



# **INTERCONNECTION FACILITIES STUDY REPORT**

GEN-2016-095  
(IFS-2016-002-32)

Published January 2021

By SPP Generator Interconnections Dept.

## REVISION HISTORY

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DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
3/30/2020	SPP	Initial draft report issued.
7/29/2020	SPP	Final report issued.
01/29/2021	SPP	Updated final report issued. Updated cost allocation in Tables 2 and 6 based on DISIS Power Flow Reposting.

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## SUMMARY

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### *INTRODUCTION*

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2016-095/IFS-2016-002-32 is for a 200 MW generating facility located in Caddo, OK. The Interconnection Request was studied in the DISIS-2016-002 Impact Study and DISIS-2016-002-2 Impact Restudy for Energy Resource Interconnection Service (ERIS) and Network Resource Interconnection Service (NRIS). The Interconnection Customer's requested in-service date is December 1, 2020.

The interconnecting Transmission Owner, American Electric Power (AEP), 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.

### *CREDITS/COMPENSATION FOR AMOUNTS ADVANCED FOR NETWORK UPGRADE(S)*

Interconnection Customer shall be entitled to compensation in accordance with Attachment Z2 of the SPP OATT for the cost of SPP creditable-type Network Upgrades, including any tax gross-up or any other tax-related payments associated with the Network Upgrades, that are not otherwise refunded to the Interconnection Customer. Compensation shall be in the form of either revenue credits or incremental Long Term Congestion Rights (iLTCR).

### ***INTERCONNECTION CUSTOMER INTERCONNECTION FACILITIES***

The Generating Facility is proposed to consist of one hundred (100) Siemens V110-2.0 MW wind turbine generators for a total generating nameplate capacity of 200 MW.

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

- 34.5 kV underground cable collection circuits;
- 34.5 kV to 345 kV transformation substation with associated 34.5 kV and 345 kV switchgear;
- One (1) 345/34.5 kV 132/175/220 MVA (ONAN/ONAF/ONAF) step-up transformer to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation;
- A seven (7) mile overhead 345 kV line to connect the Interconnection Customer's substation to the Point of Interconnection ("POI") at the 345 kV bus at new Transmission Owner substation ("Lawton Eastside-Gracemont 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
<b><u>Transmission Owner Lawton Eastside-Gracemont 345 kV Interconnection Substation:</u></b> Construct one (1) 345 kV line terminal, line switches, dead end structure, line relaying, communications, revenue metering, line arrester, and all associated equipment and facilities necessary to accept transmission line from Interconnection Customer's Generating Facility.	\$1,388,819	100%	\$1,388,819	36 Months
<b>Total</b>	<b>\$1,388,819</b>		<b>\$1,388,819</b>	

*Table 2: Non-Shared Network Upgrade(s)*

Non-Shared Network Upgrades Description	Z2 Type <sup>1</sup>	Total Cost Estimate (\$)	Allocated Percent (%)	Allocated Cost Estimate (\$)	Estimated Lead Time
<b><u>Transmission Owner Lawton Eastside-Gracemont 345 kV Interconnection Substation:</u></b> Construct new 345 kV four (4) breaker ring bus, control panels, line relaying, disconnect switches, structures, foundations, conductors, insulators, and all other associated work and materials.	non-creditable	\$17,798,882	39.71%	\$7,067,936	36 Months
<b><u>Oklahoma Gas &amp; Electric Company (OG&amp;E) Gracemont 345kV Substation:</u></b> Relay settings upgrades	non-creditable	\$10,000	100%	\$10,000	6 Months
<b>Total</b>		<b>\$17,808,882</b>		<b>\$7,077,936</b>	

\* This cost is shared by GEN-2016-091 and GEN-2016-095, if for any reason one request does not proceed with interconnection, the remaining cost will be assumed by the other request.

