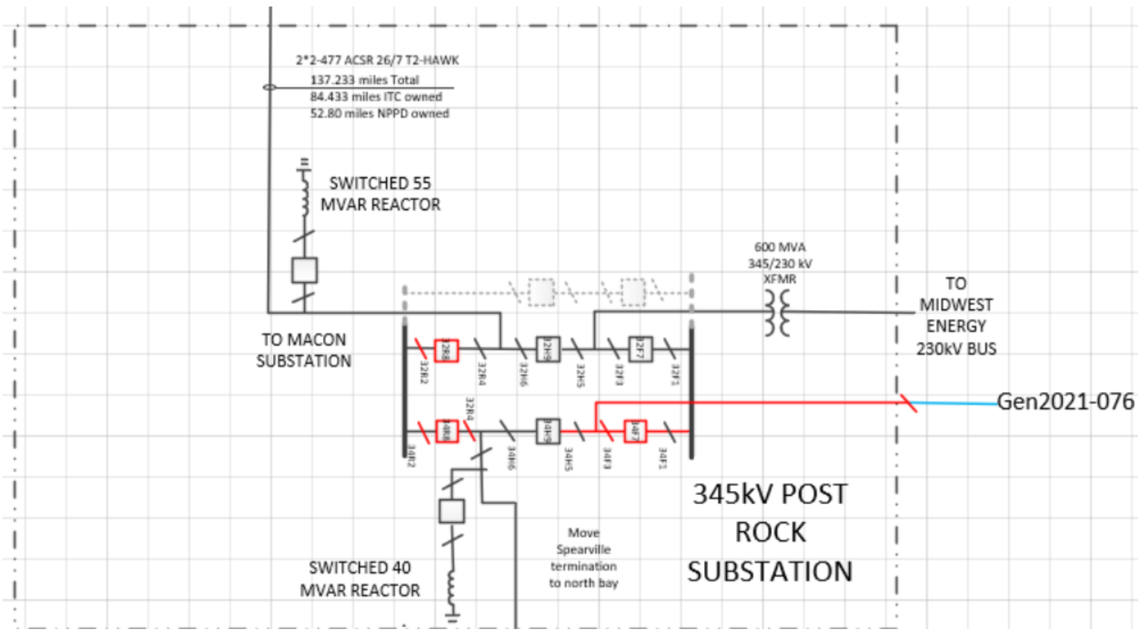


Figure 1 GEN-2021-076 Interconnection Substation One Line

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 general guidelines.

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 & Control Overview:
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 Fault Levels:
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
Post Rock 345 kV Bus	8100	7200
GEN-2021-076 345 kV Bus	6098	500

Fault currents shown in Table 1 are within the circuit breaker interrupting capabilities with the addition of 113 MW Solar contributed by GEN-2021-076.

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 Post Rock Substation facilities. ITCGP studies concluded that no

additional reactive compensation is required for interconnection of GEN-2021-076 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): (3) 345 kV, 3000A rated, 40kAIC.

- Disconnect Switch: (4) 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 wires 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:

- (4) 345 kV disconnect switch stands
- (1) H-frame line entrance structures
- (2) 345kV CCVT stands
- (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
Standard Material Procurement / Design 52 weeks
Long Lead Breakers and Disconnects 36 months
Substation Construction 32 weeks
Closeout Activities 4 weeks

3.1.20 Site Work:
NA

3.1.21 Total Cost:$ **4,928,075**
Total Cost Estimate Accuracy: +/- 20%

Note that the cost estimate provided is expressed in 2025 terms and includes applicable company overheads.

4.0 Transmission Owner Interconnection Facilities

4.1 GEN-2021-076 – Interconnection Facilities

4.1.1 Project Location:
Post Rock Substation

4.1.2 Project Overview:
A new line entrance structure will be added at the GEN-2021-076 interconnection to Post Rock 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:

Figure 2 – Site Plan

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 the 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-2021-076 line.

- 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 be installed.

4.1.11 Insulation Coordination:
345kV, 1050kV BIL

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

4.1.13 Other Equipment & Materials:

- Disconnect Switch: (1) 345 kV, 3000A rated, 1050 kV BIL.
- CCVTs: Three (3) 345 kV, 3-winding, 1550kV BIL.
- 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-panel connections.

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 80 standards.

