INTERCONNECTION FACILITIES STUDY REPORT

GEN-2016-074
(IFS-2016-002-57)

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By SPP Generator Interconnections Dept.

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
12/17/2020	SPP	Initial draft report issued.
02/11/2021	SPP	Final report issued with no changes
04/02/2021	SPP	Updated final report to relfect MISO Affected System Addendum
05/04/2021	SPP	Updated final report issued. Updated Tables 3 and 6 to reflect Group 09 Sensitivity
07/28/2021	SPP	Updated final report issued. Upated Tables 5 and 6 based on updated MISO AFS
10/01/2021	SPP	Updated Tables 5 and 6 based on MISO AFS Addendum

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SUMMARY

INTRODUCTION

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2016-074/IFS-2016-002-57 is for a 200 MW generating facility located in Custer, NE. 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 Impact Study for ERIS.The Interconnection Customer's requested in-service date is December 31st, 2020.

The interconnecting Transmission Owner, Nebraska Public Power District (NPPD), 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 (100) 2 MW - 6 Pole Asynchonout 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 collectioncircuits;
- 34.5 kV to 345 kV transformation substation with associated 34.5 kV and 345kVswitchgear;
- One 345/34.5 kV 133/178/233 MVA (ONAN/ONAF/ONAF) step-up transformer to be owned and maintained by the Interconnection Customer at the Interconnection Customer'ssubstation;
- A 9.5 mile overhead mile overhead 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 ("Sweetwater 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 andcommunicationsystems.

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
GEN-2016-074 Interconnection (TOIF) (NPPD) - UID 122677: Expand the existing Sweewater 345kV Substation to accommodate GEN-2016-074 interconnection request	$0	N/A	$0	N/A
Total	**$0**		**$0**	

*TOIF costs are included in the Non-Shared NU costs. Upgrade ID #122678 contains the complete interconnection cost estimate provided by NPPD.

Table 2: Non-Shared Network Upgrade(s)

Non-Shared Network Upgrades Description	ILTCR	Total Cost Estimate ($)	Allocated Percent (%)	Allocated Cost Estimate ($)	Estimated Lead Time
GEN-2016-074 Interconnection (Non-Shared NU) (NPPD) - UID 122678: Expand the exisitng Sweetwater 345kV Substation to accommodate GEN-2016-074 interconnection request	Ineligible	$9,700,000	100%	$9,700,000	36 Months
Total		**$9,700,000**		**$9,700,000**	

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
None	N/A	$0	N/A	$0	N/A
Total		**$0**		**$0**	

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
NTC 200220 (R-Plan) - Build new 222 mile, 345 kV line from Gentleman - Cherry Co - Holt Co. Build new 345 kV substations at Cherry Co and Holt Co. Terminal upgrades at Gentleman.	$0	04/01/2024

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 ($)	Allocated Share (%)	Allocated Cost Estimate ($)
MISO Affected System Impact Study SPP DISIS-2016-002: North Woods Capacitor	$1,500,000	7.3%	$109,272
Total	**$1,500,000**		**$109,272**

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)	$0
Non-Shared Network Upgrade(s)	$9,700,000
Shared Network Upgrade(s)	$0
Affected System Upgrade(s)	$109,272
Total	**$9,809,272**

*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).

DISIS-2016-002-2
GENERATION INTERCONNECTION FACILITY STUDY

NPPD
SPP GEN-2016-074 200.0 MW at Sweetwater 345kV Substation
SPP GEN-2016-106 400.0 MW at GGS 345 kVSubstation

WAPA/BEPC
SPP GEN-2016-110 152.0 MW on LRS-Stegall 345 kVline

TSGT
SPP GEN-2016-147 40.0 MW at Sidney 115 kVSubstation

SEPTEMBER 2020

PREPARED FOR:
SOUTHWEST POWER POOL

PREPARED BY:
NEBRASKA PUBLIC POWER DISTRICT OPERATIONS
TRANSMISSION ASSET PLANNING
T&D ENGINEERING & ASSET MANAGEMENT

Nebraska Public Power District
"Always there when you need us"

The *NPPD DISIS-2016-002-2 Facility Study* was performed to document the interconnection facilities and network upgrades for generation projects that are proposed to interconnect to the NPPD transmission system. These projects have developed through the SPP Definitive Interconnection System Impact Study process and have advanced to the facility study stage. SPP has requested that NPPD perform the Facility Study associated with the generation interconnection projects listedbelow:

