



**INTERCONNECTION
FACILITIES STUDY
REPORT**

GEN-2017-167

Published April 2023

By SPP Generator Interconnections Dept.

REVISION HISTORY

| DATE OR VERSION NUMBER | AUTHOR | CHANGE DESCRIPTION |
|------------------------|--------|---|
| 04/12/2023 | SPP | Initial draft report issued. |
| 05/02/2023 | SPP | Updated upgrade information and cost for UIDs 156445 & 156471 in Table 3. |
| 06/20/2023 | SPP | Final report issued. |
| 07/05/2023 | SPP | Cost revisions made for UID 156858 in Table 3. |
| 12/14/2023 | SPP | Cost revisions made for UIDs 143426/143429 in Table 2. |
| 06/28/2024 | SPP | Upgrade revisions made to reflect latest study. |
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SUMMARY

INTRODUCTION

This Interconnection Facilities Study (IFS) for Interconnection Request is for a 52 MW generating facility located in Carter County, OK. The Interconnection Request was studied in the DISIS-2017-002 Impact Study for ERIS. The Interconnection Customer's requested in-service date is December 01, 2025.

The interconnecting Transmission Owner, Oklahoma Gas & Electric Company (OGE), 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 (14) TMEIC Ninja 840 3.714 MW/4.05 MVA inverters for a total generating nameplate capacity of 52 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 36/48/60 MVA (ONAN/ONAF/ONAF) step-up transformer to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation;

Approx. 17 miles 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 ("Sunnyside 345kV") that is owned and maintained by Transmission Owner;

All transmission facilities required to connect the Interconnection Customer's substation to the POI;

Equipment at the Interconnection Customer's substation necessary to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 95% lagging and 95% leading in accordance with Federal Energy Regulatory Commission (FERC) Order 827. The Interconnection Customer may use inverter manufacturing options for providing reactive power under no/reduced generation conditions. The Interconnection Customer will be required to provide documentation and design specifications demonstrating how the requirements are met; and,

All necessary relay, protection, control and communication systems required to protect Interconnection Customer's Interconnection Facilities and Generating Facilities and coordinate with Transmission Owner's relay, protection, control and communication systems.

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

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

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

Table 1: Transmission Owner Interconnection Facilities (TOIF)

| Transmission Owner Interconnection Facilities (TOIF) | Total Cost Estimate (\$) | Allocated Percent (%) | Allocated Cost Estimate (\$) | Estimated Lead Time |
|---|---------------------------------|------------------------------|-------------------------------------|----------------------------|
| <u>Sunnyside 345kV GEN-2017-167 Interconnection (TOIF) (OGE) (143429):</u> Interconnection upgrades and cost estimates needed to interconnect the following Interconnection Customer facility, GEN-2017-167 (52 MW/Battery), into the Point of Interconnection (POI) at Sunnyside 345kV | \$1,591,654 | 100% | \$1,591,654 | 36 Months |
| Total | \$1,591,654 | | \$1,591,654 | |

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>Sunnyside 345kV Interconnection Expansion (DISIS-2017-002)(143426):</u> <u>Expand the Sunnyside 345kV substation to accommodate the interconnection of GEN-2017-167</u> | Ineligible | \$8,195,816 | 100% | \$8,195,816 | 36 Months |
| Total | | \$8,195,816 | | \$8,195,816 | |

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>N/A</u> | N/A | N/A | N/A | N/A | N/A |
| Total | | N/A | | N/A | |

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

CONTINGENT NETWORK UPGRADE(S)

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

Table 4: Interconnection Customer Contingent Network Upgrade(s)

| Contingent Network Upgrade(s) Description | Current Cost Assignment | Estimated In-Service Date |
|---|-------------------------|---------------------------|
| <u>NA</u> | <u>NA</u> | <u>NA</u> |

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 (\$) |
|---|---------------------------------|------------------------------|-------------------------------------|
| <u>NA</u> | NA | NA | NA |
| Total | NA | | NA |

CONCLUSION

After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 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) | \$1,591,654 |
| Non-Shared Network Upgrade(s) | \$8,195,816 |
| Shared Network Upgrade(s) | \$0 |
| Affected System Upgrade(s) | \$0 |
| Total | \$9,787,470 |

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).