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-2021-076 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:

- (1) 345 kV disconnect switch stand
- (1) H-frame line entrance structures
- (3) 345 kV CCVT stands
- (3) 345 kV surge arrester stands

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: **$1,268,386**
Total Cost Estimate Accuracy: +/- 20%
Total Project cost (Network Upgrades and Interconnection facilities): $6,196,461

Note that the cost estimate provided is expressed in 2025 terms and includes applicable company overheads and potential tax gross ups.

5.0 Interconnection Customer Interconnection Facilities

5.1 GEN-2021-076 Interconnection facilities

All facilities within the Interconnection Customer's collector substation and between the Interconnection Customer's substation and ITCGP's new GEN-2021-076 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 Solar farm collector station to ITCGP's Post Rock substation. Installation of OPGW shield wire on the radial line from GEN-2021-076 containing at least 12 single mode fibers will be required for ITCGP relaying and communication purposes.

The customer's step-up transformer between the Solar 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.

Interconnection Facilities Study

Costs associated with DISIS-2021-001 Build a new 50 MVAR cap bank at Viola 138kV August 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-2021-001 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	170643	Build a new 50 MVAR cap bank at Viola 138kV	$ 1,270,333.00	48 Months

Build a new 50 MVAR cap bank at Viola 138kV

138kV Substation

Network Upgrades to add a new 50 MVAR cap bank at Viola 138kV. This upgrade includes installation of a new 50 MVAR capacitor bank on the 138kV bus at Viola. UID 170643

Total Cost

The total cost estimate for this Network Upgrade is:

$	0	Transmission Line
$	1,161,332	Substation
$	3,800	AFUDC
$	105,201	Contingency
$	1,270,333	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	48	Months
Construction Time	48	Months
Total Project Length	48	Months

Figure 1 –Viola 138kV substation

Midwest Energy Inc.

Network Upgrade Study for DISIS-2021-001

August 15, 2025

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-2021-001) in accordance with the SPP Generator Interconnection Procedures (GIP) Section 8.11 for the following Network Upgrades:

- Rebuild North Hays to Chetolah Creek 115kV line

Network Upgrade Scope

The study performed by SPP for DISIS-2021-001 identified overloaded 115kV line between North Hays and Chetolah Creek 115kV substations. The North Hays – Chetolah Creek 115kV line is currently constructed and operated in two segments. The first segment, Chetolah Creek – Vine Tap is 0.78 miles long with 795 ACSR Drake conductor. The North Hays – Vine Tap segment is 3.61 miles long with 266.8 ACSR Partridge conductor. The existing North Hays – Vine Tap line route travels through residential and commercial portions of the City of Hays, Kansas and was constructed in 1952. The area has seen significant encroachment since construction, and rebuilding the line in place is not feasible. Midwest Energy has identified a new line route and secured easements to rebuild this line without passing through heavily populated areas of hays. The new North Hays – Chetolah Creek 115kV line will be approximately 8 miles long and will use 1192.5 ACSR Bunting Conductor on steel monopoles. The 477 ACSR Hawk strain bus at the North Hays substation will also be replaced with 1192.5 ACSR Bunting. After the new line is constructed, the existing North Hays – Vinetap line segment will be torn down. The current summer rating of North Hays – Vinetap is 83 MVA Normal and 99 MVA Emergency. The new North Hays – Chetolah Creek summer Normal Rating will be 226MVA, limited by the conductor. The summer Emergency Rating will be 239MVA, limited by 1200A switches at North Hays. Figure 1 below shows the new line route in green.

Figure 1: North Hays – Chetolah Creek 115kV line route

Estimated Upgrade Costs

Network Upgrade – UID 170652	Cost (2025 Dollars)
Rebuild North Hays - Chetolah 115kV line on new right-of-way, Replace strain bus and line deadend at North Hays Substation, Tear down existing North Hays – Vine tap 115kV line (Estimated Cost includes materials, equipment, labor, engineering, contingency costs, and taxes)	$15,250,816

The estimated cost of this project is $15,250,816 which exceeds the DISIS estimate of $11,230,000. The increased costs account for new right of way, environmental analysis, demolition of the existing North Hays – Vine Tap 115kV line segment, and escalating material and labor costs.

Project Lead Time

Project in-service date is projected to be 30 months after the issuance of an NTC from SPP.

