



**INTERCONNECTION
FACILITIES STUDY
REPORT**

GEN-2017-175

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By SPP Generator Interconnections Dept.

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
04/13/2023	SPP	Initial draft report issued.
05/25/2023	SPP	Final report issued.
07/24/2023	SPP	Table 5 revised to reflect updated AEI costs.
08/14/2023	SPP	Table 3 revised to reflect omission of NWE upgrade.

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SUMMARY

INTRODUCTION

This Interconnection Facilities Study (IFS) for Interconnection Request is for a 300 MW generating facility located in Turner County, South Dakota. 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, 2026.

The interconnecting Transmission Owner, Western Area Power Administration (WAPA), 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 (150) Vestas V110 2.0 MW wind turbines for a total generating nameplate capacity of 300 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 230 kV transformation substation with associated 34.5 kV and 230 kV switchgear;
- Two 230/34.5 kV 100/133/167 MVA (ONAN/ONAF/ONAF) step-up transformer to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation;
- Approx. 5 miles 230 kV line to connect the Interconnection Customer's substation to the Point of Interconnection ("POI") at the 230 kV bus at existing Transmission Owner substation ("Vfodnes-Utica Jct. 230kV") 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>Vfodnes - Utica Jct. 230kV GEN-2017-175 Interconnection (TOIF) (WAPA) (143441):</u> Interconnection upgrades and cost estimates needed to interconnect the following Interconnection Customer facility, GEN-2017-175 (300 MW/Wind), into the Point of Interconnection (POI) at Vfodnes - Utica Jct. 230kV	\$515,000	100 %	\$515,000	42 Months
Total	\$515,000		\$515,000	

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>Vfodnes - Utica Jct. 230kV GEN-2017-175 Interconnection (Non-Shared NU) (WAPA) (143440):</u> Interconnection upgrades and cost estimates needed to interconnect the following Interconnection Customer facility, GEN-2017-175 (300 MW/Wind), into the Point of Interconnection (POI) at Vfodnes - Utica Jct. 230kV	Ineligible	\$15,570,000	100%	\$15,570,000	42 Months
Total		\$15,570,000		\$15,570,000	

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
NA	NA	NA	NA	NA	NA
Total		NA		NA	

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)	\$515,000
Non-Shared Network Upgrade(s)	\$15,570,000
Shared Network Upgrade(s)	\$0
Affected System Upgrade(s)	\$0
Total	\$16,085,000

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).

Interconnection Facilities Study Report

*Southwest Power Pool, Inc. (SPP) Generator
Interconnection Request GEN-2017-175*

(DISIS-2017-002)



**Western Area
Power Administration**

Upper Great Plains Region (WAPA-UGP)

April 2023





1.0 Background:

The Western Area Power Administration Upper Great Plains Region (WAPA-UGP¹) received a request for an Interconnection Facilities Study in accordance with the Southwest Power Pool Inc. (SPP) Open Access Transmission Tariff (Tariff) for interconnection of a Generating Facility in Turner and Yankton Counties, South Dakota to WAPA-UGP's Utica Junction-Virgil Fodness 230kV Transmission Line. SPP generator interconnection request GEN-2017-175 represents a 300 MW nameplate wind generation facility with Point of Interconnection (POI) at the 230-kV bus of a new WAPA-UGP owned switchyard on the Utica Junction-Virgil Fodness 230-kV Transmission Line approximately 16 miles from the Utica Junction Substation.

The wind generator's collector substation will be located in close proximity to the proposed POI on the WAPA-UGP'S Utica Junction-Virgil Fodness 230-kV Transmission Line. The collector station will consist of a 230/34.5-kV transformer and multiple 34.5-kV deliveries to interconnect the individual wind turbines. The Interconnection Customer will construct, own, and maintain a 230-kV tie-line between the collector substation and the WAPA-UGP owned switchyard on the Utica Junction-Virgil Fodness 230-kV Transmission Line. The POI will be at the 230-kV bus at the WAPA-UGP owned switchyard on the Utica Junction-Virgil Fodness 230-kV Transmission Line. The Point of Change of Ownership between Interconnection Customer and WAPA-UGP will be at the points where Interconnection Customer's 230-kV conductors, jumpers, and insulators connect to WAPA-UGP's 230-kV take-off structure and the rigid bus underhung from the 230-kV take-off structure, as illustrated in Attachment B.

This Facilities Study does not address transmission service or any delivery component of transmission service; only the interconnection requirements and operating impacts of the interconnection service component of the Generating Facility.

