INTERCONNECTION FACILITIES STUDY REPORT

GEN-2014-004IS
(IFS-2015-001-22)
(Western #GI-1404)

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By SPP Generator Interconnections Dept.

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION	COMMENTS
1/6/2017	SPP	Draft Interconnection Facilities Study Report Revision 0 issued	
2/13/2017	SPP	Final Interconnection Facilities Study Report Revision 0 issued	

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SUMMARY

1. INTRODUCTION

This Interconnection Facilities Study (IFS) for GEN-2014-004IS/IFS-2015-001-22 (Interconnection Request) is for a 383.00 MW wind farm facility located in Billings County, North Dakota. The Interconnection Request was initially submitted under the Integrated System tariff and studied by Western Area Power Administration (Western) under contract number 14-UGPR-58 for Interconnection System Interconnection Study for both Energy Resource Interconnection Service (ERIS) and Network Resource Interconnection Service (NRIS). After the Integrated System became integrated with Southwest Power Pool (SPP), the Interconnection Customer executed the SPP IFS Agreement per Appendix 4 or Appendix 4A of the SPP Open Access Transmission Tariff (OATT) and provided deposit securities as required by Section 8.9 of the Generator Interconnection Procedures (GIP) to proceed to the IFS. The GIP is covered under Attachment V of the SPP OATT. The request for interconnection was placed with SPP by the requesting customer (Interconnection Customer) in accordance with the OATT, which covers new generation interconnections on SPP's transmission system.

Western performed a detailed IFS at the request of SPP for the Interconnection Request. Interconnection Customer's original in-service date was October 2016. SPP has determined that full Interconnection Service will be available after the assigned Transmission Owner Interconnection Facilities and Non-Shared Network Upgrade(s) are completed. Full interconnection service will require completion of all Network Upgrade(s) listed in the "Other Network Upgrade(s)" section.

The primary objective of the IFS is to identify necessary Transmission Owner Interconnection Facilities, Network Upgrade(s), other direct assigned upgrade(s), and associated upgrade lead times needed to grant the requested Interconnection Service at the specified Point of Interconnection (POI).

2. 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.

3. 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 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).

4. INTERCONNECTION CUSTOMER INTERCONNECTION FACILITIES

The Generation Facility is proposed to consist of two-hundred-twenty-five (225) 1.7 MW General Electric (G.E.) wind generators for a total generating nameplate capacity of 382.5 MW. The 34.5kV collector system is planned to be connected to two (2) 230/34.5kV step-up transformers to be owned and maintained by the Interconnection Customer at the Interconnection Customer's substation. A three (3) mile overhead 230kV transmission line will connect the Interconnection Customer's substation to the Point of Interconnection (POI) at a new 230kV bus addition at the existing Charlie Creek 230 kV Substation owned by Transmission Owner Basin Electric Power Cooperative (BEPC). The Interconnection Customer will be responsible for all of the transmission facilities required to connect the Interconnection Customer's substation to the Point of Interconnection (POI).

The Interconnection Customer will be responsible for installing any and all equipment at the Interconnection Customer's substation necessary to maintain a power factor at the POI between 0.95 lagging and 0.95 leading, including periods when the generators are producing little or no reactive power due to low or no wind conditions. Also, the Interconnection Customer shall coordinate relay, protection, control, and communication system configurations and schemes with the Transmission Owner.

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

To facilitate interconnection, the interconnecting Transmission Owner, BEPC, will expand and construct a new 230kV line terminal at Charlie Creek Substation, including one (1) 230kV circuit breaker rated 2000A continuous ampacity, three (3) 2000A disconnect switches, structures, and all associated terminal equipment necessary for the acceptance of the Interconnection Customer's Interconnection Facilities. The Engineering and Construction (E&C) lead time for the completion of Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades is estimated at approximately twelve (12) months after the Generator Interconnection Agreement (GIA) is fully executed.