NPPD
DISIS-2021-001
FACILITY STUDY

NOVEMBER 2025

PREPARED FOR:
SOUTHWEST POWER POOL

PREPARED BY:
NEBRASKA PUBLIC POWER DISTRICT
ENERGY DELIVERY
TRANSMISSION ASSET PLANNING
ENGINEERING & ASSET MANAGEMENT

Nebraska Public Power District
"Always there when you need us"

The *NPPD DISIS-2021-001 Facility Study* was performed to document the interconnection facilities and network upgrades identified by SPP in Phase 2 of the SPP DISIS-2021-001 Study. NPPD also reviewed the proposed interconnection facilities and network upgrades and associated generation interconnection request impacts on the Short Circuit capability of the NPPD system. The NPPD Facility Study includes detailed cost estimates and estimated project schedules for the upgrades identified in the SPP studies.

Interconnection Facility Upgrades

NPPD's Engineering, Asset Management, and Project Management groups have reviewed the interconnection facility upgrades that are required for SPP DISIS-2021-001 Generation Interconnection projects. Detailed cost estimates have been prepared for the facility upgrades that were identified in the system impact study for the requests. The prepared cost estimates are study level estimates (+20%/-20%) and assume implementation of standard NPPD construction and procurement practices. The cost estimates for the interconnection facilities are below:

- Olive Creek 115 kV Substation
    - GEN-2020-027
        - 102 MW Solar
    - Expand Olive Creek 115 kV substation.
    - 36 Month Lead Time

$ 1,300,000

- Antelope 345 kV Substation
    - GEN-2021-057
        - 300 MW Wind
    - Expand Antelope 345 kV Substation.
    - 60 Month Lead Time

$ 16,300,000

Preliminary one-line diagrams for each generation interconnection project are in Appendix 2.

Generator Interconnection Reactive Compensation Requirements (MVAR)

The SPP DISIS-2021-001 Phase 2 study documented the GI customer reactive compensation requirements for each POI. The following reactive compensation requirements should be included in the generation interconnection agreement as GI customer reactive power requirements to ensure the reliability of the SPP transmission system is maintained following the proposed GI projects.

Gen Number	Fuel Type	MW Amount	Reactive Compensation Requirement (MVAR)	POI
GEN-2020-027	Solar	102	-0.6	Olive Creek 115 kV Substation
GEN-2020-057	Wind	300	-29.9	Antelope 345 kV Substation

Network Upgrades

NPPD's Engineering, Asset Management, and Project Management groups have reviewed the network upgrades that are required for SPP DISIS-2021-001 Generation Interconnection projects. Detailed cost estimates have been prepared for the facility upgrades that were identified in the system impact study for the requests. The prepared cost estimates are study level estimates (+20%/-20%) and assume implementation of standard NPPD construction and procurement practices. The cost estimates for the network upgrades are below:

- Second Antelope 345/115 kV transformer
  - Install second 345/115 kV transformer at Antelope 345/115 kV substation including terminal upgrades.
  - At least 417 MVA
  - 60 Month Lead Time

$ 26,200,000

- Second Axtell 345/115 kV transformer
  - Install second 345/115 kV transformer at Axtell 345/115 kV substation including terminal upgrades.
  - At least 417 MVA
  - 60 Month Lead Time

$ 26,200,000

- Axtell – Kearney 115 kV Line Rebuild
    - Rebuild existing Axtell – Kearney 115 kV Line
    - At least 400 MVA (rebuild)
    - 60 Month Lead Time

$ 15,600,000

Network Upgrade project schedule details will be further discussed in the development of the generator interconnection agreements (GIA) and the milestones associated with the generation interconnection projects.

<u>Contingent Upgrades</u>

The results of DISIS-2021-001 documented that several Generation Interconnection requests are contingent on the completion of the following previously allocated required network upgrades:

- Gentleman – Thedford - Holt County (R-Project) and Thedford 345/115 kV Transformer project (2012 ITP10/HPILS)

If the generation interconnection projects proceed to the generation interconnection agreement, then an operating study may need to be performed to fully assess and evaluate the operation of the generation facility and network upgrades in accordance with NERC Standards. The operating study requirement will be included in the generation interconnection agreement with NPPD. If any generation interconnection projects are identified to have significant impact on the GGS Stability Interface (Flowgate #6006) and LRS/DC stability limitations in western NE, then the operating study will need to take these issues into account. The operating study may also need to evaluate the reactive power control requirements and associated equipment necessary to meet operational voltage requirements at the requested point of interconnection.