FACILITY STUDY

for

IFS-2017-002-156496 Network Upgrades For DISIS-2017-002

Switch Out Border Line Reactor
In Beckham County
Oklahoma

March 21, 2023

Chris Rich, P.E.
Transmission Planning Engineer
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 IFS-2017-002-1 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 install one 345kV Reactor breaker/switch, and associated relay and control equipment in Border substation. The total cost for OKGE to complete these upgrades is \$1,790,448.

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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 Beckham County Oklahoma. The proposed Network Upgrade Facilities are for the addition of a 345kV breaker for the existing 50 Mvar reactor at Border substation in Beckham County, Oklahoma to allow for remote switching.

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

Other 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 installing a 345kV breaker for the existing 50 Mvar reactor at Border substation on the OG&E transmission system to allow for remote switching and to accommodate generator interconnection requests identified in SPP-GI DISIS-2016-002-1. These 345kV network upgrades shall be constructed and maintained by OKGE.

The total cost for OKGE to install one 345kV reactor breaker, and associated relay and control equipment to allow an existing 50 Mvar Reactor in Border substation to be remotely switched is estimated at \$1,790,448.

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 one breaker 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 this DISIS-2017-002 Network Upgrade.

Table 1: Required Interconnection Network Upgrade Facilities

| Facility | ESTIMATED COST (2023 DOLLARS) |
|--|----------------------------------|
| Lead time | 20 months |
| OKGE – Network Upgrades at Border Sub. Install 1-345kV Reactor Breaker/switch and associated relay and control equipment. | \$1,790,448 |
| Total | \$1,790,448 |

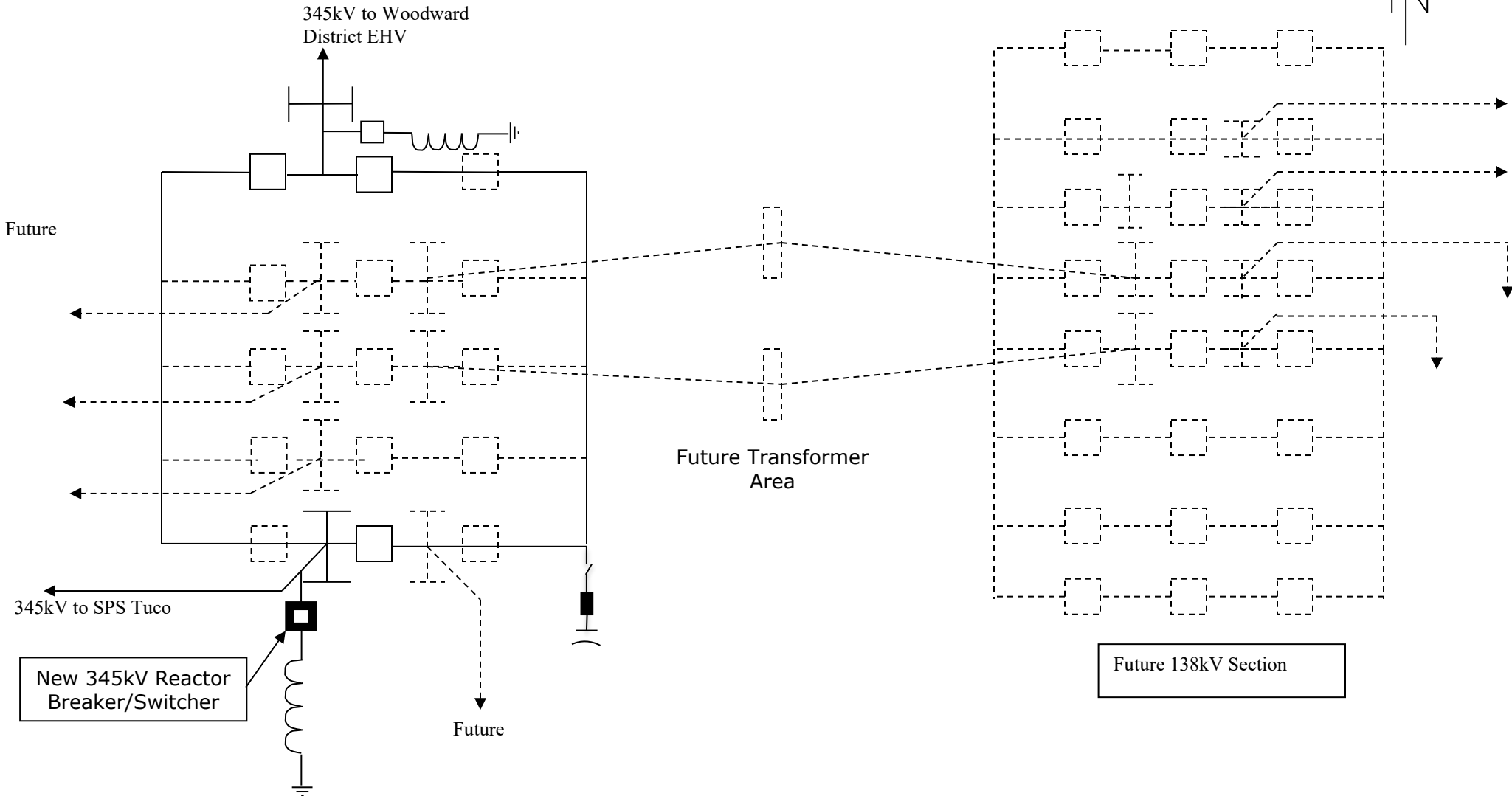
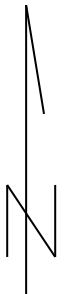
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March 27, 2023

