



# **INTERCONNECTION FACILITIES STUDY REPORT**

GEN-2016-031  
(IFS-2016-001-10)

Published February 2022

By SPP Generator Interconnections Dept.

## REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
1/25/2018	SPP	Initial draft revision 0 report issued.
2/12/2018	SPP	Final report issued.
5/24/2019	SPP	Revised Final report issued. Updated Tables 3 and 5 in the Facility Study Report.
1/6/2020	SPP	Revised final report per DISIS-2016-001-5. Removed Wolf Creek-Emporia Shared NU in Table 3. Added Contingent Network Upgrade table in report.
02/24/2022	SPP	Revised final report issued. Removed “Wolf Creek – Blackberry” from Table 4 based on latest reposting.

# CONTENTS

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Revision History.....	i
Summary.....	1
Introduction .....	1
Phase(s) of Interconnection Service .....	1
Credits/Compensation for Amounts Advanced for Network Upgrade(s).....	1
Interconnection Customer Interconnection Facilities .....	2
Transmission Owner Interconnection Facilities and Non-Shared Network Upgrade(s) .....	3
Shared Network Upgrade(s) .....	4
Contingent Network Upgrade(s).....	4
Previous Network Upgrade(s).....	5
Conclusion.....	5
Appendices.....	6
A: Transmission Owner’s Interconnection Facilities Study Report and Network Upgrades Report(s) .....	7

## SUMMARY

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### *INTRODUCTION*

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2016-031/IFS-2016-001-10 is for a 1.5 MW generating facility located in Kay County, Oklahoma. GEN-2016-031 is an uprate for GEN-2015-001. GEN-2015-001 (200 MW) and GEN-2016-031 (1.5 MW) combined together have a total Interconnection Service of 201.5 MW. The Interconnection Request was studied in the DISIS-2016-001 Impact Study for Energy Resource Interconnection Service (ERIS) and Network Resource Interconnection Service (NRIS). Prior to an executed IFS agreement, the Interconnection Customer requested to withdraw NRIS per Section 4.4.1 of the Southwest Power Pool (SPP) Generator Interconnection Procedures (GIP), therefore ERIS-only was analyzed for this request in the DISIS-2016-001 Impact Restudies. The Interconnection Customer's requested in-service date was June 31, 2017.

The interconnecting Transmission Owner, Oklahoma Gas and Electric Company (OKGE), 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, Non-Shared Network Upgrades, Shared Network Upgrades, Contingent Network Upgrades and Previous Network Upgrades 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, 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 upgrading GEN-2015-001's five (5) 3.0 MW Vestas V126 wind generators to five (5) 3.3 MW Vestas V126 wind generators for a total generating nameplate capacity of 1.5 MW for GEN-2016-031.

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) 345/34.5kV 127/169/211 MVA (ONAN/ONAF/ONAF) step-up transformer that is owned and maintained by the GEN-2015-001 Interconnection Customer at the GEN-2015-001 Interconnection Customer's substation.
- An approximate five (5) mile overhead 345 kV line as part of GEN-2015-001 facilities will connect the Interconnection Customer's substation to the Point of Interconnection (POI) at the 345 kV bus at existing OKGE substation ("Ranch Road") that is owned and maintained by OKGE;
- All transmission facilities required to connect the Interconnection Customer's facilities to GEN-2015-001's 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. Additionally approximately 9.7 Mvars<sup>1</sup> of reactors will be required to compensate for GEN-2015-001 and GEN-2016-031 combined injection of reactive power into the transmission system under no/reduced generating conditions. 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.

The Interconnection Customer shall coordinate relay, protection, control, and communication system configurations and schemes with the Transmission Owner.

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<sup>1</sup>This approximate minimum reactor amount is needed for the current configuration of GEN-2016-031 as studied in the DISIS-2016-001 Impact Study and Restudies.

***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)*

<b>Transmission Owner Interconnection Facilities (TOIF)</b>	<b>Total Cost Estimate (\$)</b>	<b>Allocated Percent (%)</b>	<b>Allocated Cost Estimate (\$)</b>	<b>Estimated Lead Time</b>
<b><u>OKGE Ranch Road Interconnection Substation: Transmission Owner Interconnection Facilities</u></b>	\$0	N/A	\$0	N/A
<b>Total</b>	<b>\$0</b>		<b>\$0</b>	

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

<b>Non-Shared Network Upgrades Description</b>	<b>Total Cost Estimate (\$)</b>	<b>Allocated Percent (%)</b>	<b>Allocated Cost Estimate (\$)</b>	<b>Estimated Lead Time</b>
<b><u>OKGE Ranch Road Interconnection Substation - Non-Shared Network Upgrades</u></b>	\$0	N/A	\$0	N/A
<b>Total</b>	<b>\$0</b>		<b>\$0</b>	