Project	MW	Type	Point-of-Interconnection
GEN-2016-074	200.00	Wind	NPPD Sweetwater 345 kV
GEN-2016-106	400.00	Wind	NPPD GGS 345kV

GI requests for other TO's in Nebraska GI Group 9:

Project	MW	Type	Point-of-Interconnection
GEN-2016-110	152.00	Wind	WAPA/BEPC LRS-Stegall 345 kV
GEN-2016-147	40.00	Solar	TSGT Sidney 115 kV

SPP entered into a facility study agreement with each of the generation interconnection customers and subsequently requested that NPPD perform the Facility Study for each request. This facility study focused on the generation interconnection facilities and network upgrades identified in the SPP DISIS studies. The NPPD Facility Study includes detailed cost estimates and estimated project schedules for the interconnection and network upgrades identified in the SPP studies.

Interconnection Facilities & Network Upgrades

NPPD's Engineering, Asset Management, and Project Management groups have reviewed the list of interconnection facility and network upgrades that are required for DISIS-2016-002-2 projects. Detailed cost estimates have been prepared for the facility upgrades that were identified in the system impact study for the requests. The prepared cost estimates are study level estimates (+20%/-20%) and assume implementation of standard NPPD construction and procurement practices. The cost estimates for the interconnection facilities and network upgrades arebelow:

Interconnection Facilities

- GEN-2016-074: Expand existing Sweetwater 345 kV Substationtoaccommodate new GI.

$ 9,700,000

- GEN-2016-106: Construct satellite 345 kV Substation near GGS 345 kV substation to accommodate new GI. The existing GGS 345 kV substation is full and additional terminals at this location will require a remote satellite substations and re-route of existing transmission lines to interconnect the new satellite substation and the existing GGS 345 kV substation. This cost estimate is an initial proposed design which will need to be refined and validated through additional study work and field work to determine an acceptable long-term plan for new interconnections at this location. The current working assumption is a new satellite substation approximately 15-miles southwest of the existing GGSsubstation.

$ 94,900,000

Network Upgrades

- Construct Keystone – Red Willow 345 kV line & substationexpansions.

$ 295,000,000

- Construct Red Willow – Post Rock 345 kV line (portion of line in StateofNebraska) & Red Willow substationexpansion.

$ 111,000,000

- Construct Holt County – Antelope 345 kV line & substationexpansions.

$ 70,000,000

The results of DISIS-2016-002-2 documented that these requests are contingent on the completion of the following previously-allocated required network upgrades:

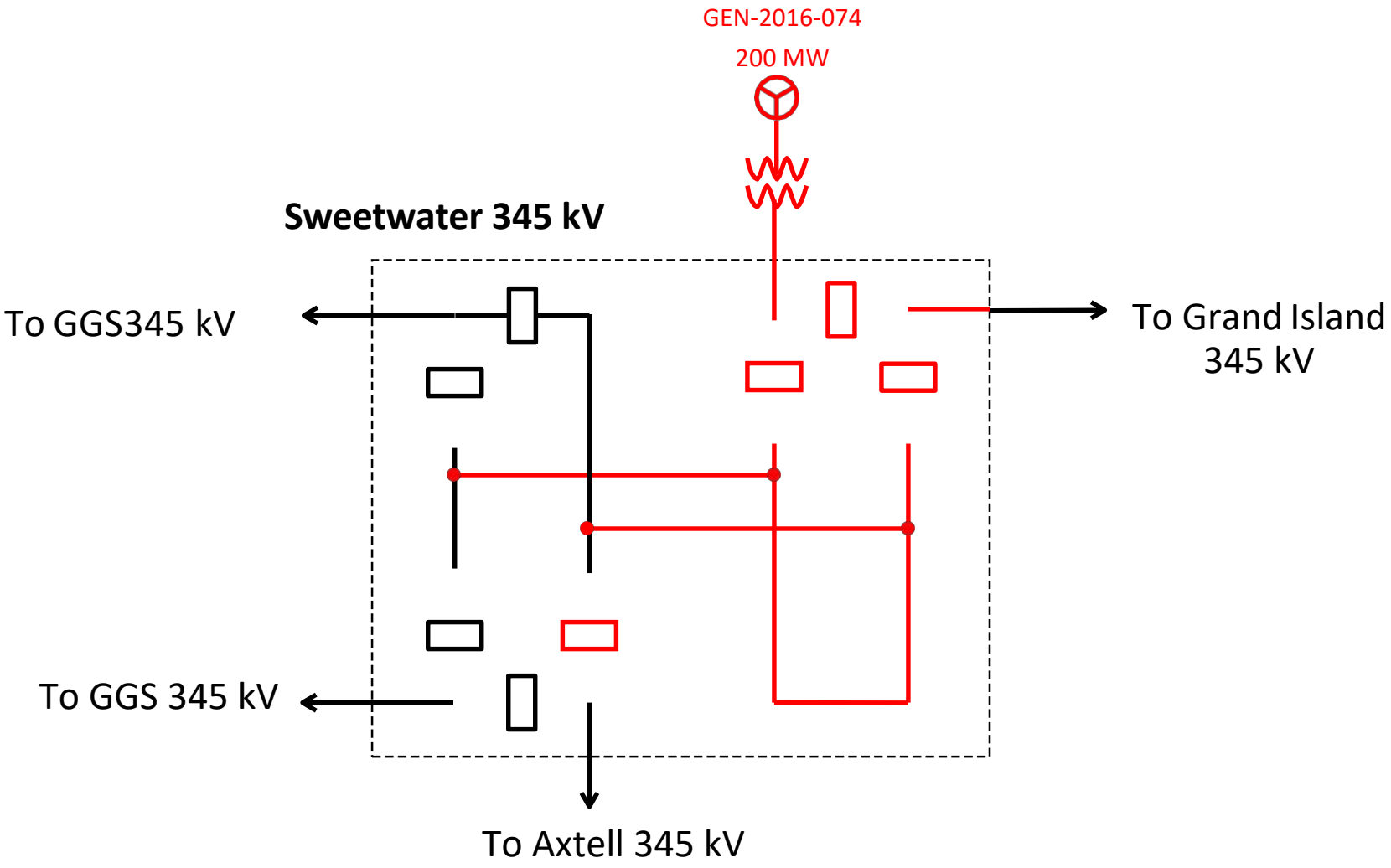
- Gentleman – Thedford - Holt County (R-Project) and Thedford345/115kV Transformerproject

The substation one-line diagrams highlighting the required facility upgrades for each generator interconnection are on the following pages. NPPD will work with the generation interconnection projects to develop project schedules for the interconnection facilities and network upgrade projects listed above during the development of the generation interconnection agreement. Typical implementation schedules for new transmission lines (≥ 115 kV) are roughly 4 years or longer to accommodate the public routing process and construction schedules. For the DISIS-2016-002-2 network upgrades (Keystone – Red Willow – Post Rock), the construction schedule will likely be much