As of the date of this study, the Interconnection Customer's responsibility for BEPC Transmission Owner Interconnection Facilities (TOIF) and Non-Shared Network Upgrade(s) is estimated at $2,700,000 as shown in Table 1.

Table 1: Interconnection Customer TOIF and Non-Shared Network Upgrade(s)

TOIF and Non-Shared Network Upgrades Description	Allocated Cost ($)	Allocated Percent (%)	Total Cost ($)
BEPC Interconnection Substation: Transmission Owner Interconnection Facilities 230kV Substation work for one (1) new line terminal, line switch, dead-end structure, line relaying, communications, revenue metering, and line arrestors.	$400,000	100%	$400,000

BEPC Interconnection Substation - Non-Shared Network Upgrades 230kV Substation work for one (1) new line terminal, one (1) 2000A circuit breaker, control panel replacement, line relaying, disconnect switches, and associated equipment.	$2,300,000	100%	$2,300,000
Total	**$2,700,000**	**100%**	**$2,700,000**

6. SHARED NETWORK UPGRADE(S)

At this time, the Interconnection Customer is allocated $0 for Shared Network Upgrades. If higher-queued Interconnection Request(s) withdraw from the queue, suspend or terminate their GIA, restudies will be conducted to determine the Interconnection Customers' allocation of Shared Network Upgrades. All studies have been conducted assuming that higher-queued Interconnection Request(s) and the Network Upgrade(s) associated with those higher-queued Interconnection Requests will be placed into service. At this time, the Interconnection Customer is allocated the following cost listed in Table 2 for Shared Network Upgrades.

Table 2: Interconnection Customer Shared Network Upgrades

Shared Network Upgrades Description	Allocated Cost ($)	Allocated Percent (%)	Total Cost ($)
Currently not allocated Shared Network Upgrades	$0	n/a	$0
Total	**$0**	**n/a**	**$0**

7. OTHER NETWORK UPGRADE(S)

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

Currently none

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.

8. CONCLUSION

Interconnection Service for the Interconnection Request will be delayed until the Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades are constructed. The Interconnection Customer's estimated cost responsibility for Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades is estimated at $2,700,000. At this time, the Interconnection Customer is allocated $0 for Shared Network Upgrades. After all Interconnection

Facilities and Non-Shared Network Upgrades have been placed into service, Interconnection Service for 383.00 MW, as requested by the Interconnection Customer can be granted.

At this time the total allocation of costs assigned to Interconnection Customer for interconnection Service are estimated at $2,700,000.

APPENDICES

A: WESTERN TRANSMISSION OWNER INTERCONNECTION FACILITIES STUDY REPORT

See next page for detailed IFS Report.

Interconnection Facilities Study Report
Generation Interconnection Request GI-1404
Charlie Creek Substation

1.0 Background:

The Upper Great Plains Region (UGPR) of the Western Area Power Administration (Western) received Large Generator Interconnection Request GI-1404 (Request) from the Interconnection Customer requesting to interconnect a total of 383 MW of wind generation (Generating Facility). The request is for a 230-kV interconnection located at the Basin Electric Power Cooperative (Basin Electric) Charlie Creek Substation in Billings County, North Dakota.

The Interconnection Customer will install and own a 230/35-kV collector substation approximately 10 miles west of Basin Electric's existing Charlie Creek Substation. The Interconnection Customer will also install and own the radial 230-kV transmission line between the collector substation and the Charlie Creek Substation. A new 230-kV line terminal will be constructed in the Charlie Creek Substation to accommodate the interconnection. The Point of Interconnection will be at 230-kV ring at the Charlie Creek Substation. The Point of Change of Ownership which is located at the 230-kV take-off structure(s) at the Charlie Creek Substation where the Interconnection Customer's 230-kV transmission line(s) connects to the take-off structure(s). This facility study only addresses the facility additions in the existing Basin Electric Charlie Creek Substation.