**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 Upgrades*

Shared Network Upgrades Description	Z2 Type	Total Cost Estimate (\$)	Allocated Percent (%)	Allocated Cost Estimate (\$)	Estimated Lead Time
<b>OKGE: Ranch Road – Sooner 345kV</b> <b>CKT 1:</b> Upgrade terminal equipment. Install two (2) 345kV 3000 amp switches at the existing Sooner 345kV substation	Creditable	\$255,000	0.98	\$2,495	9 Months
<b>Total</b>		<b>\$255,000</b>		<b>\$2,495</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
<b>None</b>	N/A	N/A

**PREVIOUS NETWORK UPGRADE(S)**

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

*Table 5: Interconnection Customer Previous Network Upgrade(s)*

<b>Previous Network Upgrade(s) Description</b>	<b>Current Cost Assignment</b>	<b>Estimated In-Service Date</b>
None	\$0	N/A

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 Other Network Upgrades.

**CONCLUSION**

After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 1.5 MW can be granted. Full Interconnection Service will be delayed until the Transmission Owner Interconnection Facilities, Non-Shared Network Upgrades, Shared Network Upgrades, Contingent Network Upgrades and Previous Network Upgrades are completed. The Interconnection Customer’s estimated cost responsibility for Transmission Owner Interconnection Facilities and Shared Network Upgrades is summarized in the table below.

*Table 6: Cost Summary*

<b>Description</b>	<b>Allocated Cost Estimate</b>
Transmission Owner Interconnection Facilities	\$0
Network Upgrades	\$2,495
<b>Total</b>	<b>\$2,495</b>



# 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).



## **FACILITY STUDY**

**for**

### **Generation Interconnection Request 2016-031**

1.5 MW Wind Generating uprate  
In Kay County  
Oklahoma

January 10, 2017

Andrew R. Aston, 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-2016-031. 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. There are no requirements for interconnection to increase GEN-2015-001's generation by 1.5 MW at Ranch Road substation. No new or additional facilities are necessary to accommodate the additional generation.

## Table of Contents

Table of Contents	3
Introduction	4
Interconnection Facilities	5
Interconnection Costs	6
One-Line diagram of Interconnection	7

## **Introduction**

The Southwest Power Pool has requested a Facility Study for the purpose of interconnecting a wind generating facility within the service territory of OG&E Electric Services (OKGE) in Kay County Oklahoma. The proposed 345kV point of interconnection is at Ranch Road Substation in Kay County Oklahoma. This substation is owned by OKGE.

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.

### **Interconnection Facilities**

The primary objective of this study is to identify attachment facilities. There are no requirements for additional interconnection facilities at the existing Ranch Road Substation.

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> - No new interconnection facilities necessary	<b>\$0</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>\$0</b>

Prepared by Andrew R. Aston, P.E.  
Lead Engineer, Transmission Planning  
OG&E Electric Services