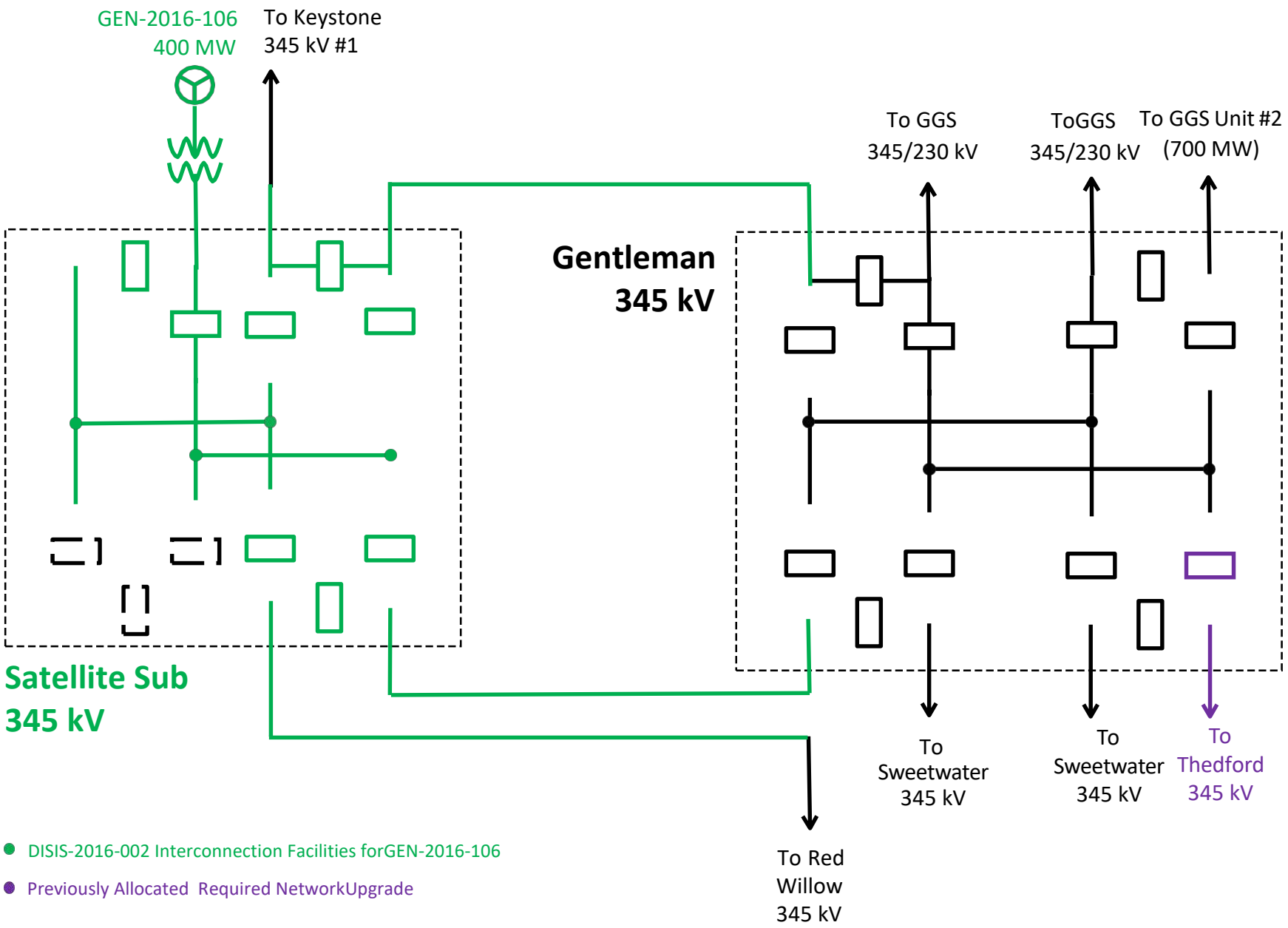
longer (> 6 Years) due to the length of the projects and complex project scope involving multiple state jurisdictions. Substation additions require less land acquisition and typically can be implemented in less time or approximately 2-3 years. Project schedule details will be further discussed in the development of the generator interconnection agreement (GIA) and the milestones associated with the generation interconnection projects.

It should also be noted that the interconnection plan for the DISIS-2016-002-2 generation projects are dependent on the transmission upgrades/additions that are required as part of the previous SPP DISIS GI Studies and SPP ITP Studies. If there are any modifications to these previous studies and related upgrades, then the interconnection plan for the DISIS-2016-002-2 projects could be affected. There is no interconnection capacity for the DISIS-2016-002-2 projects without the previouslyidentifiedupgrades.

If the generation interconnection projects proceed to the generation interconnection agreement, then an operating study may need to be performed to fully assess and evaluate the operation of the generation facility and network upgrades in accordance with NERC Standards. The operating study requirement will be included in the generation interconnection agreement with NPPD. The generation interconnection projects will have significant impact on the GGS Stability Interface (Flowgate #6006) and LRS/DC stability limitations in western NE and the operating study will need to take these issues into account.



- DISIS-2016-002 Interconnection Facilities for GEN-2016-074


GEN-2016-106
400 MW
To Keystone
345 kV #1
To GGS
345/230 kV
ToGGS
345/230 kV
To GGS Unit #2
(700 MW)
Gentleman
345 kV
Satellite Sub
345 kV
To
Sweetwater
345 kV
To
Sweetwater
345 kV
To
Thedford
345 kV
To Red
Willow
345 kV
DISIS-2016-002 Interconnection Facilities forGEN-2016-106
Previously Allocated Required NetworkUpgrade