



INTERCONNECTION FACILITIES STUDY REPORT

GEN-2016-162
(IFS-2016-002-38)

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By SPP Generator Interconnections Dept.

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
08/17/2020	SPP	Initial draft report issued.
09/11/2020	SPP	Updated Table 2 and Table 3 to reflect elimination of Z2 credits.
09/17/2020	SPP	Updated final report issued and updated ILTCR eligibility (TBD).
07/28/2021	SPP	Updated final report issued. Updated Tables 3 and 6 based on DISIS Power Flow Reposting

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SUMMARY

INTRODUCTION

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2016-162/IFS-2016-002-38 is for a 252 MW generating facility located in Marion, 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, 2019.

The interconnecting Transmission Owner, Evergy 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 one-hundred twenty-six (126) GE 2.0 MW Wind Turbine Generation Systems for a total generating nameplate capacity of 252 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 174/232/290 MVA (ONAN/ONAF/ONAF) step-up transformer to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation;
- A 20 mile overhead mile 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 ("Benton 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 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
<u>GEN-2016-162 and 163 Interconnection (TOIF) (WERE) (143150)</u> : Construct one (1) new 345 kV dead-end, one (1) new 345 kV disconnect switch, three (3) new voltage transformers, three (3) new current transformers, and one (1) new line panel.	\$1,198,282	50%	\$599,141	68 Weeks
Total	\$1,198,282		\$599,141	

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-2016-162 and 163 Interconnection (Non-Shared NU) (WERE) (122676):</u> Construct one (1) new 345 kV circuit breaker and two (2) new 345 kV disconnect switches.	Ineligible	\$810,255	50%	\$405,127.50	68 Weeks
Total		\$810,255		\$405,127.50	

¹ Indicates the method used for calculating credit impacts under Attachment Z2 of the Tariff.

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>GEN-2016-119 Tap – Arcadia 345 kV (DISIS-2016-002-2) (122791):</u> Build new terminal at new substation on Sooner to Spring Creek line being built for Gen-2016-119. Expand Arcadia Substation and re-route four transmission lines to allow for room for new transmission line to be brought in. Build approximately 47 miles of new 345kV line from new	Ineligible	\$67,234,906	5.69%	\$3,825,666	36 Months
<u>Sooner – Spring Creek (GEN-2016-119 Tap) 345kV Substation (122627):</u> Construct a new EHV substation. Install 4-345 kV 3000A breakers, line relaying, disconnect switches, and associated equipment	Ineligible	\$11,145,332	5.69%	\$634,169	14 Months
Total		\$78,380,238		\$4,459,835	

All studies have been conducted assuming that higher-queued Interconnection Request(s) and the associated Network Upgrade(s) will be placed into service. If higher-queued Interconnection Request(s) withdraw from the queue, suspend or terminate service, the Interconnection Customer’s share of costs may be revised. Restudies, conducted at the customer’s expense, will determine the Interconnection Customer’s revised allocation of Shared Network Upgrades.

CONTINGENT NETWORK UPGRADE(S)

Certain Contingent Network Upgrades are **currently not the cost responsibility** of the Interconnection Customer but will be required for full Interconnection Service.

Table 4: Interconnection Customer Contingent Network Upgrade(s)

Contingent Network Upgrade(s) Description	Current Cost Assignment	Estimated In-Service Date
Blackberry – Wolf Creek 345 kV (122598): Build a new 345kV line from Wolf Creek to Blackberry with a summer emergency rating of 1792 MVA	\$0	1/1/2026

