



INTERCONNECTION FACILITIES STUDY REPORT

GEN-2016-112
(IFS-2016-002-07)

Published January 2021

By SPP Generator Interconnections Department

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
09/10/2020	SPP	Initial draft report issued.
09/11/2020	SPP	Updated Table 2 and Table 3 to reflect elimination of Z2 credits.
10/08/2020	SPP	Final report issued. No change.
12/10/2020	SPP	Updated final report. Revised Facility Study for 'Hoyt to JEC' Upgrade
01/11/2021	SPP	Updated final report issued. Updated Table 3 to reflect cost allocation included in GEN-2016-122

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SUMMARY

INTRODUCTION

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2016-112/IFS-2016-002-07 is for a 220 MW generating facility located in Ellsworth, KS. The Interconnection Request was studied in the DISIS-2016-002 Impact Study for Energy Resource Interconnection Service (ERIS) and Network Resource Interconnection Service (NRIS). This request was restudied in the DISIS-2016-002-2 Impact Study for ERIS. The Interconnection Customer's requested in-service date is December 31st, 2020.

The interconnecting Transmission Owner, Eversource Kansas Central (WERE), 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 eighty-eight (88) General Electric 2.5 MW Wind Turbine Generation Systems for a total generating nameplate capacity of 220 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 345/34.5 kV 204/272/340 MVA (ONAN/ONAF/ONAF) step-up transformer to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation;
- An overhead kV line to connect the Interconnection Customer's substation to the Point of Interconnection ("POI") at the kV bus at existing Transmission Owner substation ("Reno - Summit 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 Turbine 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 communications 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
<u>GEN-2016-112 Interconnection (TOIF) (WERE) -122618:</u> No upgrade needed.	\$0	N/A	\$0	N/A
Total	\$0		\$0	

*Because GEN-2016-112 shares a generator lead with GEN-2016-122 from the customer facility to the Point of Interconnection, if, for any reason, GEN-2016-122 does not proceed with interconnection, all costs associated with the GEN-2016-122 interconnection will still be required for the remaining request.

Table 2: Non-Shared Network Upgrade(s)

Non-Shared Network Upgrades Description	ILTCR	Total Cost Estimate (\$)	Allocated Percent (%)	Allocated Cost Estimate (\$)	Estimated Lead Time
<u>GEN-2016-112 Interconnection (Non-Shared NU) (WERE) - 122619:</u> Update relay settings.	Ineligible	\$10,000	100%	\$10,000	36 Months
Total		\$10,000		\$10,000	

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
<u>Hoyt – Jeffrey EC 345kV Double Circuit Rebuild – 122705:</u> Rebuild the existing JEC – Hoyt 345 kV line as double circuit 345 kV with normal/minimal emergency rating of 1792 MVA. Network upgrade shared by four requests: GEN-2016-111, GEN-2016-112, GEN-2016-114, GEN-2016-122.	Eligible	\$53,508,060	22.37%	\$11,969,753	36 – 48 Months
<u>Reno 345/115 kV Transformer Ckt 1 (DISIS-2016-002-2) – 122793:</u> Replace existing Reno transformer with one rate 400/440.	Eligible	\$4,683,105	15.91%	\$745,082	18 – 24 Months
<u>Reno 345/115 kV Transformer Ckt 2 (DISIS-2016-002-2) – 122794:</u> Replace existing Reno transformer with one rate 400/440.	Eligible	\$4,683,105	15.91%	\$745,082	18 – 24 Months
<u>Reno – Summit 345kV Interconnection Substation - 122615:</u> Construct a new 345kV breaker and a half substation consisting of eight (8) breakers, sixteen (16) switches, eight (8) CCVTs, and ten (10) control panels.	Ineligible	\$17,540,382	0%	\$0	36 Months
<u>Reno – Summit 345kV Interconnection Line Work – 122617:</u> Construct approximately .15 miles of new bundled 1590 Lapwing ASCR line with 64mm OPGW static wire, two (2) 3-pole steel dead-end structures, and no distribution under build.	Ineligible	\$1,131,744	0%	\$0	36 Months
Total		\$81,546,396		\$13,459,917	

*The cost allocation for “Reno – Summit 345 kV Interconnection Substation” and “Reno – Summit 345kV Interconnection Line work” are included in the IFS Summary for GEN-2016-122. The allocation from the DISIS for these requests result in an aggregate 42.1% included in the GEN-2016-122 IFS Summary and GIA.