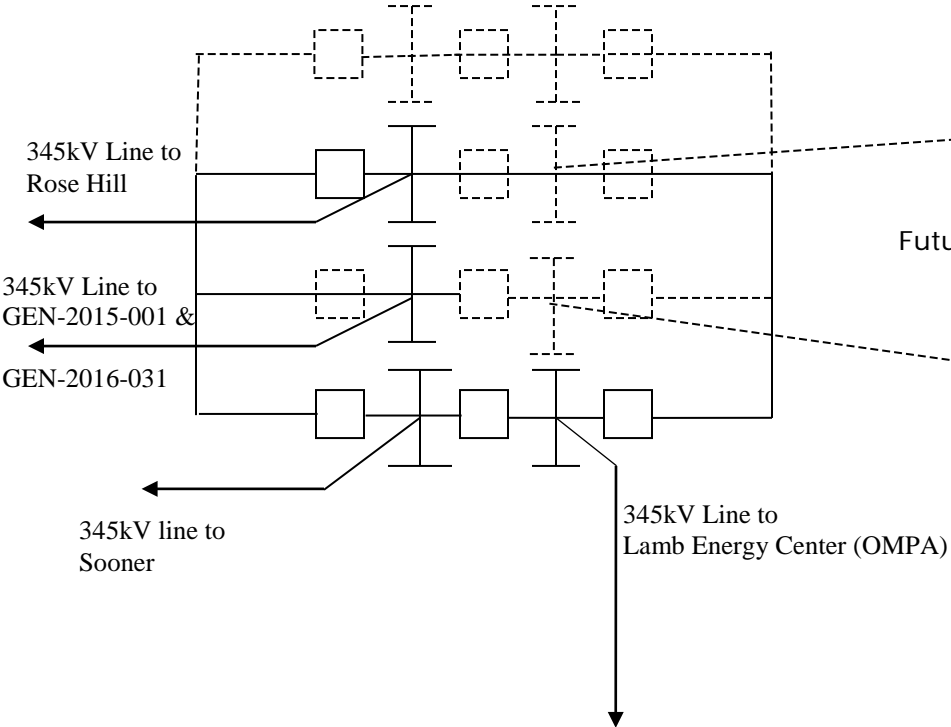
January 10, 2017

Reviewed by:

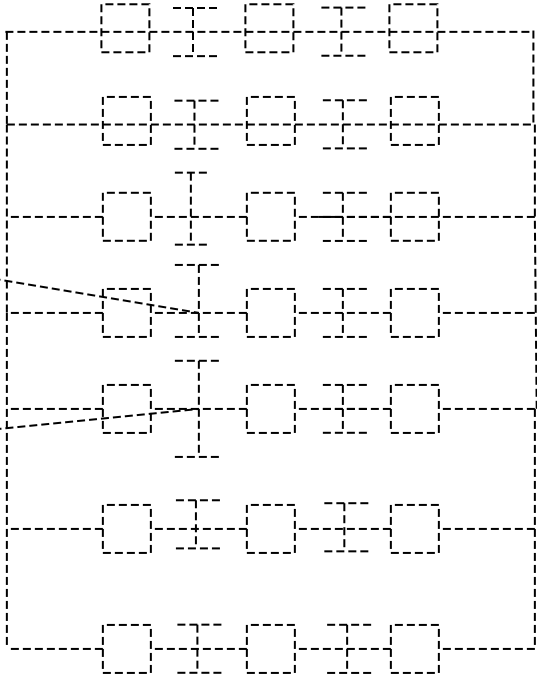
Steve M. Hardebeck, P.E.  
Manager, Transmission Planning



# Ranch Road Substation



Future Transformer Area



Possible Future 138kV Section



## **FACILITY STUDY**

**for**

### **Network Upgrade Request, GI Cluster Impact Restudy DISIS-2016-001-2**

Ranch Road to Sooner 345kV substations  
In Noble and Kay County  
Oklahoma

February 12, 2019

Daryl Huslig  
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 network upgrade. The request for a network upgrade was placed with SPP in accordance SPP's Open Access Transmission Tariff. The requirements for the network upgrade consist of replacing two 2000A switches at Sooner 345kV with 3000A rated equipment. The total cost for OKGE to replace two switches at Sooner 345kV substitution is estimated at \$255,000.

## Table of Contents

Table of Contents	3
Introduction	4
Network Upgrade	5
Network Upgrades Estimates	6
One-Line diagrams of substations	7

## **Introduction**

The Southwest Power Pool has requested a network upgrade for the purpose of upgrading the ratings between Ranch Road 345kV and Sooner 345kV substations in Kay and Noble County Oklahoma, respectively. Both substations are owned by OKGE.

The cost for OKGE to replace two switches at Sooner 345kV substitution is estimated at \$255,000.

### **Network Upgrade Facilities**

The primary objective of this study is to identify network upgrade facilities. The requirements for the network upgrade consists of replacing two switches at Sooner 345kV with 3000A ratings. The new branch ratings for Ranch Road to Sooner 345kV will be 1716 MVA normal, 1793 MVA emergency for both summer and winter seasons. The next most limiting series element in the Ranch Road to Sooner 345kV branch will be the 2-1590 ACSR jumpers on the breakers at Sooner 345kV. This 345kV addition shall be constructed and maintained by OKGE.

The total cost for OKGE to replace two switches at Sooner 345kV substation is estimated at \$255,000.

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

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 a 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 the network upgrade are listed in Table 1.

### Short Circuit Fault Duty Evaluation

It is standard practice for OKGE 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. The available fault current did not exceed the breaker rating. No breakers needed to be replaced.