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 (\$)
<u>AECL Affected System Study Cycle Projects:</u> Rebuild the 18 mile-long Hamburg to Northboro 69 kV line to 336 ASCR.	\$7,434,000	3.24%	\$240,896
<u>AECL Affected System Study Cycle Projects:</u> Rebuild the 4.4 mile-long Phelps to Rockport 69 kV line to 336 ASCR.	\$1,817,000	3.26%	\$59,302
<u>AECL Affected System Study Cycle Projects:</u> Rebuild the 11.4 mile-long Linden to Phelps 69 kV line to 336 ASCR.	\$4,708,000	3.48%	\$163,827
<u>AECL Affected System Study Cycle Projects:</u> Rebuild the 4.136-mile-long Bevier to Macon Lake 69 kV line to 477 ASCR.	\$2,938,000	3.87%	\$113,719
<u>AECL Affected System Study Cycle Projects:</u> Rebuild the 2.2 mile-long Macon Lake to Axtell to Macon Tap 69 kV line to 477 ASCR.	\$1,562,000	3.4%	\$53,091
<u>AECL Affected System Study Cycle Projects:</u> Upgrade the 10.92 mile section of Neosho to Sweetwater 69 kV line to 336 ASCR.	\$6,273,000	2.34%	\$146,733
<u>AECL Affected System Study Cycle Projects:</u> Add .08 p.u. series reactor on Washburn to Seligman 69 kV line.	\$675,000	.35%	\$2,344
Total	\$25,407,000		\$779,902

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)	\$599,141
Non-Shared Network Upgrade(s)	\$405,127
Shared Network Upgrade(s)	\$4,459,835
Affected System Upgrade(s)	\$779,902
Total	\$6,224,005

*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).



Evergy

Facility Study for Southwest Power Pool

Generation Interconnection Requests

GEN-2016-162

GEN-2016-163

March 2020

Introduction

Pursuant to the Southwest Power Pool (SPP) Open Access Transmission Tariff (Tariff) and at the request of SPP, Evergy Transmission Planning performed the following Facility Study on behalf of Evergy Kansas Central to satisfy the Facility Study Agreement executed by the requesting Interconnection Customer (Customer) for SPP Generation Interconnection Requests GEN-2016-162 and GEN-2016-163. The request for interconnection was placed with SPP in accordance with the Tariff, which covers new generation interconnections on SPP member's transmission system. The Customer requests interconnection service for two (2) separate 252 MW wind farms. The Customer proposed a commercial operation date for the wind farm of December 31, 2019. The requirements for interconnection consist of construction of a new 345kV line terminal at the Benton 345kV substation in Butler County, Kansas.

This Facility Study does not guarantee the availability of transmission service necessary to deliver the additional generation to any specific point inside or outside the SPP transmission system. The transmission network facilities may not be adequate to deliver the additional generation output to the transmission system. If the Customer requests firm transmission service under the SPP Tariff at a future date, Network Upgrades or other new construction may be required to provide the service requested under the SPP Tariff.

Southwest Power Pool Generation Interconnection Request

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

GI Request #	Point of Interconnection	Capacity (MW)	Fuel Type
GEN-2016-162	Benton 345kV	252	Wind
GEN-2016-163	Benton 345kV	252	Wind

Cost Estimates

Costs 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, cost fluctuations in materials are significant and the accuracy of this estimate at the time of actual procurement and construction cannot be assured.

GEN-2016-162 & GEN-2016-163

Evergy Kansas Central

Estimates for these facilities were developed together. If either facility does not interconnect a reevaluation of the cost estimates provided will be needed.

Transmission Owner Interconnection Facilities (TOIF)

TOIF at the Benton substation include one (1) new 345kV dead-end, one (1) new 345kV disconnect switch, three (3) new voltage transformers, three (3) new current transformers, and one (1) new line panel.

TOIF Cost \$1,198,282

Network Upgrades

Network Upgrades at the Benton substation include one (1) new 345kV circuit breaker and two (2) new 345kV disconnect switches.

Network Upgrades \$810,255

The total cost for the required Transmission Owner Interconnection Facilities (TOIF) and Network Upgrades for Evergy Kansas Central is shown below