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
Total	\$0	

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 MISO as part of the Affected System Impact review. The Affected System facilities study could provide revised costs and will provide each Interconnection Customer's allocation responsibilities for the upgrades.

Table 5: Interconnection Customer Affected System Upgrade(s)

Affected System Upgrades Description	Total Cost Estimate (\$)	Allocated Share (%)	Allocated Cost Estimate (\$)
None	\$0	N/A	\$0
Total	\$0		\$0

CONCLUSION

After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for [Insert Interconnection Amount] 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 [Insert all upgrades (TOIF, non-shared NU, shared NU, affected system, etc)] that is required for full interconnection service is summarized in the table below.

Table 6: Cost Summary

Description	Allocated Cost Estimate
Transmission Owner Interconnection Facilitie Upgrade(s)	\$0
Non-Shared Network Upgrade(s)	\$10,000
Shared Network Upgrade(s)	\$13,459,917
Affected System Upgrade(s)	\$0
Total	\$13,469,917

*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 Facility
Study**

For

**Generation Interconnection Requests
GEN-2016-111, GEN-2016-114, GEN-
2016-112 and GEN 2016-122**

July 6, 2020

Introduction

This report summarizes the scope of the Generation Interconnection Facility Study to evaluate the Generation Interconnection Requests for GEN-2016-111, GEN-2016-114, GEN-2016-112 and GEN-2016-122. GEN-2016-111 is proposing to build a 302.0 MW wind-powered generation facility. GEN-2016-114 is proposing to build a 310.0 MW wind-powered generation facility. GEN-2016-112 is proposing to build a 220 MW wind-powered generation facility. GEN-2016-122 is proposing to build a 225 MW wind-powered generation facility. All the above four will interconnect at a new interconnection substation in central Kansas with an in-service date of December 31, 2020.

The new interconnection substation will have breaker and a half configuration with total five terminals for GEN-2016-111, GEN-2016-114, GEN-2016-112 & GEN-2016-122, 345kV line to Reno County substation, and 345kV line to Summit substation. GEN-2016-112 shares a generator lead with GEN-2016-122 from the customer facility to the Point of Interconnection.

Southwest Power Pool Generation Interconnection Request:

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

GI Request #	Point of Interconnection	Capacity (MW)	Fuel Type	Comments
GEN-2016-111	Tap Reno County - Summit 345 kV	302.0	Wind	Please provide Interconnection upgrades and costs estimates needed to interconnect the following Interconnection Customer facilities into the Point of Interconnection (POI) at Reno-Summit 345kV.
GEN-2016-114	Tap Reno County - Summit 345 kV	310.0	Wind	
GEN-2016-112	Tap Reno County - Summit 345 kV	220.0	Wind	
GEN-2016-122	Tap Reno County - Summit 345 kV	225.0	Wind	

Estimated Costs for TOIF and Network Upgrades

SPP-GEN-2016-111, SPP GEN-2016-114 and SPP-GEN-2016-122

GEN-2016-111 Transmission Owner Interconnection Facilities (TOIF)

The estimated cost includes work necessary to install one (1) steel dead-end structure, three (3) standalone CT's and three (3) PT's to accept a transmission line from the Interconnection Customer's Generating Facility.

GEN-2016-114 Transmission Owner Interconnection Facilities (TOIF)

The estimated cost includes work necessary to install one (1) steel dead-end structure, three (3) standalone CT's and three (3) PT's to accept a transmission line from the Interconnection Customer's Generating Facility.

GEN-2016-122 Transmission Owner Interconnection Facilities (TOIF)

The estimated cost includes work necessary to install one (1) steel dead-end structure, three (3) standalone CT's and three (3) PT's to accept a transmission line from the Interconnection Customer's Generating Facility.

345kV Transmission Line Work

The estimated cost is for approximately 0.15 miles of new bundled 1590 Lapwing ACSR line with 64mm OPGW static wire, two (2) 3-pole steel dead-end structures, and no distribution underbuild.

345kV Substation Work

The estimated cost is for constructing a new greenfield 345kV breaker and a half substation consisting of eight (8) breakers, sixteen (16) switches, eight (8) CCVTs, and ten (10) control panels. As every equipment item cannot be split into thirds, the total cost for 345kV substation work is equally split between GEN-2016-111, GEN-2016-114 and GEN-2016-122 instead.

