



# **INTERCONNECTION FACILITIES STUDY REPORT**

GEN-2016-007

IFS-2016-001-037

Published July 2019

By SPP Generator Interconnections Dept.

## REVISION HISTORY

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DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
06/13/2019	SPP	Initial draft report issued.
07/15/2019	SPP	Final report issued.

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## SUMMARY

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### *INTRODUCTION*

This Interconnection Facilities Study (IFS) for Interconnection Request GEN-2016-007/IFS-2016-001-037 is for a 100.05 MW generating facility located in Barnes County, North Dakota. The Interconnection Request was studied in the DISIS-2016-001 Impact Study for Network Resource Interconnection Service (NRIS) and Energy Resource Interconnection Service (ERIS). The Generation Interconnection Request was also studied in the DISIS-2016-001-1 Impact Restudy for Energy Resource Interconnection Service (ERIS). The Interconnection Customer's original requested Commercial Operation Date was 12/31/2018. The revised Commercial Operation Date in the Facilities Study Agreement is 12/31/2019.

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 interconnect facilities (TOIF), non-shared network upgrades, shared network upgrades, previously allocated, 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 twenty nine (29) Vestas V126 3.45 MW wind turbines for a total generating nameplate capacity of 100.05 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 collector circuits;
- 34.5 kV to 115 kV transformation substation with associated 34.5 kV and 115 kV switchgear;
- One (1) 115/34.5 kV, 69/92/115 MVA (ONAN/ONAF/ONAF) step-up transformer to be owned and maintained by the Interconnecting Customer at the Interconnection Customer's substation;
- Approximately a eight (8) mile overhead 115 kV line to connect the Interconnection Customer's substation to the Point of Interconnection ("POI") at the 115 kV bus at existing Transmission Owner's substation (Valley city 115 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. Additionally approximately 2.74 Mvars<sup>1</sup> of reactors will be required to compensate for 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-2016-007 as studied in the DISIS-2016-001 Impact Study and Impact Restudy.

## **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>WAPA Valley City 115 kV Interconnection Substation:</b> Construct bay addition at the Valley City Substation will require one (1) 115-kV power circuit breakers, three (3) 115-kV disconnect switches, instrument transformers, associated control and protection equipment, high voltage bus, a transmission line take-off-structure, and conductor.	\$1,300,000	100%	\$1,300,000	24 Months
<b>Total</b>	<b>\$1,300,000</b>	<b>100%</b>	<b>\$1,300,000</b>	

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

Non-Shared Network Upgrades Description	Z2 Type <sup>2</sup>	Total Cost Estimate (\$)	Allocated Percent (%)	Allocated Cost Estimate (\$)	Estimated Lead Time
<b>None</b>	N/A	\$0	N/A	\$0	N/A
<b>Total</b>		<b>\$0</b>		<b>\$0</b>	

<sup>2</sup> Indicates the method used for calculating credits impacts under Attachment Z2 of the Tariff.

**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>None</b>	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.

**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 4: Interconnection Customer Previous Network Upgrade(s)*

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

<b>Affected System Upgrades Description</b>	<b>Total Cost Estimate (\$)</b>	<b>Allocated Share (%)</b>	<b>Allocated Cost Estimate (\$)</b>
<b>None</b>	\$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 100.05 MW can be granted. Full Interconnection Service will be delayed until the transmission owner interconnect facilities (TOIF), non-shared network upgrades, shared network upgrades, previously allocated, and affected system upgrades that are required for full interconnection service are completed. The Interconnection Customer's estimated cost responsibility is summarized in the table below.

*Table 6: Cost Summary*

<b>Description</b>	<b>Allocated Cost Estimate</b>
Transmission Owner Interconnection Facilities	\$1,300,000
Network Upgrades	\$0
<b>Total</b>	<b>\$1,300,000</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 Report

*Southwest Power Pool, Inc. (SPP) Generator  
Interconnection Request GEN-2016-007*



**Western Area  
Power Administration**

Upper Great Plains Region (WAPA-UGP)

*March 2019*

## **1.0 Background:**

The Western Area Power Administration Upper Great Plains Region (WAPA-UGP<sup>1</sup>) 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 Barnes County, North Dakota to WAPA-UGP's Valley City 115-kV Substation. SPP generator interconnection request GEN-2016-007 represents a 100 MW nameplate wind generation facility with Point of Interconnection at WAPA-UGP's Valley City 115-kV bus.

