



# **INTERCONNECTION FACILITIES STUDY REPORT**

## **GENERATOR INTERCONNECTION REQUEST # GI-2015-1**

**250 MW Wind Generating Facility  
Interconnecting at  
Comanche – Daniels Park 345kV Line**

**Xcel Energy – Public Service Company of Colorado (PSCo)  
September 7, 2018**

## **Executive Summary**

This Interconnection Facilities Study Report summarizes the analysis performed by Public Service Company of Colorado (PSCo) to specify and estimate the cost of the siting, engineering, equipment procurement and construction needed to physically and electrically connect the GI-2015-1, 250 MW wind generation facility (GF) in Elbert County, Colorado.

The Point of Interconnection (POI) requested for GI-2015-1 is the midpoint of the Comanche-Daniels Park 345kV line (L7015), approximately 57.24 miles from Comanche or the Daniels Park station. The Customer's GF will connect 250 MW of generation to a new 345kV switching station (GI-2015-1 substation) via an approximately 45 mile Customer-owned generator tie line. A total of one-hundred forty (140) GE 1.79 MW wind turbines will be connected in two groups, with both groups being connected to a 34.5/345kV Main Step-up Transformer (MST).

The original proposed Commercial Operation Date (COD<sup>1</sup>) was December 31, 2018, which is not feasible based on the site, design, procure and construct time-frames noted in Tables 1, 2 and 3 of this report. Interconnection Customer and Transmission Provider have mutually agreed to a new COD of December 31, 2021, with an assumed back feed date of six months prior to the COD. The new COD allows for the estimated time of 36 months required to site, engineer, procure and construct the facilities from the date the customer meets all applicable milestones as agreed to in any future Large Generator Interconnection Agreement (LGIA). An Engineering & Procurement Agreement can be executed to facilitate completion of the interconnection facilities.

The proposed one-line diagram for the GI-2015-1 interconnection station is shown in Figure 1 in the Appendix.

This request was studied both as an Energy Resource Interconnection Service (ERIS)<sup>2</sup> and a Network Resource Interconnection Service (NRIS)<sup>3</sup>.

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<sup>1</sup> **Commercial Operation Date** of a unit shall mean the date on which the Generating Facility commences Commercial Operation as agreed to by the Parties pursuant to Appendix E to the Standard Large Generator Interconnection Agreement.

<sup>2</sup> **Energy Resource Interconnection Service** shall mean an Interconnection Service that allows the Interconnection Customer to connect its Generating Facility to the Transmission Provider's Transmission System to be eligible to

The estimated costs of the recommended transmission system upgrades to interconnect the GI-2015-1 project include:

- \$1.707 million for Transmission Provider's Interconnection Facilities (cf. Table 1).
- \$13.405 million for Network Upgrades for Interconnection applicable for either ERIS or NRIS (cf. Table 2).
- \$0.649 million for additional Network Upgrades required for NRIS (cf. Table 3).

**The total estimated cost of the transmission system improvements required for GI-2015-1 to qualify for:**

- **ERIS is \$15.112 Million (Tables 1 and 2); and**
- **NRIS is \$15.7611 Million (Tables 1, 2 and 3)**

**This is contingent upon completion of the Network Upgrades identified for all applicable higher-queued Interconnection Requests (see footnote to Table 3).**

**For GI-2015-1 interconnection:**

**NRIS (after required transmission system improvements) = 250 MW**

**ERIS (after required transmission system improvements) = 250 MW** (output delivery assumes the use of existing firm or non-firm capacity of the PSCo Transmission System on an as-available basis.)

**Note: NRIS or ERIS, in and of itself, does not convey transmission service.**

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deliver the Generating Facility's electric output using the existing firm or non-firm capacity of the Transmission Provider's Transmission System on an as available basis. ERIS in and of itself does not convey transmission service

<sup>3</sup> **Network Resource Interconnection Service** shall mean an Interconnection Service that allows the Interconnection Customer to integrate its Large Generating Facility with the Transmission Provider's Transmission System (1) in a manner comparable to that in which the Transmission Provider integrates its generating facilities to serve native load customers; or (2) in an RTO or ISO with market based congestion management, in the same manner as all other Network Resources. NRIS in and of itself does not convey transmission service.