If any of the generation interconnection requests decide not to move forward, the costs of the substation and transmission line work will need to be recalculated between the remaining requests.

SPP-GEN-2016-112

345 kV Substation Work

The estimated cost is to review relay settings for the generator lead and apply adjusted settings if necessary. No physical modifications or additional construction is anticipated.

The total cost estimate for GEN-2016-111 for the required Transmission Owner Interconnection Facilities (TOIF) and the Network Upgrades:

\$	1,149,246	TOIF (Substation)
\$	3,447	TOIF (AFUDC)
\$	368,481	Transmission Line Work
\$	5,838,026	345 kV Substation Work
\$	<u>17,535</u>	<u>AFUDC</u>
\$	7,376,735	Total

The total cost estimate for GEN-2016-114 for the required Transmission Owner Interconnection Facilities (TOIF) and the Network Upgrades:

\$	1,149,246	TOIF (Substation)
\$	3,447	TOIF (AFUDC)
\$	368,481	Transmission Line Work
\$	5,838,026	345 kV Substation Work

\$	-	<u>17,535</u>	<u>AFUDC</u>
\$		7,376,735	Total

The total cost estimate for GEN-2016-122 for the required Transmission Owner Interconnection Facilities (TOIF) and the Network Upgrades:

\$	1,149,246	TOIF (Substation)
\$	3,447	TOIF (AFUDC)
\$	368,481	Transmission Line Work
\$	5,838,026	345 kV Substation Work
\$	-	<u>17,535</u> <u>AFUDC</u>
\$	7,376,735	Total

The total cost estimate for GEN-2016-112 for the required Transmission Owner Interconnection Facilities (TOIF) and the Network Upgrades:

\$	0	TOIF (Substation)
\$	0	TOIF (AFUDC)
\$	0	Transmission Line Work
\$	10,000	345 kV Substation Work
\$	-	<u>0</u> <u>AFUDC</u>
\$	10,000	Total

These estimates are 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 significant and the accuracy of this estimate at the time of actual settings cannot be assured.

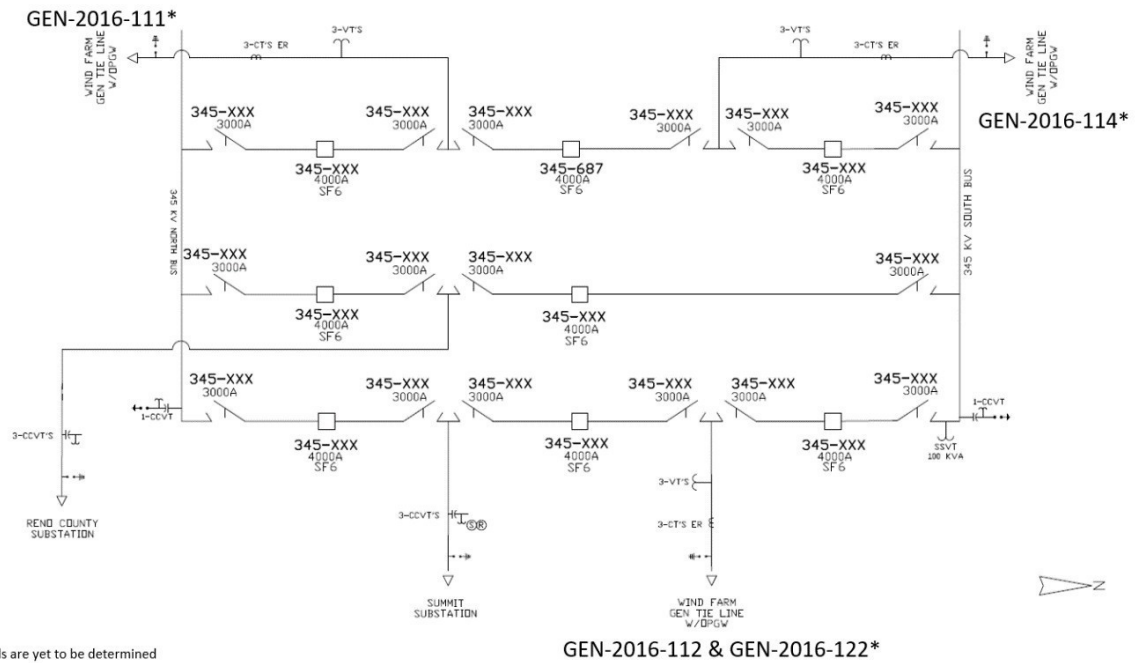
Because GEN-2016-112 shares a generator lead with GEN-2016-122 from the customer facility to the Point of Interconnection, if, for any reason, GEN-2016-122 does not proceed with interconnection, all costs associated with the GEN-2016-122 interconnection will still be required for the remaining request.