Short Circuit Study

NPPD's Engineering group has reviewed the short circuit impacts of the SPP DISIS-2021-001 Generation Interconnection projects and associated network upgrades interconnected to the NPPD transmission system. The result of this study is documented in Appendix 1. The short circuit study identified three breakers at the NPPD Axtell 115 kV substation that needs replaced (Axtell 115 – 1102, 1104, 1108). The details of these breaker replacements are listed below. This breaker replacement network upgrade project should be included in the Generation Interconnection agreements associated with the DISIS-2021-001.

- Replace Axtell 115 kV breakers
  - Replace Axtell 115 kV breaker 1102, 1104 and 1108 with higher interrupting rating breaker.
  - At least 40 KA
  - 36 Month Lead Time

$ 2,000,000

Appendix 1

NPPD Short Circuit Study Report

DISIS-2021-001

Short Circuit Study

Model Development

Computer Programs

The Aspen OneLiner software program was utilized to perform short circuit simulations and studies on the transmission system. Where elements were added to the short-circuit model, best estimates for impedance parameters were used based on available data and typical modeling practices. Short-circuit calculation options used were as follows:

- Flat voltage profile with V(pu) = 1.0
- Generator Impedance = Subtransient
- Ignore loads, transmission line G+jB, and shunts with positive sequence values

OneLiner was used to calculate three-phase (3PH) and single-line-to-ground (SLG) system-intact bus fault currents for all system buses associated with interrupting devices being evaluated in this study. For devices that the full bus fault current approached or exceeded the device's interrupting rating, more detailed fault calculations were done, calculating the maximum phase current through the breaker for close-in faults, close-in faults with the remote end open, and bus faults with all other branches to the bus open. The maximum phase current of these faults was recorded. For comparison with the breaker interrupting ratings, maximum phase current was multiplied by a factor of 1.05 to account for the possibility of the system operating at up to the maximum normal operating voltage of 1.05 per-unit.

Base System Model Additions ("Base Case")

The base system model used by the transmission system protection department as of October 27, 2025 was used as the starting point for the short-circuit model used for this study. The base system model included all projects that were in-service at the time the model was copied. All Nebraska-area generation in the short-circuit model was enabled in order to provide maximum short-circuit current. For the study base case, planned system upgrades in the area of the studied projects and prior-queued large generator interconnections expected to be in-service prior to the projects being studied were added to the base case model. Table 1 lists the prior-queued large generator interconnections that were added to the base model for this study.

Table 1: Prior Queued Large Generator Interconnections

Queue Designation	Proposed POI	Capacity (MW)
GEN-2013-002	Hallam 115kV / Panama WF to Olive Creek	50.6
GEN-2013-019	Hallam 115kV / Panama WF to Olive Creek	73.6
GEN-2016-074	Sweetwater 345kV (Expand substation)	200
GEN-2017-144	Holt County 345kV Substation (Expand substation)	200
GEN-2017-181	Tobias 345kV Substation (Expand substation)	300
GEN-2017-182	Tobias 345kV Substation (Expand substation)	128
GEN-2017-201	Turtle Creek 345kV connect at Sholes WF	250
GEN-2017-234	Greeley 115kV Substation (New substation)	115
GEN-2018-060	Macon 345kV (Expand substation)	50
GEN-2018-125	Etna 345kV (New substation)	231
GEN-2018-131	Pierce County 115kV (New substation)	221.4
GEN-2018-132	Pierce County 115kV (New substation)	201.6
GEN-2019-039	Butler County 115kV (New substation)	174.5
GEN-2019-041	Olive Creek 115kV (Expand substation)	78
GEN-2020-011	Axtell 345kV Substation (Expand substation)	320
GEN-2020-013	Orleans 115kV Substation (Expand substation)	215
GEN-2020-069	Kilgore 115kV Substation (New substation)	52.85

In addition to the prior-queued large generator interconnections, planned system upgrades in the area of the studied projects were added to the base model. These include:

- The planned 345kV line from GGS – Thedford – Holt County "RPLAN" was included with a 345kV/115kV tie transformer at Thedford 115 kV
- New 345kV line from Antelope to Holt County
- New Olive Creek sub addition near Mark Moore/Sheldon
- Upgrade of the Columbus East T3 to 336MVA
- Stanton North expansion for a new 100MVA load-serving transformer, future 115kV line Stanton North to Norfolk, Hoskins T1 replaced with a 336MVA
- Upgrade of Mark Moore T1 replacement with a 417MVA
- Rebuild of L1153B Columbus SE to new collector sub for G19-39-TAP (Butler County) to Rising City
- Rebuild of L1132 Holdrege-Orleans to new collector sub for G20-13 at/near Orleans

Model Additions for Projects Being Studied ("Study Case")

The base-case study model was modified to include the new generation interconnections being considered in this study as well as the system upgrades identified to accommodate this additional generation. Table 2 lists the large generator interconnections that were added to the study-case model for this study.