## **Cost Estimates and Assumptions**

Transmission Provider has specified and estimated the cost of the equipment, engineering, procurement and construction work needed to interconnect GI-2015-1. The results of the engineering analysis for facilities owned by the Transmission Provider are estimates and are summarized in Tables 1 and 2.

Table 1: “Transmission Provider’s Interconnection Facilities” includes the nature and estimated cost of the Transmission Provider's Interconnection Facilities and an estimate of the time required to complete the construction and installation of such facilities.

Table 2: “Network Upgrades required for Interconnection (applicable for either ERIS or NRIS)” includes the nature and estimated cost of the Transmission Provider's Network Upgrades necessary to accomplish the interconnection and an estimate of the time required to complete the construction and installation of such facilities.

Upgrades identified in Tables 1 and 2 are illustrated in Figure 1 in the Appendix which shows the physical and electrical connection of the Interconnection Customer’s Generating Facility to the Transmission Provider’s Transmission System. The one-line diagram also identifies the electrical switching configuration of the interconnection equipment, including, without limitation: the transformer, switchgear, meters, and other station equipment.

Transmission Provider has also specified and estimated the cost of the equipment, engineering, procurement and construction work of additional Network Upgrades required for NRIS. The results of the engineering analysis for facilities owned by the Transmission Provider are estimates and are summarized in Table 3.

Table 3: “Additional Network Upgrades required for NRIS” includes the nature and estimated cost of the Transmission Provider's additional Network Upgrades required for NRIS and an estimate of the time required to complete the construction and installation of such facilities.

The total estimated cost of the transmission system improvements required for GI-2015-1 to qualify for:

- ERIS is \$15.112 Million (Tables 1 and 2); and
- NRIS is \$15.7611 Million (Tables 1, 2 and 3)

The following tables list the transmission system improvements required to accommodate the interconnection of GI-2015-1. The cost responsibilities associated with these transmission system improvements shall be handled as per current FERC guidelines.

**Table 1: Transmission Provider's Interconnection Facilities**

Element	Description	Cost Est. (Millions)
PSCo's New 345kV Switching Station — New Terminal for GI-2015-01	Interconnect Customer to tap at the New 345kV Switching Station built for GI-2015-01 The new equipment includes: <ul style="list-style-type: none"> <li>• One 345kV gang switch</li> <li>• Three 345kV arresters</li> <li>• Three 345kV Metering CT's</li> <li>• Three 345kV Metering PT's</li> <li>• Two 345kV Line Traps</li> <li>• Two 345kV CCVT's</li> <li>• Power Line Carrier System</li> <li>• Station controls</li> <li>• Associated electrical equipment, bus, wiring and grounding</li> <li>• Associated foundations and structures</li> <li>• Associated transmission line communications, fiber, relaying and testing.</li> </ul>	\$1.632
	Transmission line tap into substation:	\$0.055
	Siting and Land Rights support for siting studies, land and ROW acquisition and construction:	\$0.020
	<b>Total Cost Estimate for Transmission Provider's Interconnection Facilities</b>	<b>\$1.707</b>
<b>Time Frame</b>	<b>Site, design, procure and construct</b>	<b>36 Months</b>