The details of the Generation Interconnection Request are as follows:

Generation Interconnection Request:	GI-1404
Location of Generation	Billings County, ND
Requested In-Service Date:	October 2016
Generation Size:	383 MW Total
New Load:	None

Western UGPR provides administration of the Integrated System (IS) utilizing Western's Open Access Transmission Tariff (Western's Tariff) on behalf of the IS partners, Basin Electric Power Cooperative and Heartland Consumers Power District. Effective October 1, 2015, Basin Electric joined the Southwest Power Pool (SPP) as a Transmission Owner and transferred functional control of its eligible transmission facilities to SPP. The majority of Basin Electric's facilities are now subject to the SPP Tariff, including SPP's Generator Interconnection Procedures (GIP). Basin Electric's Charlie Creek Substation has been transferred to the functional control of SPP.

This Facilities Study Report (Report) fulfills the requirements in Western's Tariff and the Large Generator Interconnection Procedures (LGIP) Section 8, Interconnection Facilities Study and the Facilities Study Agreement, Contract No. 15-UGPR-88, which was executed between Western and the Interconnection Customer prior to October 1, 2015. Pursuant to the *Transition of Integrated System (IS) Interconnection Request to SPP Tariff* posting on SPP's OASIS, issuance of this final Report shall cause the Request to be fully transitioned to the SPP GIP. Pursuant to its requirements under the SPP Tariff, SPP will tender a Generator Interconnection Agreement (GIA) or Interim Generator Interconnection Agreement (Interim GIA) in accordance with Sections 11 and 11A of the SPP GIP.

This Report does not address transmission service or any delivery component of transmission service; only the interconnection service component of the Generating Facility.

2.0 Status of Existing Studies Applicable to Request:

An Interconnection System Impact Study (ISIS) was performed under Contract No. 14-UGPR-58 and an ISIS Report dated August 2015 was provided to the Interconnection Customer. The ISIS performed was an "interconnection only" study for the generation interconnection.

The initial Request for 600 MW but was reduced by the Interconnection Customer to 383 MW. At the reduced level of 383 MW the ISIS Report indicated that the interconnection of this Generating Facility resulted in no adverse impacts on local area stability. The steady-state analysis noted no system intact violations or post-contingency interconnection related impacts for near term or out year cases.

3.0 Study Requirements:

Basin Electric has performed this Interconnection Facilities Study to determine a good faith estimate of (1) the costs of Direct Assignment Facilities to be charged to the Interconnection Customer, (2) the Interconnection Customer's appropriate share of the cost of any required Network Upgrades, and (3) the time required to complete such construction to accommodate the interconnection.

This Interconnection Facilities Study includes an evaluation of the following:

3.1 Review applicable contractual agreements.

3.2 Perform/develop a substation layout, perform a preliminary bus design, determine all electrical equipment requirements, and determine a suitable site location to accommodate the Request. Develop/compile cost estimates for all Basin Electric labor, overheads, equipment additions, modifications, etc. to accommodate the generator interconnection.

3.3 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.

3.4 Determination of need to develop an Operating Guide for Western'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.

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

4.0 Study Results:

The following results document the analysis of the addition of the Generating Facility to Basin Electric's transmission system and fulfill the tasks outlined in Section 3.0 above:

4.1 Required Facility Additions by Basin Electric Power Cooperative:

Basin Electric has determined that the following additions and improvements are required to maintain a safe and reliable interconnection to Basin Electric's transmission system.

The single 230 kV interconnection will require one (1) 230-kV power circuit breakers, three (3) disconnect switch motor operators, associated relay panels, and steel and bus work.

Basin Electric's estimated cost for labor, overhead, equipment additions, modifications, and other miscellaneous costs are outlined in Attachment A. The total cost is estimated at $2,700,000. Attachment B shows the proposed 230-kV interconnection at the Charlie Creek Substation.

The Point of Change of Ownership location is defined as the 230-kV take-off structure(s) at the Charlie Creek Substation where the Interconnection Customer's 230-kV transmission line(s) connects to the take-off structure(s). Interconnection Customer will furnish and install the conductor jumper and insulator assembly to the take-off structure(s).