Time Estimate

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

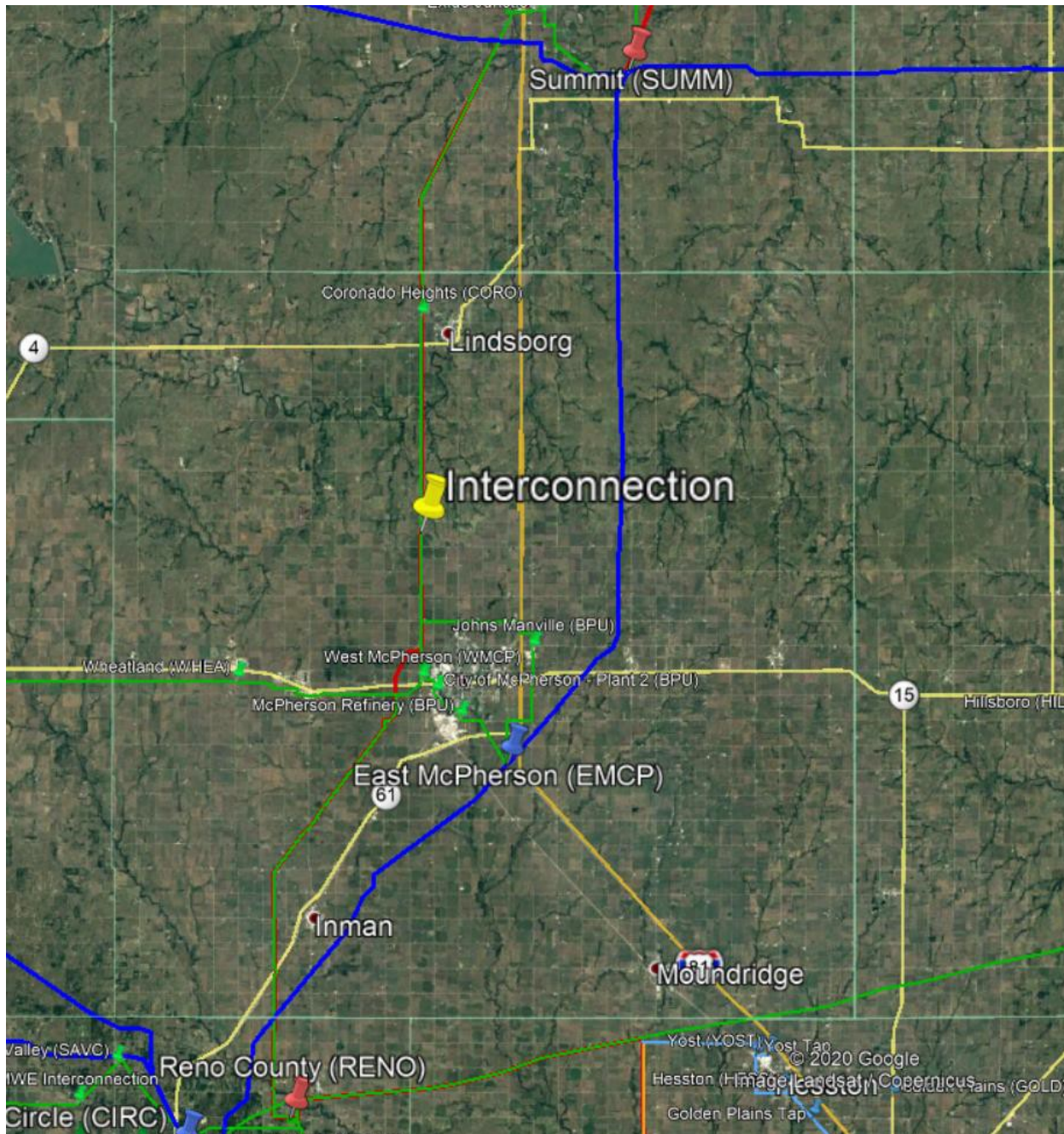
Engineering Time	8	Months
Procurement Time	12	Months
Construction Time	24	Months
Total Project Length	36	Months

One-line Diagram



One-line diagram of the interconnection substation

Interconnection Map



The map shows an approximate location of the interconnection project on the Reno County-Summit 345 kV Line, the exact location is yet to be determined.