\$	1,198,282	TOIF
\$	810,255	Network Upgrades
\$	2,008,537	Total

Time Estimate

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

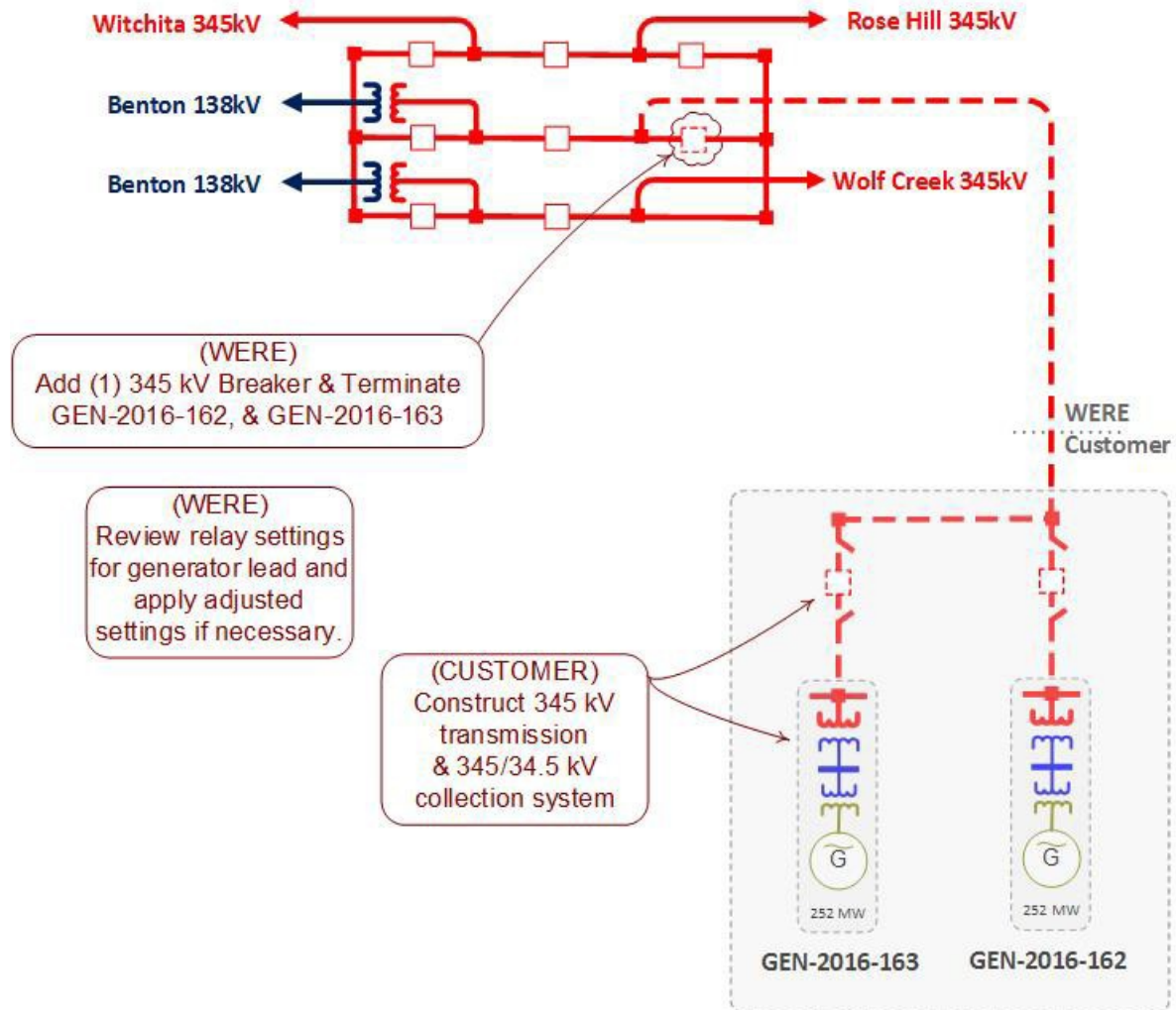
Engineering Time	33 Weeks
Procurement Time	37 Weeks
<u>Construction Time</u>	<u>49 Weeks</u>
Total Project Length	68 Weeks

Short Circuit Fault Duty Evaluation

Evergy engineering staff reviewed short circuit analysis for the Benton 345 kV substation to determine if the added generation would cause the available fault currents to exceed the interrupting capability of any existing circuit breakers. The fault currents are within circuit breaker interrupting capability with the addition of the GEN-2016-162 and GEN-2016-163 windfarms.