4.2 **Contractual Agreements:**

Pursuant to the SPP Tariff, SPP and Basin Electric 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 and Interim GIA for use when Basin Electric is a Party to the GIA/Interim GIA, as the Transmission Owner, as in this case, are located in Appendix 6 and 8 respectively of Attachment V of the SPP Tariff. The GIA will address specific funding requirements and provide a payment schedule for facility additions and upgrades to avoid deficit spending by Basin Electric. 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 based on design, procurement, and construction activities will be included in the GIA consistent with the SPP Tariff provisions.

The Interconnection Customer shall be entitled to compensation for the cost of Network Upgrades eligible for transmission credits in accordance with the SPP Tariff including Attachment Z2. The Network Upgrades at the Charlie Creek Substation are described herein. Upon completion of the installation and/or upgrades to the Network Upgrades, Basin Electric shall own such Network Upgrades and other facility additions (e.g. the Transmission Owner's Interconnection Facilities) to its transmission system.

Equipment installed by Basin Electric 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, metering, interrogation, and communication equipment, are direct assignment facilities and not subject to inclusion as Network Upgrades, thus not entitled to transmission service credits, pursuant to the provisions of the SPP Tariff. The direct assignment costs for such equipment are estimated at $400,000 based upon Basin Electric's understanding of the SPP Tariff provisions and are included in the total cost estimate provided in Attachment A.

4.3 **Other Interconnection/Metering Requirements:**

Basic indication, metering, monitoring, control, and relaying requirements due to a generator interconnection are included in the cost estimate. Basin Electric's generation metering requirements, as an SPP Transmission Owner, must be met. A list of specific needs will be provided by Basin Electric once design has progressed.

4.4 **Operating Guide/Operating Agreement:** Prior to energization, an Operating Guide will be developed by Basin Electric and Western 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. In addition, an Operating Agreement will be developed 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.

4.5 **Schedule:** Attachment A outlines Basin Electric'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, Basin Electric anticipates the 230-kV additions to the Charlie Creek Substation would be completed by then end of November 2017. This schedule is based on the GIA/Interim GIA being executed prior to December 5, 2016.

5.0 Facilities Study Costs: Basin Electric and Western 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

CONSTRUCTION SCHEDULE
230-kV ADDITIONS AT CHARLIE CREEK SUBSTATION

ACTIVITY	ESTIMATED START	DURATION
CONTRACT EXECUTION	12/5/2016	MILESTONE
PROJECT PLANNING	12/5/2016	8 WEEKS
ENGINEERING DESIGN	12/19/2016	24 WEEKS
EQUIPMENT PROCUREMENT (PCB, INSTRUMENT TRANSFORMERS, & RELAY PANELS)	12/19/2016	32 WEEKS
ADVERTISE CONSTRUCTION CONTRACT	3/1/2017	4 WEEKS
AWARD CONSTRUCTION CONTRACT	4/5/2017	1 WEEK
CONSTRUCTION CONTRACT & COMMISSIONING	5/22/2017	25 WEEKS
IN-SERVICE DATE	11/20/2017	MILESTONE

***Schedule assumes Generator Interconnection Agreement executed no later than December 5, 2016**.

COST ESTIMATE
230-kV ADDITIONS AT CHARLIE CREEK SUBSTATION

SINGLE INTERCONNECTION (ONE BREAKERS)	
ITEM	**ESTIMATED COST**
ENGINEERING, PLANNING, PROJECT MANAGEMENT, ENVIRONMENTAL, COMMISSIONING, AND MISC EXPENSES	$1,050,000
CONTRACT TOTALS: PACKAGER, CONSTRUCTION, RELAY PANELS, POWER CIRCUIT BREAKERS, INSTRUMENT TRANSFORMERS	$1,650,000
TOTAL ESTIMATED COST	**$2,700,000***

***Note: The direct assignment costs of $250,000 are included in this estimate.**

ATTACHMENT B