2.0 Study Requirements:

This Facilities Study includes an evaluation of the following:

- 2.1** Prepare/develop a substation layout, perform a preliminary bus design, and determine all electrical equipment requirements to accommodate the request. Develop/compile cost estimates for all WAPA-UGP labor, overheads, equipment additions, modifications, etc. to accommodate the generator interconnection.
- 2.2** Review and document any other interconnection/control area requirements. Document these additional requirements (such as indication/metering, monitoring, control, relaying) and include these in the cost estimate.

¹ WAPA-UGP is also referred to as "Western-UGP" in the SPP Tariff.



2.3 Determination of need to develop an Operating Guide for WAPA-UGP's Dispatch to document the conditions under which the new Generating Facility must be operated to protect against unacceptable pre- or post-contingent transient voltage and loading conditions.

2.4 Develop an overall time schedule for completion of the necessary addition/modifications.

3.0 Study Results:

The following results document the analysis of the addition of the Generating Facility to WAPA-UGP's transmission system and fulfill the tasks outlined in Section 2.0 above:

3.1 Required Facility Upgrades by WAPA-UGP: WAPA-UGP has determined that following additions are required to maintain a safe and reliable interconnection to WAPA-UGP's transmission system:

- A new 230-kV switchyard on the Utica Junction-Virgil Fodness 230-kV Transmission Line. WAPA-UGP'S minimum requirement for new 230-kV interconnection to an existing transmission line is a three (3) ring bus. Construction of the new WAPA-UGPR owned switchyard will require three (3) 230-kV power circuit breakers, nine (9) 230-kV disconnection switches, instrument transformers, associated control and protection equipment, high voltage bus, three (3) transmission line take-off-structures, conductor, communication equipment, control building, and associated station service equipment.

WAPA-UGP's estimated cost for labor, overhead, equipment, construction, and other miscellaneous costs for the new WAPA-UGPR owned 230-kV switchyard are outlined in Attachment A. The total cost is estimated at \$16,085,000.

3.1.1 Transmission Owner's Interconnection Facilities: Equipment installed by WAPA-UGP for the sole purpose of this interconnection, such as the Transmission Owner's Interconnection Facilities, which includes equipment between of the Point of Interconnection and Point of Change of Ownership, interrogation, and communication equipment, are considered direct assignment facilities and not subject to inclusion as Network Upgrades. The direct assigned costs for such equipment are estimated at \$515,000 based upon WAPA-UGP's understanding of the SPP Tariff provisions and are included in the total cost estimate provided in Attachment A.

3.1.2 Non-Shared Network Upgrades constructed by Transmission Owner: Non-Shared Network Upgrades to be designed, procured, constructed, installed, and owned by WAPA-UGP are the cost responsibility of the Interconnection Customer. This includes the new WAPA-UGP owned 230-kV switchyard on the Utica Junction-Virgil Fodness 230-kV Transmission Line. The cost estimate for the Network Upgrades constructed by the Transmission Owner is \$15,570,000. Based on WAPA-UGP's understanding of the SPP Tariff, these Non-Shared Network Upgrades are considered Non-Capacity Network



Upgrades. These Upgrades would not be subject to the transmission service credits described in Article 11.5 of the SPP Generator Interconnection Agreement (GIA).

3.2 Contractual Agreements:

Pursuant to the SPP Tariff, SPP and WAPA-UGP will need to execute a GIA (or initially an Interim GIA, if applicable, with a subsequent execution of a GIA) with the Interconnection Customer for the interconnection of the Generating Facility. The GIA will address specific funding requirements and provide an advanced payment schedule for facility additions and upgrades to address WAPA-UGP's requirements. The GIA, which discusses the construction and interconnection aspects of this project, will need to be developed and offered by SPP, pursuant to their obligations and procedures under the SPP Tariff, and forwarded to the Interconnection Customer for review and signature. A schedule for payment(s) based on design, procurement, and construction activities will be included in the GIA consistent with the SPP Tariff provisions.

3.3 Other Interconnection, Metering Requirements:

Basic indication, monitoring, control, and relaying requirements due to a generator interconnection are included in the cost estimate. A list of specific needs will be provided by WAPA-UGP's Operations Office and WAPA-UGP's South Dakota Maintenance Office once design has progressed.