Results of Short Circuit Analysis

As a part of this Interconnection Facility Study, a short circuit study was performed to determine the available fault current at the interconnection bus (GEN-2016-111, GEN-2016-114, GEN-2016-112 and GEN-2016-122 345 kV Interconnection) using PSS/E's activity ASCC. The 2021 Summer Peak case from the 2020 MDWG Final Max Fault Short-Circuit model was used. The GEN-2016-111, the GEN-2016-114, the GEN-2016-112 and the GEN-2016-122 wind farm generation facilities were taken out of service for this analysis, and all other transmission facilities were in service. As a result, the numbers generated represent the available utility interconnection fault current.

2021 Summer:

3-PH FAULT		1-PH FAULT		THEVENIN IMPEDANCE (PU on 100 MVA and bus base KV)		
AMP	MVA	AMP	MVA	Positive Sequence	Negative Sequence	Zero Sequence
9666	5776	8669	5180	0.001865 + j0.017467	0.001897 + j0.017492	0.004129 + j0.023268



Interconnection Facilities Study

Network Upgrades associated with DISIS-2016-002-2

September 2020

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-2016-002-2 Interconnection Request(s) mentioned below.

- GEN-2016-100
- GEN-2016-101
- GEN-2016-111
- GEN-2016-112
- GEN-2016-114
- GEN-2016-119
- GEN-2016-122
- GEN-2016-128
- GEN-2016-133 thru 146
- GEN-2016-153

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):

Network Upgrade	Description	SCERT UID	DISIS Estimate
Hoyt - JEC 345kV Rebuild	Rebuild the existing JEC - Hoyt 345 kV line as double circuit 345 kV with normal/minimal emergency rating of 1792 MVA. Network upgrade shared by four requests: GEN-2016-111, GEN-2016-112, GEN-2016-114, GEN-2016-22.	122705	\$49,284,648.00
Viola 345/138kV Transformer CKT 2	Build second 345/138/13.8kV transformer at Viola.	122792	\$9,038,339.00
Reno 345/115 kV Transformer Ckt 1	Replace existing Reno transformer with one rated 400/440.	122793	\$4,683,106.00
Reno 345/115 kV Transformer Ckt 2	Replace existing Reno transformer with one rated 400/440	122794	\$4,683,106.00

Hoyt – Jeffrey EC 345kV Rebuild (as double circuit)

345kV Transmission Line

The estimated cost is for 24.3 miles of 345kV double circuit with new bundled 1590 Lapwing ACSR line conductor with 64mm OPGW static wire, eight (8) steel dead end structures, one-hundred forty-three (143) steel tangent structures, four (4) steel running angle structures, and no distribution underbuild.

345kV Substation

At Hoyt 345kV substation, the estimated cost is for a new 345kV terminal consisting of one (1) breaker, two (2) switches, and one (1) control panel, 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 a new 345kV terminal on a new rung consisting of two (2) breakers, four (4) switches, and 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:

\$	49,140,587	345kV Transmission Line
\$	4,135,456	345kV Substation
\$	232,017	AFUDC
\$	0	Contingency
<hr/>		
\$	53,508,060	Total