Border Substation





FACILITY STUDY

for

Generation Interconnection Request 2017-167

52 MW Battery Generating Facility
Carter County
Oklahoma

December 14, 2023

Benjamin Sasu
Senior 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-2017-167. 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 interconnection consist of adding a 345kV breaker, 50 Mvar 138kV reactor, a new 345kV line terminal for a new Solar farm. In addition, an engineering EMTP study will need to be completed. Costs for any mitigation steps taken due to EMTP study results will need to be added to the facility study's estimate. The portion of total cost allocated to this GIA request for OKGE to add a 345kV breaker, 50 Mvar 138kV reactor, a new 345kV line terminal for a new solar generating facility and have an EMTP study at Sunnyside 345kV substation, the interconnection facility, is estimated at \$9,787,470. If the EMTP study results show that the line reactor is not needed, then it will not be added, and this facility study's estimate will be reduced.

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Introduction

The Southwest Power Pool has requested a Facility Study for the purpose of interconnecting a battery generating facility within the service territory of OG&E Electric Services (OKGE) in Carter County Oklahoma. The proposed 345kV point of interconnection is at Sunnyside Substation in Carter County. This substation is owned by OKGE. The cost for adding a new 345kV terminal to Sunnyside Substation, the required interconnection facility, is estimated at \$1,591,654.

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

Other 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.

Interconnection Facilities

The primary objective of this study is to identify attachment facilities. The requirements for interconnection consist of adding a new 345kV terminal at Sunnyside substation. This 345kV addition shall be constructed and maintained by OKGE. It is assumed that obtaining all necessary right-of-way for the line to Sunnyside substation will be performed by the interconnection customer.

An EMTP study will be required for Gen-2017-167 due to the length of the gen-tie at 125 miles. Costs for any mitigation steps revealed by the EMTP study results may require the facility study's estimate to be adjusted. The total cost for OKGE to build Transmission to the POI, add one new 345kV breaker, a 138kV reactor and a 345kV terminal to Sunnyside Substation, the interconnection facility, is estimated at \$9,787,470. This cost does not include building the 345kV line from the Customer substation into Sunnyside Substation. The Customer is responsible for this 345kV line up to the point of interconnection. This cost does not include the Customer's 345-34.5kV substation and the cost estimate should be determined by the Customer.

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 52MW 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-2017-167 interconnection.

Table 1: Required Interconnection Network Upgrade Facilities

| Facility | ESTIMATED COST (2023 DOLLARS) |
|--|----------------------------------|
| Lead Time | 36 Months |
| OKGE – Interconnection Facilities - Add one 345kV line terminals to Sunnyside Substation. one dead end structures, line switch, line relaying, revenue metering including CTs and PTs | \$1,591,654 |
| OKGE – Network Upgrades Sunnyside sub, install one-345kV 3000A breaker, line relaying, disconnect switches, and associated equipment. | \$1,790,448 |
| OKGE- Reactive Interconnection Facilities - Add 138kV reactor, FIS, 1-138kV Breaker/switch, relaying and protection | \$6,405,368 |
| OKGE - Right-of-Way for 345kV terminal addition | No Additional ROW |
| Total for Gen-2017-167 | \$9,787,470 |

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December 14th, 2023

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Sunnyside Substation