Interconnection Customer shall install metering at their 230/34.5-kV collector substation in accordance with SPP and WAPA-UGP metering requirements. WAPA-UGP's generation metering requirements, as an SPP Transmission Owner, must be also met, unless specific SPP metering requirements are more restrictive, in accordance with the most current **Western Area Power Administration Meter Policy** posted at the "WAPA Meter Policy" link at the following page: <http://www.oasis.oati.com/WAPA/WAPAdocs/Western-Common-Business-Practices.html>

Any WAPA-UGP specific implementation of more restrictive SPP metering requirements are also posted on WAPA-UGP's OASIS home page under the "Effective Business Practices" folder at the "UGP Meter Policy Modifications" link at the following URL: <http://www.oasis.oati.com/wapa/index.html>

Western's **General Requirements for Interconnection** must also be met in accordance with the *General Requirements for Interconnection* document posted at the "General Requirements for Interconnection (GRI)" link at the following page: <http://www.oasis.oati.com/WAPA/WAPAdocs/Western-Common-Business-Practices.html>

3.4 Operating Guide/Operating Agreement:

Prior to energization, an Operating Guide will need to be developed by WAPA-UGP in coordination with SPP, if necessary, to outline any required operating restrictions under which the generation interconnection must be energized (or de-energized) to protect against



unacceptable system stability limits and/or pre-contingent and post-contingent voltage and loading conditions. The Operating Guide will be developed by WAPA-UGP's Transmission System Planning Division in coordination with SPP Staff. In addition, an Operating Agreement will be developed by WAPA-UGP's Operations Office, jointly with the Interconnection Customer and SPP, if necessary, as will be set forth in the GIA to outline the necessary operations coordination and requirements not otherwise set forth in the GIA.

3.5 Schedule:

Attachment A outlines WAPA-UGP's estimated schedule for planning, design and construction of the facilities required to accommodate the Interconnection Customer's Request. WAPA-UGP anticipates the new 230-kV switchyard on the Utica Junction-Virgil Fodness 230-kV Transmission Line would be completed by December 31, 2026. This schedule is based on the GIA (or Interim GIA) being executed prior to July 15, 2023, and issuance of the NEPA Finding of No Significant Impact or Record of Decision by October 1, 2024.

3.6 Environmental Review:

The Environmental Review for this project, as described in Attachment V, Sections 3.3.5, and 8.6.1, and any other applicable sections of the SPP Tariff. An Environment Review agreement is being coordinated between WAPA-UGP and Interconnection Customer. The Environmental Review is performed at the Interconnection Customer's expense, and those costs are considered direct assigned costs and are ineligible for credits under the SPP Tariff. Until the appropriate NEPA review is completed (issuance of a FONSI, ROD, or other), no construction activities relating to the TO's Network Upgrades may commence.

4.0 Facilities Study Cost:

WAPA-UGP will audit the Interconnection Facilities Study costs and provide a summary of costs once the study is completed or the interconnection request is withdrawn.