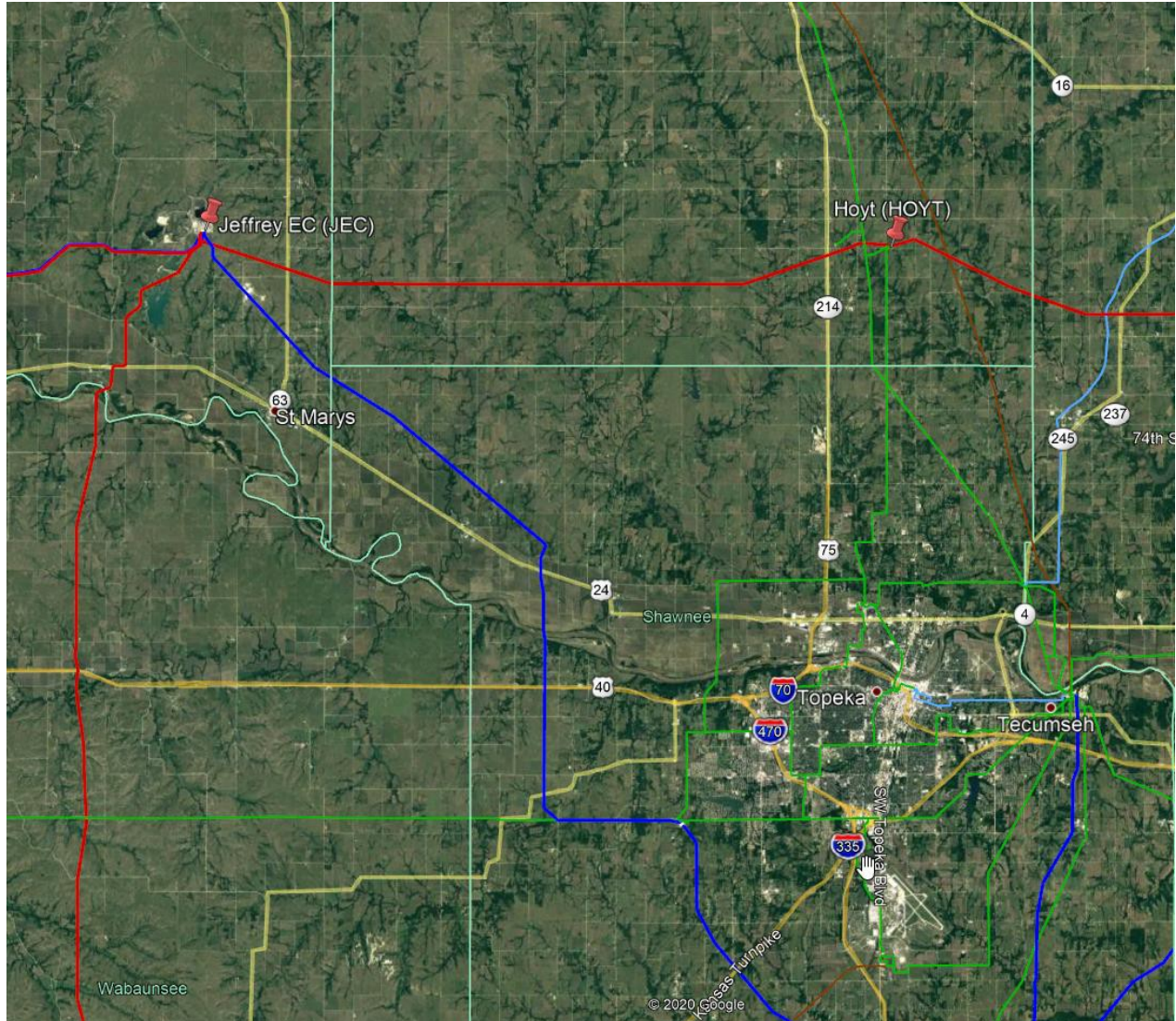
This estimate is accurate to +/- twenty (20) percent, based on current prices, in accordance with Attachment A of Appendix 4 of the Interconnection Facilities Study Agreement. However, recent cost fluctuations in materials are very significant and the accuracy of this estimate at the time of actual settings 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
<hr/>		
Total Project Length	36-48	Months

Figure 1 – Hoyt-Jeffrey EC 345kV Line



Viola 345-138kV TX-2 Transformer Addition

345kV and 138kV Substation

At Viola 345kV substation, the estimated cost is for a new 345kV terminal on a new rung consisting of two (2) breakers, four (4) switches, and two (2) control panels. Also, at Viola 138kV substation, the estimated cost is for a new 138kV terminal on an existing rung consisting of one (1) breaker, three (3) switches, three (3) PTs, and one (1) 400/440 MVA 345-138kV transformer with LTCs.