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

Facility	ESTIMATED COST (2019 DOLLARS)
OKGE – <b>Network Upgrades</b> at existing Sooner 345kV sub, Install 2-345kV 3000A switches.	<b>\$255,000</b>
<b>Total</b>	<b>\$255,000</b>

Prepared by Daryl Huslig, P.E.  
Lead Engineer, Transmission Planning  
OG&E Electric Services

February 12, 2019

Reviewed by:

Steve Hardebeck, P.E.  
Manager, Transmission Planning

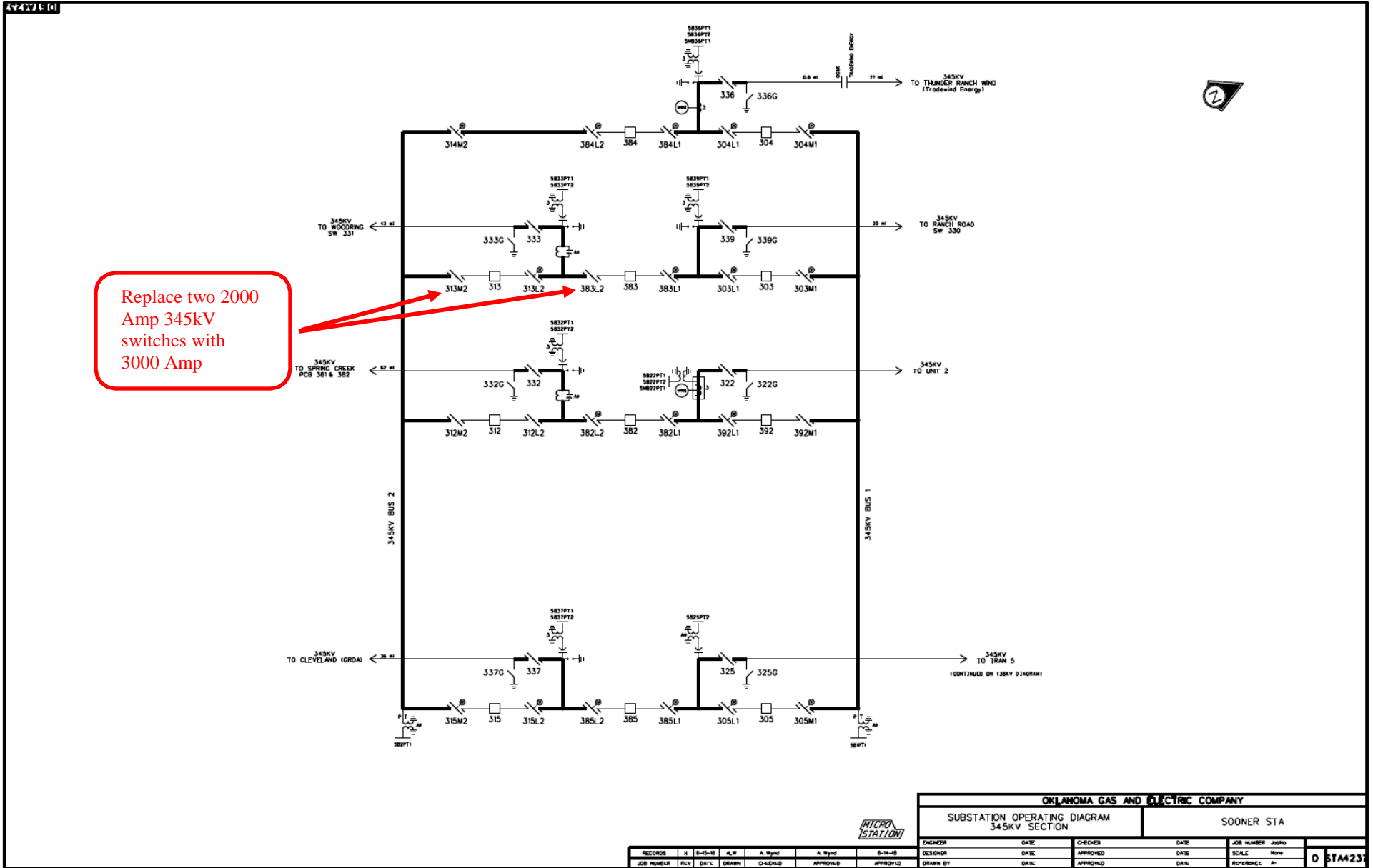


Figure 1 – Sooner 345kV One-line diagram

OKLAHOMA GAS AND ELECTRIC COMPANY												
SUBSTATION OPERATING DIAGRAM 345KV SECTION						SOONER STA						
RECORDS	1	2-15-18	ALW	A. Wynn	A. Wynn	8-16-18	ENGINEER	DATE	CHECKED	DATE	JOB NUMBER	JOB NO
JOB NUMBER	REV	DATE	DRAWN	CHECKED	APPROVED	APPROVED	DESIGNED	DATE	APPROVED	DATE	SCALE	Name
							DRAWN BY	DATE	APPROVED	DATE	REFERENCE	A-
											0	STA423