<sup>1</sup> Indicates the method used for calculating credit impacts under Attachment Z2 of the Tariff.  
Interconnection Facilities Study Report GEN-2016-095/IFS-2016-002-32

**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	Z2 Type	Total Cost Estimate (\$)	Allocated Percent (%)	Allocated Cost Estimate (\$)	Estimated Lead Time
None	N/A	\$0	N/A	\$0	N/A
<b>Total</b>		<b>\$0</b>		<b>\$0</b>	

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
<b>Total</b>	\$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 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
<b>Total</b>	<b>\$0</b>		<b>\$0</b>

## CONCLUSION

After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 200 MW can be granted. Full Interconnection Service will be delayed until the TOIF, Non-Shared NU, Shared NU, Contingent NU, Affected System Upgrades that are required for full interconnection service are completed. The Interconnection Customer's estimated cost responsibility for TOIF, Non-Shared NU and Affected System Upgrades 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(s)	\$1,388,819
Non-Shared Network Upgrade(s)	\$8,909,441
Shared Network Upgrade(s)	\$7,077,936
Affected System Upgrade(s)	\$0
<b>Total</b>	<b>\$17,376,196</b>

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

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## **A: TRANSMISSION OWNER'S INTERCONNECTION FACILITIES STUDY REPORT AND NETWORK UPGRADES REPORT(S)**

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See next page for the Transmission Owner's Interconnection Facilities Study Report and Network Upgrades Report(s).



***Interconnection Facilities Study for  
GI Cluster Impact Re-study  
DISIS-2016-002  
New 345kV Station for  
Generation Interconnection  
Network Upgrade***

October 2019

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## **Summary**

American Electric Power Southwest Transmission Planning (AEP) performed the following study at the request of the Southwest Power Pool (SPP) for SPP Generation Interconnection request DISIS-2016-002. Per the SPP Generator Interconnection Procedures (GIP), SPP requested that AEPW perform an Interconnection Facilities Studies (IFS) for Network Upgrade(s) in accordance with the Scope of Interconnection Facilities Study in GIP 8.10 and the Interconnection Facilities Study Procedures in accordance with GIP 8.13 for the following Network Upgrades:

- New 345 kV Four Breaker Ring Bus Station
  - Build new 345 kV four breaker ring bus station on the Lawton Eastside to Gracemont 345 kV line.

## **Interconnection Facilities (See Figures 1 and 2)**

### **New 345 kV Substation**

AEP will build a new 345 kV four breaker ring bus to facilitate the interconnection of GEN-2016-091 and GEN-2016-095.

The design and construction of the new station will meet all AEP specifications for stations. Bus work and disconnect switches will be designed to accommodate the loading requirements, and circuit breakers will be rated to ensure adequate load and fault interrupting capability. AEP will own, operate and maintain the station.

### **Short Circuit Fault Duty Evaluation**

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

In the AEP system, no breakers were found to exceed their interrupting capability after the addition of the generation and related facilities. Therefore, there are no short circuit upgrade costs associated with the DISIS-2016-002 interconnections.



## **Interconnection Costs**

Listed below are the associated costs.

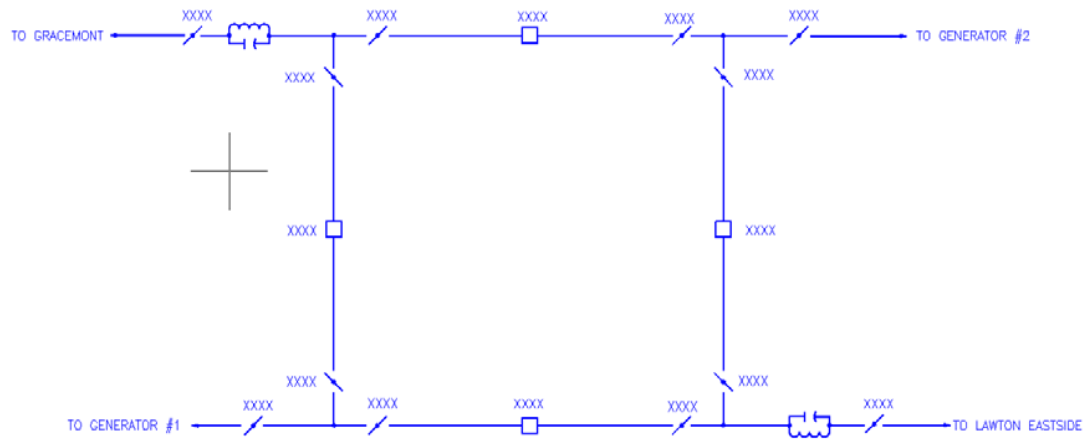
SYSTEM IMPROVEMENT	COST (2019 DOLLARS)
Build new 345 kV four breaker ring bus. (Network Upgrades)	\$17,798,882
Gen-2016-091 Transmission Owner Interconnection Facilities (TOIF)	\$1,388,819
Gen-2016-095 Transmission Owner Interconnection Facilities (TOIF)	\$1,388,819
<b>TRANSMISSION INTERCONNECTION FACILITY TOTAL COSTS</b>	<b>\$20,576,520</b>