Total Cost

The total cost estimate for this Network Upgrade is:

\$	9,177,056	345kV and 138kV Substation
\$	27,531	AFUDC
\$	0	Contingency
<hr/>		
\$	9,204,587	Total

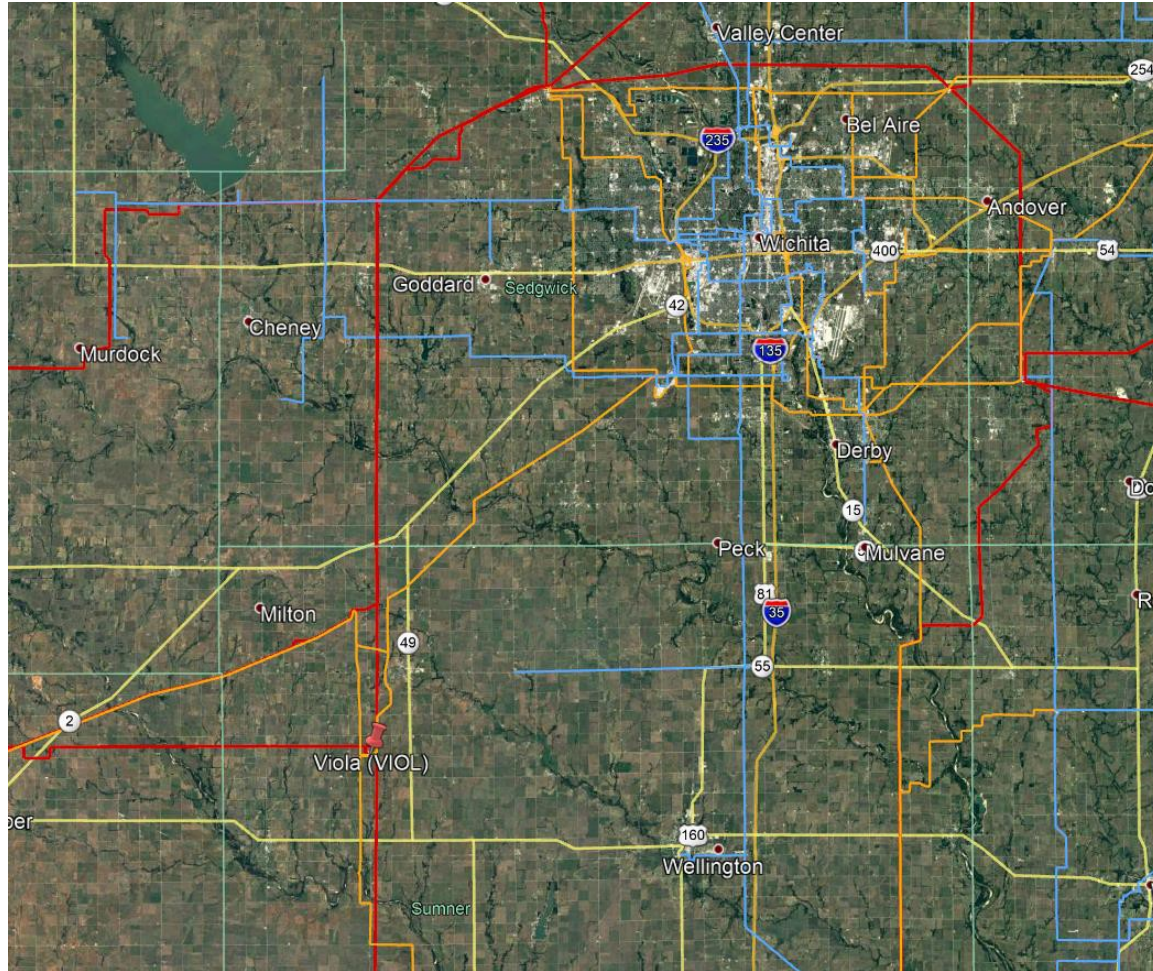
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Time Estimate

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
<hr/>		
Total Project Length	18-24	Months

Figure 2 – Viola Substation



Reno County 345-115kV TX-1 Transformer Replacement

345kV and 115kV Substation

At Reno County 345kV and 115kV substation, the estimated cost is for one (1) 345-115kV 400/440 MVA transformer with LTCs, and removal of the existing transformer.

Total Cost

The total cost estimate for this Network Upgrade is:

\$	4,669,098	Substation
\$	14,007	AFUDC
\$	0	Contingency
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\$	4,683,105	Total