Table 2: Large Generator Interconnections Added to Study Case

Queue Designation	Proposed POI	Capacity (MW)
GEN-2021-027	Olive Creek 115kV Substation (Expand substation)	102
GEN-2021-057	Antelope 345kV Substation (Expand substation)	300

In addition to the DISIS-2021-001 generator interconnections, network system upgrades in the area of the studied projects were added to the base model. These include:

- Addition at Antelope of a 345kV/115kV transformer at 417MVA
- Addition at Axtell of a 345kV/115kV transformer at 417MVA
- Rebuild of L1067 Axtell-Kearney.

Study Methodology

Circuit breaker, circuit switcher, and fuse ratings were identified by querying NPPD's SAP equipment database and extracting equipment data including short-circuit ratings. Breaker ratings given on an asymmetrical (total current) basis were converted to symmetrical current ratings using an assumed maximum system operating voltage of 1.05 per unit.

The calculated short-circuit current at the equipment bus was extracted from the short-circuit results from Aspen OneLiner and compared against the interrupting device interrupting rating. It is recommended that all equipment be replaced if it is found to be at or above 95% of its interrupting rating and seeing an increase of 1% or more in its interrupting duty as a result of the studied projects.

Results

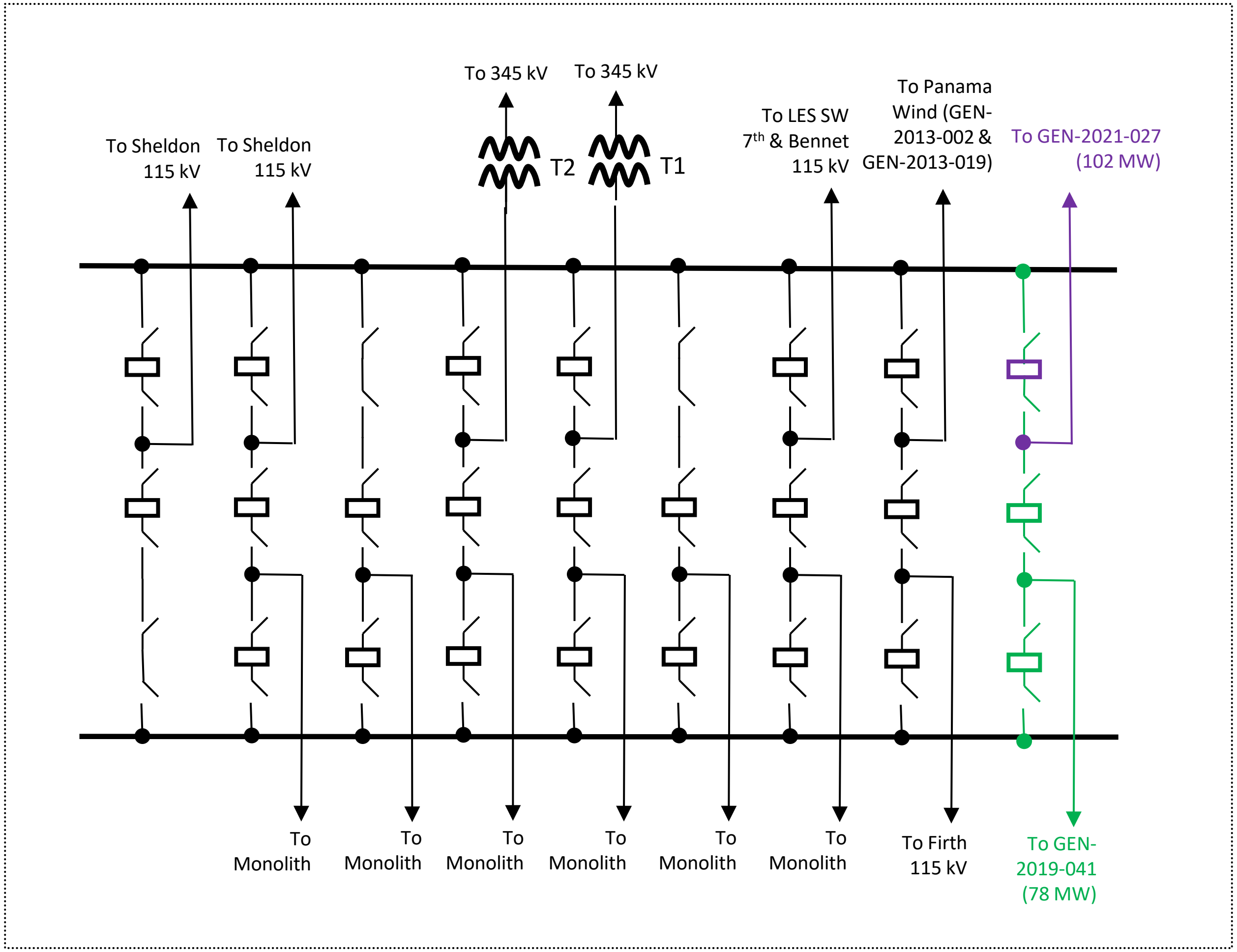
The following devices were found to be above 95% of their interrupting rating due to the addition of the projects considered in this study and are recommended for replacement.