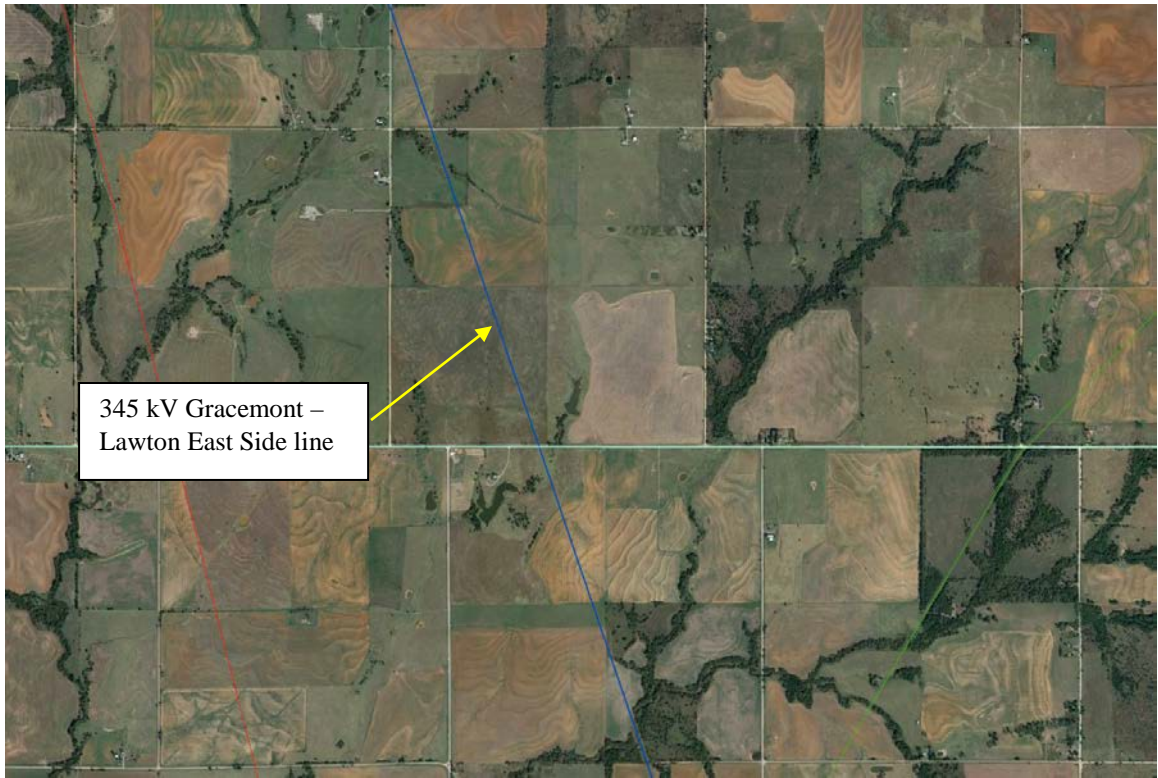
TABLE 1

## **Project Lead Time**

Project in-service date is projected to be 36 months after the issuance of Authorization to Proceed (ATP) from the Interconnection Customer.