Appendix A: Topology Benton 345kV with GEN-2016-162 and GEN-2016-163

Benton 345kV (WERE)





FACILITY STUDY

for

IFS-2016-002-2 for GI Cluster Impact Study For DISIS-2016-002-2

New Tap at Gen-2016-100/101/119 Substation on Sooner – Spring Creek line
New 345kV Transmission Line from New Tap to Arcadia Substation
In Payne, Logan, and Oklahoma Counties
Oklahoma

August 11, 2020

Adam Snapp, P.E.
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OG&E Electric Services

Summary

Pursuant to the tariff and at the request of the Southwest Power Pool (SPP), Oklahoma Gas and Electric (OG&E) performed the following Facility Study for Network Upgrades to satisfy the Facility Study Agreement executed by the requesting customer for SPP DISIS-2016-002-2 for Network Upgrades. The request for interconnection was placed with SPP in accordance SPP's Open Access Transmission Tariff, which covers new generation interconnections on SPP's transmission system. The requirements for the Network Upgrade are to build a new terminal at a new substation on Sooner - Spring Creek line being built for Gen 2016-100 and 119. OGE must also build approximately 47 miles of 345 kV transmission line from new substation serving GEN-2016-100 and 119 to Arcadia Substation. Arcadia Substation needs to be expanded and one transmission line re-routed to a new terminal to allow for room for the new transmission line to be brought in. Two other lines must be re-routed at Arcadia to accommodate expanded footprint of the substation but will remain in their current terminal locations.

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Introduction

The Southwest Power Pool has requested a Facility Study for Network Upgrades within the service territory of OG&E Electric Services (OKGE) in Payne and Oklahoma Counties in Oklahoma. The proposed Network Upgrade Facilities are for the addition of a 345kV terminal at a new substation in Payne county Oklahoma. This substation is being built to serve Gen-2016-100 and 119. Further network upgrades include the expansion of Arcadia substation, the installation of two 345kV breakers and a new terminal at Arcadia substation.

Network Constraints in the American Electric Power West (AEPW), Southwest Public Service (SPS), OKGE and Western Farmers Electric Cooperative (WFEC) systems may be verified with a transmission service request and associated studies.

Network Upgrade Facilities

The primary objective of this study is to identify Network Upgrades. The requirements for this Network Upgrade consist of the expansion of Arcadia substation, the building of a 345kV transmission line between the two substations, and the installation of a new terminal at Arcadia substation to re-route an existing line into in order to accommodate generator interconnection requests identified in SPP-GI DISIS-2016-002-2. These 345kV network upgrades shall be constructed and maintained by OKGE.

Network upgrades for this GI cluster study include the addition of a new 345kV terminal to the new substation built for Gen-2016-100 and 119 as well as relay equipment and other upgrades at Arcadia to allow the addition of a new transmission line.

Total cost of all Network Upgrades is estimated at \$67,234,906 and will take 36 months to construct.

This Facility Study does not guarantee the availability of transmission service necessary to deliver the additional generation to any specific point inside or outside the Southwest Power Pool (SPP) transmission system. The transmission network facilities may not be adequate to deliver the additional generation output to the transmission system. If the customer requests firm transmission service under the SPP Open Access Transmission Tariff at a future date, Network Upgrades or other new construction may be required to provide the service requested under the SPP OATT.

The costs of interconnecting the facility to the OKGE transmission system are listed in Table 1.

Short Circuit Fault Duty Evaluation

It is standard practice for OG&E to recommend replacing a circuit breaker when the current through the breaker for a fault exceeds 100% of its interrupting rating with re-closer de-rating applied, as determined by the ANSI/IEEE C37.5-1979, C37.010-1979 & C37.04-1979 breaker rating methods.

For this Network Upgrade, no breakers were found to exceed their interrupting capability after the addition of the line terminals at the new EHV substation and Arcadia as well as addition of related facilities. OG&E found no breakers that exceeded their interrupting capabilities on their system. Therefore, there is no short circuit upgrade costs associated with this DISIS-2016-002-2 Network Upgrade.