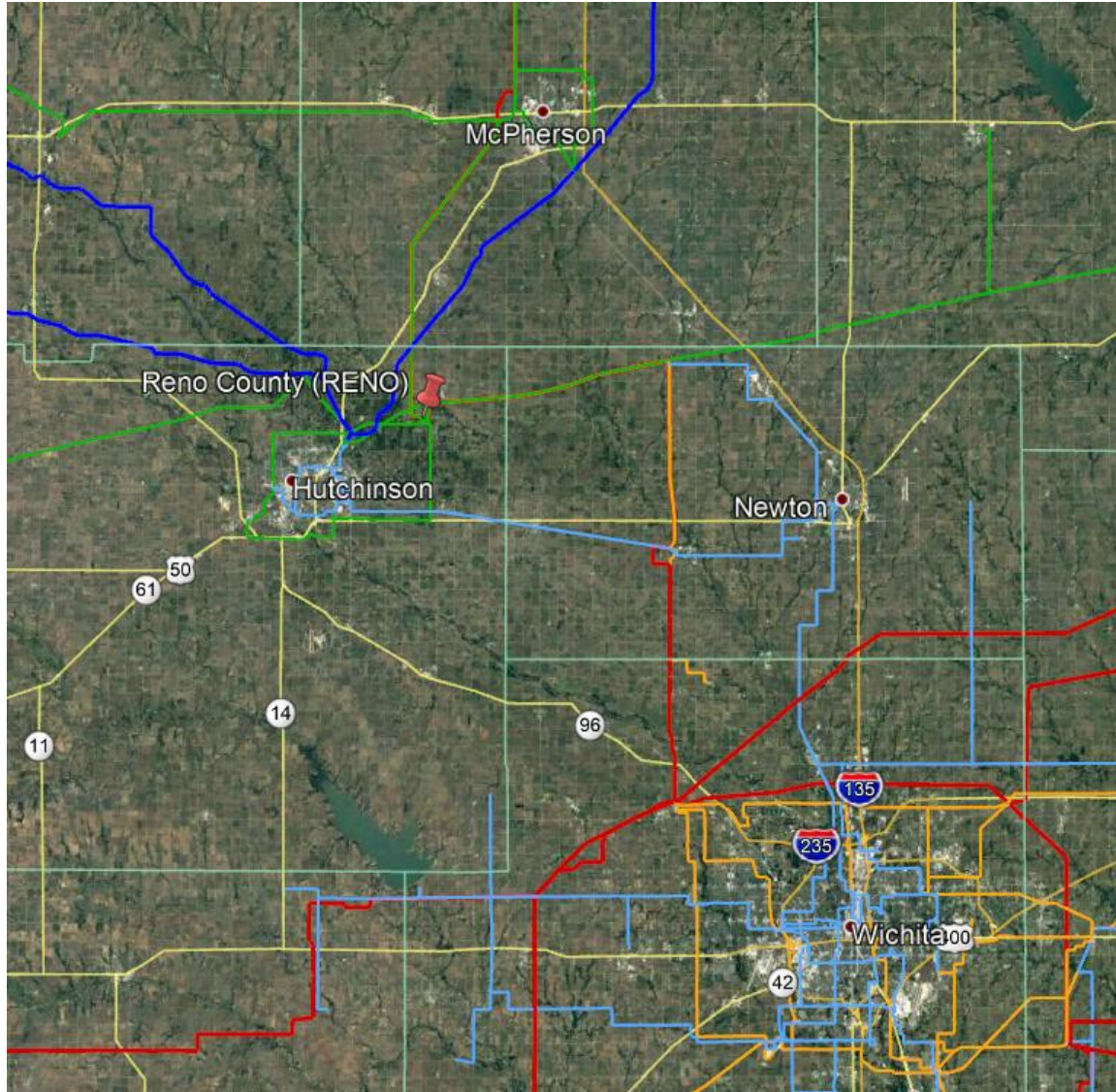
This estimate is accurate to +/- twenty (20) percent, based on current prices, in accordance with Attachment A of Appendix 4 of the Interconnection Facilities Study Agreement. However, recent cost fluctuations in materials are very significant and the accuracy of this estimate at the time of actual settings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

Time Estimate

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Engineering Time	6	Months
Procurement Time	12	Months
Construction Time	6	Months
<hr/>		
Total Project Length	18-24	Months

Figure 3 – Reno County Substation



Reno County 345-115kV TX-2 Transformer Replacement

345kV and 115kV Substation

At Reno County 345kV and 115kV substation, the estimated cost is for one (1) 345-115kV 400/440 MVA transformer with LTCs, and removal of the existing transformer.

Total Cost

The total cost estimate for this Network Upgrade is:

\$	4,669,098	Substation
\$	14,007	AFUDC
\$	0	Contingency
<hr/>		
\$	4,683,105	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.

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<hr/>		
Total Project Length	18-24	Months