## New 345 kV Station





345 kV Gracemont –  
Lawton East Side line



## **FACILITY STUDY**

**for**

### **Generation Interconnection Request 2016-091**

200 MW Windfarm  
In Comanche County  
Oklahoma

September 24, 2019

Adam Snapp, PE  
Lead Engineer  
Transmission Planning  
**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 to satisfy the Facility Study Agreement executed by the requesting customer for SPP Generation Interconnection request Gen-2016-091. 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. Requirements for interconnection include settings update at OG&E's Gracemont substation. No new or additional facilities are necessary to accommodate the new substation.

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## **Introduction**

The Southwest Power Pool has requested a Facility Study for the purpose of interconnecting a wind generating facility within the service territory of AEP in Comanche County Oklahoma. The proposed 345kV point of interconnection is at a new substation on the OG&E Gracemont to AEP Lawton Eastside line in Comanche County, Oklahoma. This substation is owned by AEP.

Network Constraints in the OKGE and American Electric Power (AEP) systems may be verified with a transmission service request and associated studies.

### **Interconnection Facilities**

The primary objective of this study is to identify attachment facilities. There are no requirements for additional interconnection facilities at the existing Gracemont substation other than updates to relay settings on the Gracemont to Lawton Eastside line.

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 generator interconnection, no breakers were found to exceed their interrupting capability after the addition of the Customer's generation and 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 the Gen-2016-031 interconnection.



**Table 1: Required Interconnection Network Upgrade Facilities**

Facility	ESTIMATED COST (2017 DOLLARS)
OKGE – <b>Interconnection Facilities</b> - Relay settings upgrades on OKGE Gracemont – AEP Lawton Eastside line	<b>\$10,000</b>
OKGE – <b>Network Upgrades</b> - No new network upgrades necessary	<b>\$0</b>
OKGE - Right-of-Way for 345kV terminal addition	No Additional ROW
<b>Total</b>	<b>\$10,000</b>

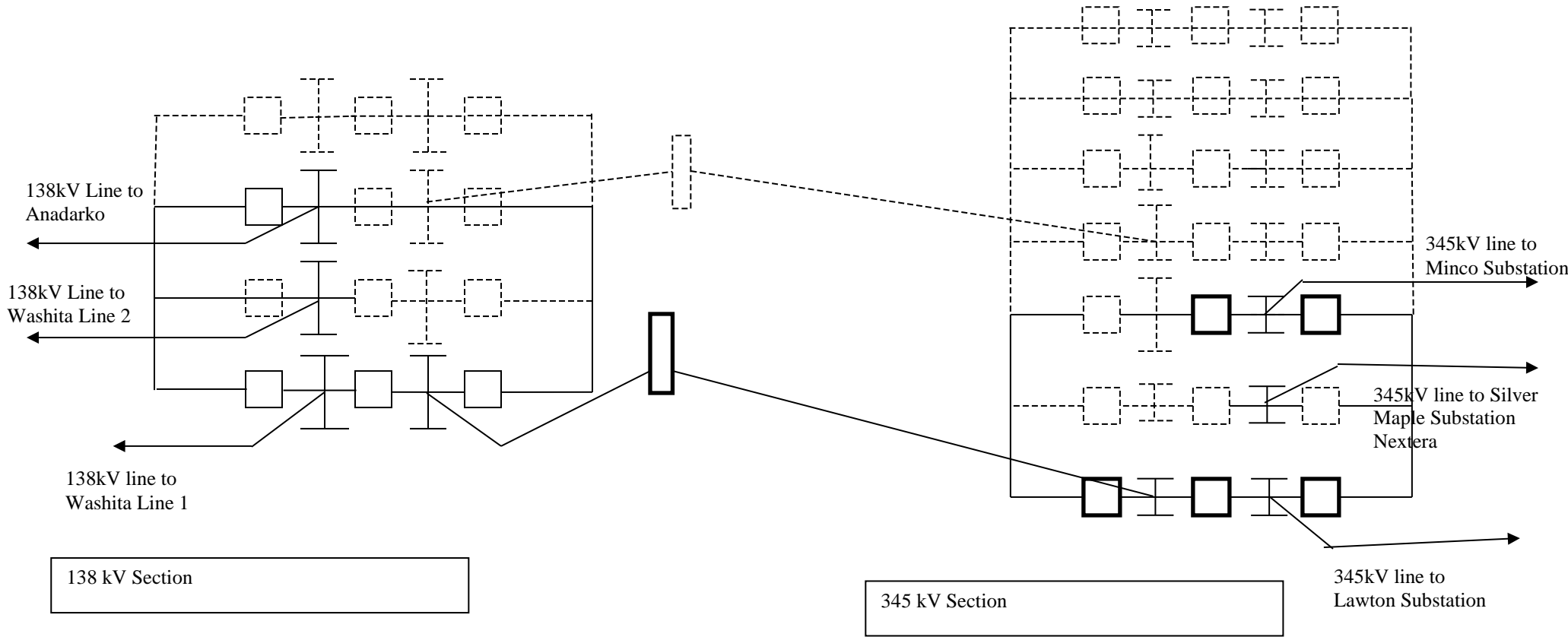
Prepared by Adam Snapp, P.E.  
Lead Engineer, Transmission Planning  
OG&E Electric Services