**Table 2: Network Upgrades required for Interconnection (applicable for either ERIS or NRIS) \***

<b>Element</b>	<b>Description</b>	<b>Cost Est. (Millions)</b>
PSCo's New 345kV Switching Station — New Terminal for GI-2015-01	Interconnect Customer to tap at the New 345kV Switching Station built for GI-2015-01 The new equipment includes: <ul style="list-style-type: none"> <li>• Nine 345kV gang switches</li> <li>• Six 345kV arresters</li> <li>• Four 345kV Line Traps</li> <li>• Eight 345kV CCVT's</li> <li>• Four 345kV Deadend Towers</li> <li>• Four 345kV Gas Circuit Breakers</li> <li>• One 27x55 Electrical Equipment Enclosure</li> <li>• Station Controls</li> <li>• Associated foundations and structures</li> <li>• Associated electrical equipment, bus, wiring and grounding</li> <li>• Associated foundations and structures</li> </ul>	\$11.614
PSCo's Comanche 345kV Station – due to new 345kV switching station	Addition of one 345kV CCVT, one 345kV Line trap, and upgrade for associated line relaying.	\$0.779
PSCo's Daniels Park 345kV Station – due to new 345kV switching station	Addition of one 345kV CCVT, one 345kV Line trap, and upgrade for associated line relaying.	\$0.812
	Siting and Land Rights support for substation construction	\$0.200
	<b>Total Cost Estimate for Network Upgrades</b>	<b>\$13.405</b>
<b>Time Frame</b>	<b>Site, design, procure and construct</b>	<b>36 Months</b>

**\* Not contingent on completion of the Network Upgrades for Interconnection identified for any higher queued Interconnection Requests.**

**Table 3: Additional Network Upgrades required for NRIS \***

<b>Element</b>	<b>Description</b>	<b>Cost Est. (Millions)</b>
PSCo's Arapahoe 230kV station – For Line Rating Increase	Add a new line trap, jumpers and associated equipment and foundations for an increased load	\$0.222
PSCo's Daniels Park 230kV station – For Line Rating Increase	Add a new line trap, jumpers and associated equipment and foundations for an increased load	\$0.204
PSCo's Greenwood 230kV station – For Line Rating Increase	Add a new line trap, jumpers and associated equipment and foundations for an increased load	\$0.222
	<b>Total Cost Estimate for Network Upgrades</b>	<b>\$0.648</b>
<b>Time Frame</b>	<b>Site, design, procure and construct</b>	<b>36 Months</b>

**\* Not contingent on completion of the Network Upgrades for NRIS identified for any higher queued Interconnection Requests.**

### **Cost Estimate Assumptions**

- Appropriations level cost estimates for Interconnection Facilities and Network Upgrades have a specified accuracy of +/- 20%.
- Estimates are based on 2018 dollars (appropriate contingency and escalation applied).
- Labor is estimated for straight time only – no overtime included. Assumes contracted construction for the majority of the work.
- Lead times for materials were considered for the schedule.
- Estimates are developed assuming typical construction costs for previous completed projects. These estimates include all applicable labor and overheads associated with the siting support, engineering, design, material/equipment procurement, construction, testing and commissioning of these new substation and transmission line facilities.
- The Generation Facility is in PSCo's retail service territory. Therefore, costs for retail load metering are included in these estimates.
- PSCo (or it's Contractor) crews will perform all construction, wiring, and testing and commissioning for PSC owned and maintained facilities.

- The estimated time to site, design, procure and construct the Transmission Provider's Interconnection Facilities and Network Upgrades required for Interconnection is approximately 36 months after authorization to proceed has been obtained.
- A CPCN will be required for the construction of Transmission Provider's Interconnection Facilities and Network Upgrades required for Interconnection. The time to secure the CPCN is included in the 36 months estimate.
- A CPCN will not be required for additional Network Upgrades for NRIS.
- Line and substation bus outages will be necessary during the construction period. Outage availability could potentially be problematic and necessitate extending the back-feed date.
- Estimates do not include the cost for any Customer owned equipment and associated design and engineering.
- The Customer will be required to design, procure, install, own, operate and maintain a Load Frequency/Automated Generation Control (LF/AGC) RTU at the Customer Substation. PSCo / Xcel will need indications, readings and data from the LFAGC RTU.
- Power Quality Metering (PQM) will be required on the Customer's 230 kV line terminating into the POI.
- Customer will string optical ground wire (OPGW) cable into the substation as part of their transmission line construction scope.

## Appendix

**Figure 1. GI-2015-1 Interconnection Facilities and Network Upgrades in New Switching Station**