The wind generation facility's proposed collector station would be located approximately 8 miles northeast of WAPA-UGP's Valley City 115-kV Substation. The collector substation will consist of one (1) 115/34.5-kV transformer and multiple 34.5-kV deliveries to interconnect the individual wind turbines. The Interconnection Customer will construct, own, and maintain approximately 8 miles of 115-kV transmission line between the collector substation and WAPA-UGP's Valley City 115-kV Substation. The Point of Interconnection(s) will be at the 115-kV main and transfer buses at WAPA-UGP's Valley City 115-kV Substation. The Point of Change of Ownership between Interconnection Customer and WAPA-UGP will be at WAPA-UGP's Valley City 115-kV Substation at the points where Interconnection Customer's conductors, jumpers, and insulators connect to WAPA-UGP's 115-kV take-off structure and the rigid bus underhung from the 115-kV take-off structure, as illustrated in Attachment B.

This Interconnection 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 Interconnection 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.

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<sup>1</sup> 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 Additions by WAPA-UGP:**

WAPA-UGP has determined that following addition is required to maintain a safe and reliable interconnection to WAPA-UGP's transmission system:

- Addition of a new 115-kV bay at Valley City Substation

Construction of the GEN-2016-007 bay addition at the Valley City Substation will require one (1) 115-kV power circuit breakers, three (3) 115-kV disconnect switches, instrument transformers, associated control and protection equipment, high voltage bus, a transmission line take-off-structure, and conductor.

WAPA-UGP's estimated cost for labor, overhead, equipment additions, modifications, replacements, and other miscellaneous costs are outlined in Attachment A. The total cost is estimated at \$1,300,000.

**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 \$1,300,000 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 Network Upgrades constructed by Transmission Owner:** There are no Network Upgrades to be designed, procured, constructed, installed and owned by WAPA-UGP.

#### **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 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 North Dakota Maintenance Office once design has progressed.

Interconnection Customer shall install metering at their 115/34.5-kV step up 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's 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 URL: <http://www.oasis.oati.com/WAPA/WAPAdocs/Western-Common-Business-Practices.html>

Any WAPA-UGP specific implementation of more restrictive SPP metering requirements will be posted on WAPA-UGP's OASIS home page under the "Effective Business Practices" sub-folder 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 URL: <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. Based upon the proposed facility additions, WAPA-UGP anticipates the new 115-kV bay addition at the Valley City Substation would be completed by the end of May 2021. This schedule is based on the GIA/Interim GIA being executed prior to June 1, 2019, and issuance of the NEPA Finding of No Significant Impact or Record of Decision by September 1, 2020.

### **3.6 Environmental Review:**

WAPA-UGP is a federal agency under the U.S. Department of Energy and is subject to the National Environmental Policy Act (NEPA), 42 U.S.C §4321, et seq., as amended. An 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, will be required prior to construction activities taking place. WAPA-UGP anticipates an Environmental Assessment (EA) level of NEPA review will be required. WAPA-UGP will coordinate with Interconnection Customer to tender and execute an Environmental Review agreement. WAPA-UGP's general cost estimate for an EA level of NEPA review is \$100,000. The Environmental Review is performed at the Interconnection Customer's expense, and those costs are considered direct assigned costs ineligible for credits under the SPP Tariff.

### **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**

**GEN-2016-007 VALLEY CITY 115-KV ADDITIONS**

<b>PROJECT ACTIVITY</b>	<b>ESTIMATED START DATE</b>	<b>ESTIMATED COST</b>
Preconstruction activities – planning, project management, etc.	July 2019*	\$100,000
Provide staff and other resources to engineer, design, and plan construction	July 2019	\$150,000
Procure equipment, parts, and control equipment necessary to construct	January 2020	\$380,000
Construction Activities	June 2020	\$580,000
Commissioning, Energization, and construction supervision	March 2021	\$90,000
In-Service (Estimated Completion Date)	May 2021*	
<b>TOTAL ESTIMATED COSTS</b>		<b>\$1,300,000</b>

\*Subject to execution of a Generator Interconnection Agreement, advance funding being provided, and completion of an Environmental Review prior to the start of construction.





**ATTACHMENT B**