September 24, 2019

Reviewed by:

Steve M. Hardebeck, P.E.  
Manager, Transmission Planning

Gracemont Substation





***Interconnection Facilities Study for  
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DISIS-2016-002  
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October 2019

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- New 345 kV Four Breaker Ring Bus Station
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## **Interconnection Facilities (See Figures 1 and 2)**

### **New 345 kV Substation**

AEP will build a new 345 kV four breaker ring bus to facilitate the interconnection of GEN-2016-091 and GEN-2016-095.

The design and construction of the new station will meet all AEP specifications for stations. Bus work and disconnect switches will be designed to accommodate the loading requirements, and circuit breakers will be rated to ensure adequate load and fault interrupting capability. AEP will own, operate and maintain the station.

### **Short Circuit Fault Duty Evaluation**

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

In the AEP system, no breakers were found to exceed their interrupting capability after the addition of the generation and related facilities. Therefore, there are no short circuit upgrade costs associated with the DISIS-2016-002 interconnections.

## **Interconnection Costs**

Listed below are the associated costs.

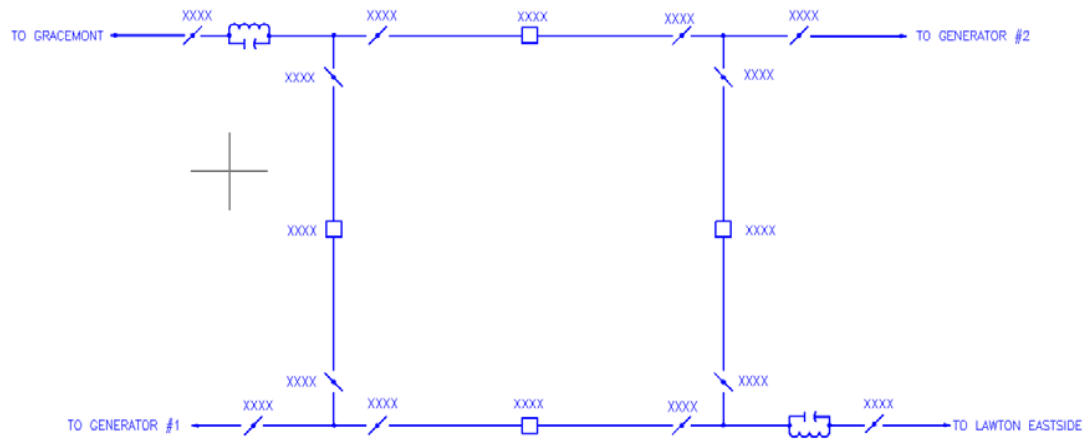