Location – Breaker	Manuf.	Model Number	Interrupting Rating	Max Expected Interrupting (A)	Max Current (% of Rating)	Relative Change (%)
Axtell 345 – 1102	WESTING HOUSE	1150-GM-5000	19367	25345	130.9%	45.0%
Axtell 345 – 1104	ITE IMPERIAL COMPANY	115-KM-5000-12B	19089	25345	132.8%	45.0%
Axtell 345 – 1108	ALLIS CHALMER S	BZO-121-20-7	20000	25345	126.7%	45.0%

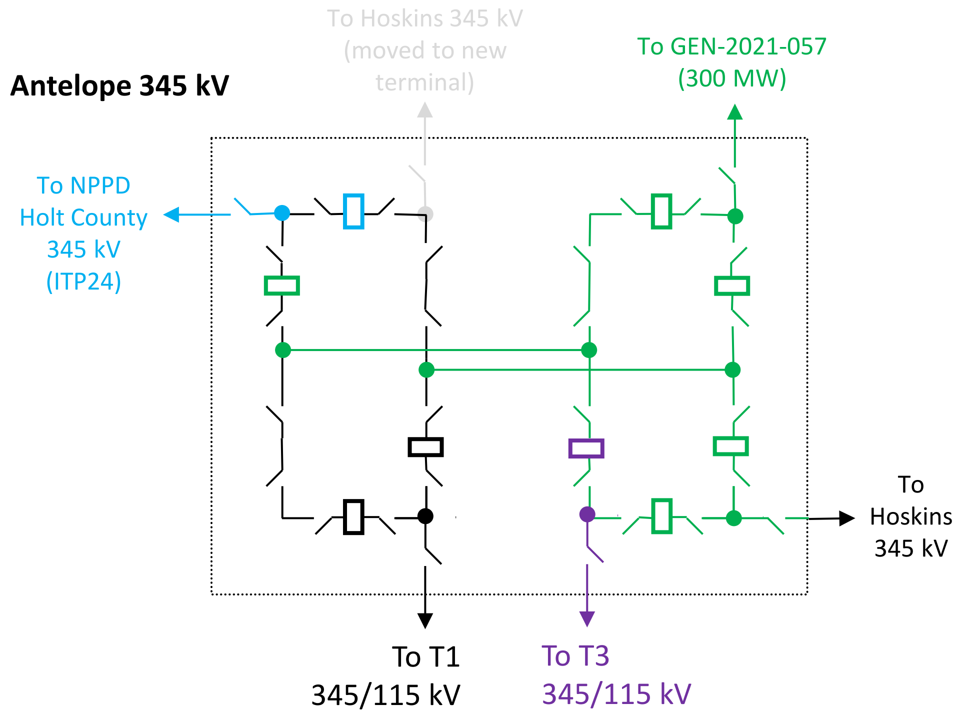
Appendix 2

Generation Interconnection Facilities One-Line Diagrams

Olive Creek 115 kV Substation



- DISIS-2018-002 and DISIS-2019-001 Interconnection Facilities for GEN-2019-041
- DISIS-2021-001 Interconnection Facilities for GEN-2021-027



- DISIS-2021-001 Interconnection Facilities for GEN-2021-057
- DISIS-2021-001 Network Upgrade – 2nd Axtell 345/115 kV Transformer
- ITP24 Project: Antelope – Holt County 345 kV