ATTACHMENT A

NEW 230-kV SWITCHYARD
ON THE UTICA JUNCTION-VIRGIL FODNESS 230-KV TRANSMISSION LINE

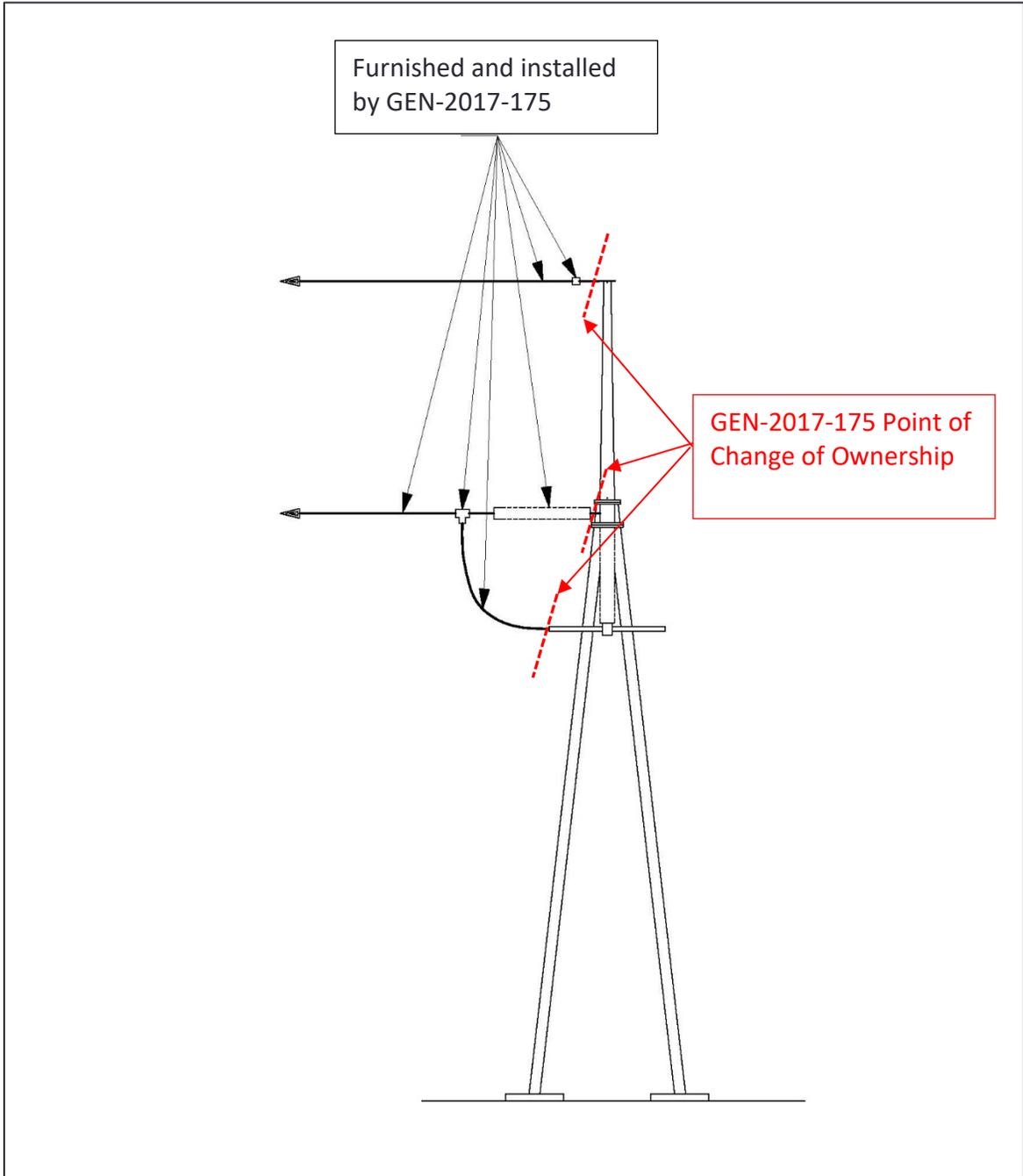
PROJECT ACTIVITY	ESTIMATED START DATE	ESTIMATED COST, MILESTONE PAYMENT DUE
Preconstruction activities – planning, project management, etc.	30 Calendar Days Following GIA Execution*	\$380,000
Provide staff and other resources to engineer, design, and plan construction	30 Calendar Days Following GIA Execution*	\$740,000
Procure equipment, parts, and control equipment necessary to construct	December 1, 2023	\$3,600,000
Development, Solicitation, and Award of Construction Contract(s)	November 1, 2024	\$10,710,000
WAPA-UGP Construction Administration	March 1, 2025	\$495,000
Commissioning, Energization, and construction supervision	March 1, 2026	\$160,000
In-Service (Estimated Completion Date)	December 31, 2026	
TOTAL ESTIMATED COSTS		\$16,085,000**

*Assumes Execution of GIA NLT July 15, 2023.

**Includes Transmission Owner Interconnection Facilities costs estimated at \$515,000 and Non-Shared Network Upgrades constructed by Transmission Owner costs estimated at \$15,570,000.



ATTACHMENT B





NorthWestern[®]
Energy

Delivering a Bright Future

SPP – DISIS-2017-002 GEN-2017-175

AFFECTED SYSTEM

FACILITY STUDY

8/14/2023

ELECTRIC TRANSMISSION PLANNING



Introduction

Southwest Power Pool has notified NorthWestern Energy (NWE) that NWE is an Affected System of their proposed system change.

Description

When Southwest Power Pool originally studied GEN-2017-175, NorthWestern Energy's Utica Junction to Napa Junction 115 kV line was identified as overloaded. The line rating of 120/141 MVA (normal/emergency) has since been reviewed. The revised rating of this line is now 146.8 MVA (all times). With this revised rating, the overload identified in the original study is no longer an issue, and therefore no line rebuild is required.

System Modifications

Substation Modifications:

None

Transmission Lines Modifications:

None

Communications Modifications:

None

Metering and EMS Data Modifications:

None

Cost Estimate

Non-binding cost estimates of the proposed system change in Table 1

Table 1: High-level, non-binding estimates of the proposed system change.

	Cost
System Modifications (NWE system)	
None identified	\$0.00
Total Direct Cost Estimate	\$0.00
Other required modifications	
GIA Network Upgrades (NWE system)	
None identified	\$0.00
Total Direct and Other Cost Estimate	\$0.00