Table 1: Required Interconnection Network Upgrade Facilities

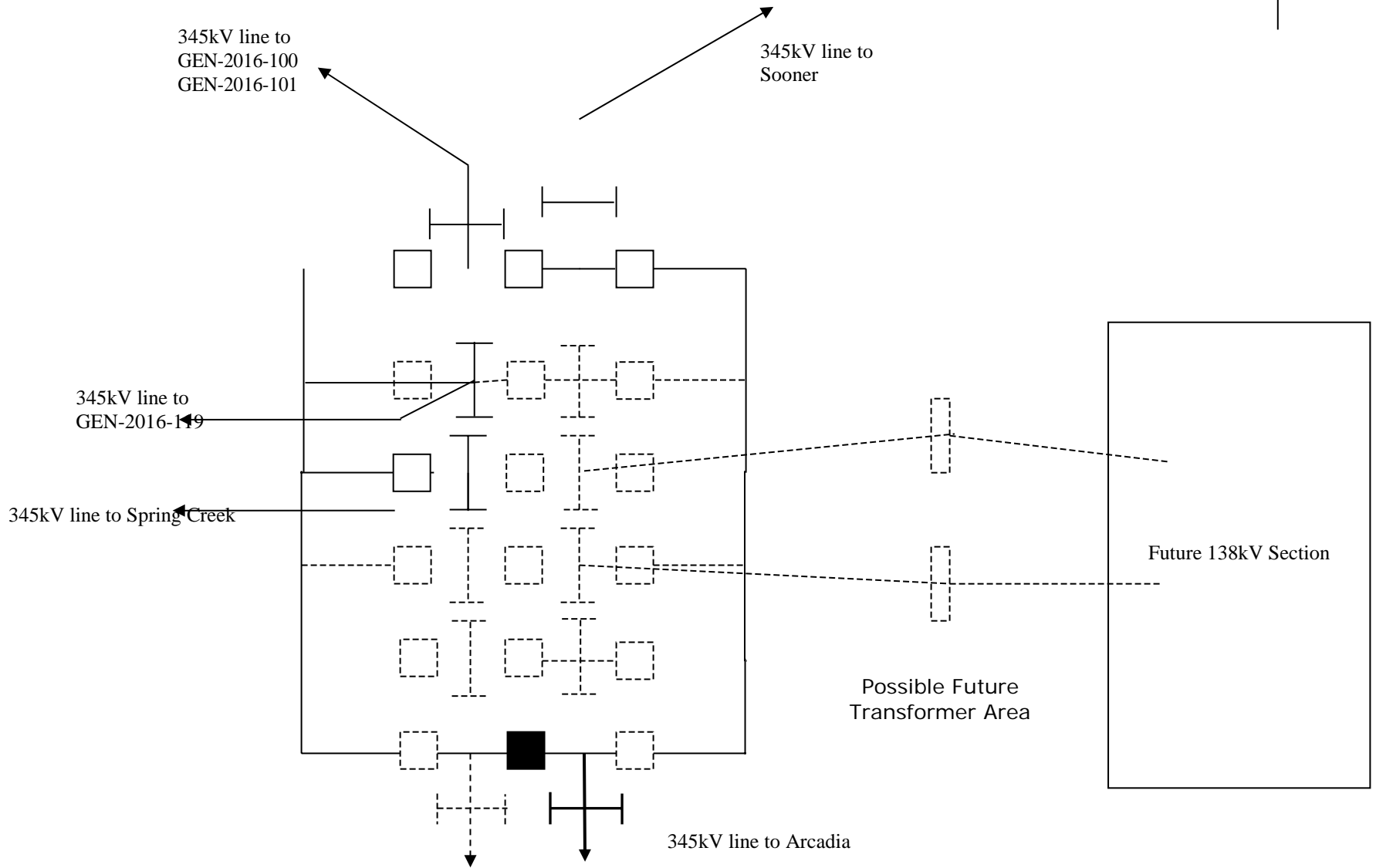
Facility	ESTIMATED COST (2020 DOLLARS)	Estimated Lead time
<p>OKGE – Network Upgrades at a new EHV sub, Install 1-345kV 3000A breakers, line relaying, disconnect switches, and associated equipment.</p> <p>Build approx. 47 Miles of 345kV Transmission line from new EHV substation to Arcadia Substation</p> <p>Bring in 345kV line to Arcadia substation. Line relaying and all associated equipment.</p> <p>Expand Arcadia substation, Install new rung, 2-345kV breakers, Dead end structure, line switch, line relaying, metering including CTs and PTs. Re-route existing 345kV line into new terminal and two other existing lines around expanded substation.</p>	\$67,234,906	36 Months
OKGE – Transmission Line ROW obtainment	Not Included	12 Months
Total	\$67,234,906	36 months

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August 11, 2020

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Substation developed for GEN-2016-100/119



Arcadia Substation