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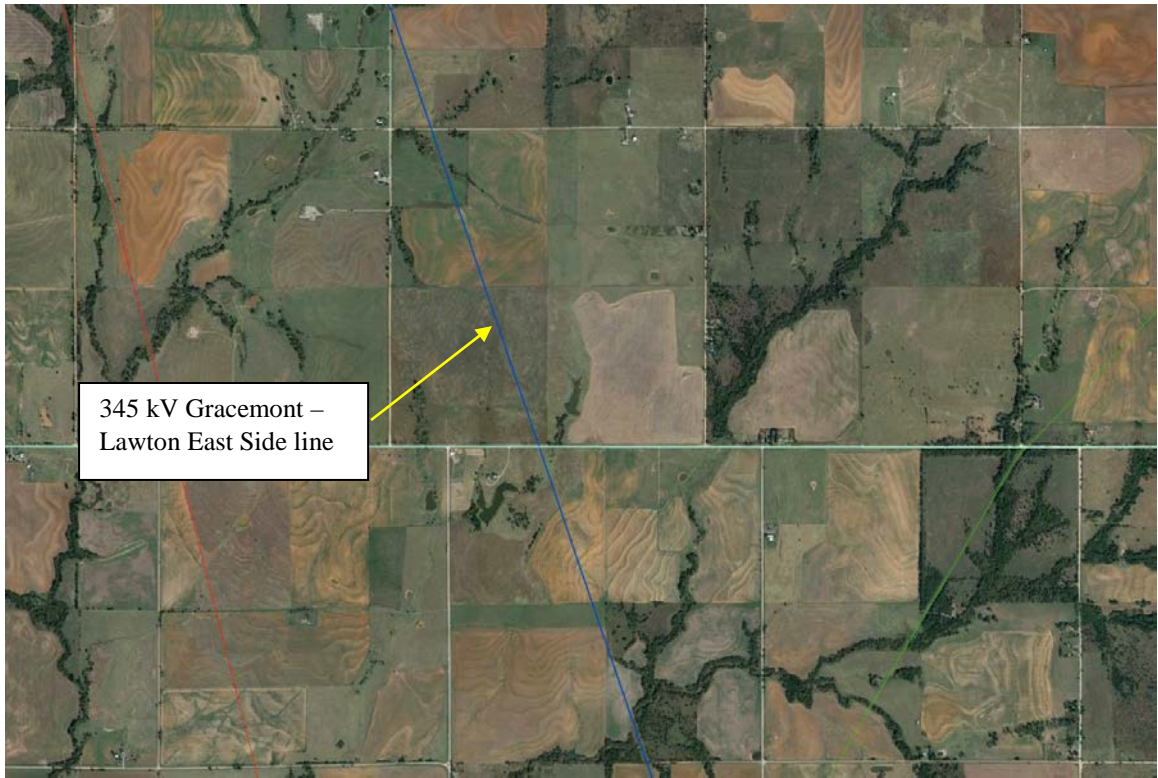
## **Project Lead Time**

Project in-service date is projected to be 36 months after the issuance of a NTC from the Southwest Power Pool.

## New 345 kV Station







345 kV Gracemont –  
Lawton East Side line



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**for**

### **Generation Interconnection Request 2016-091**

200 MW Windfarm  
In Comanche County  
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September 24, 2019

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

### **Short Circuit Fault Duty Evaluation**

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For this generator interconnection, no breakers were found to exceed their interrupting capability after the addition of the Customer's generation and 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 the Gen-2016-031 interconnection.

**Table 1: Required Interconnection Network Upgrade Facilities**

Facility	ESTIMATED COST (2017 DOLLARS)
OKGE – <b>Interconnection Facilities</b> - Relay settings upgrades on OKGE Gracemont – AEP Lawton Eastside line	<b>\$10,000</b>
OKGE – <b>Network Upgrades</b> - No new network upgrades necessary	<b>\$0</b>
OKGE - Right-of-Way for 345kV terminal addition	No Additional ROW
<b>Total</b>	<b>\$10,000</b>

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Gracemont Substation

