



# **INTERCONNECTION FACILITIES STUDY REPORT**

## **GENERATOR INTERCONNECTION REQUEST # GI-2014-11**

### **50 MW PV Solar Generating Facility Interconnecting at San Luis Valley 230kV Substation**

**Xcel Energy – Public Service Company of Colorado (PSCo)**  
July 30, 2018

## **Executive Summary**

This Interconnection Facilities Study Report summarizes the analysis performed by Public Service Company of Colorado (PSCo or Public Service) to specify and estimate the cost of the siting, engineering, equipment procurement and construction needed to physically and electrically connect the GI-2014-11, 50 MW photovoltaic (PV) solar generation facility (GF) in Alamosa County, Colorado.

The Point of Interconnection (POI) requested for GI-2014-11 is the San Luis Valley 230 kV bus. The Customer's GF will connect 50 MW of solar generation to the SLV 230 kV bus via an approximate 0.5 mile generator tie line. A total of twenty-three (23) Power Conversion Stations (PCS) and associated PV modules will be connected to a common 34.5 kV collector bus. The GF will include 23 PCS (each with 2.5 MVA SMA Solar Technology inverter), and one 34.5/230 kV Main Step-up Transformer (MST).

The original proposed Commercial Operation Date (COD<sup>1</sup>) was November 1, 2016 with an assumed back feed date of six months prior to the COD. The proposed COD 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 an in-service date of December 31, 2022. Public Service estimates a 48 month schedule to site, engineer, procure and construct the facilities from the date the customer meets all applicable milestones as will be agreed to in any future Large Generator Interconnection Agreement (LGIA). An Engineering & Procurement Agreement may be executed to facilitate completion of the interconnection facilities to preserve the current COD.

The proposed station one-line diagram for the expansion of the San Luis Valley 230 kV Substation to a six breaker ring bus configuration is shown in Figure 1 in the Appendix.

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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.

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>. The customer has continued with a NRIS request into this study phase.

The estimated costs of the recommended transmission system improvements to interconnect the GI-2014-11 project include:

- \$1.070 million for Transmission Provider's Interconnection Facilities (cf. Table 1).
- \$1.263 million for Network Upgrades required for either ERIS or NRIS (cf. Table 2).
- \$111.716 million for additional Network Upgrades required for NRIS (cf. Table 3).

**The total estimated cost of the transmission system improvements required for GI-2014-11 to qualify for:**

- **ERIS is \$2.333 Million (Tables 1 and 2); and**
- **NRIS is ~\$114.0 Million (Tables 1, 2 and 3)**

**This is contingent upon completion of the Network Upgrades identified for all applicable prior-queued Interconnection Requests.**

**For GI-2014-11 interconnection:**

**NRIS (after required transmission system improvements) = 50 MW**

**ERIS (after required transmission system improvements) = 50 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 does not convey transmission service.**

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<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 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-2014-11. 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-2014-11 to qualify for:**

- **ERIS is \$2.333 Million (Tables 1 and 2); and**
- **NRIS is ~\$114.0 Million (Tables 1, 2 and 3).**

The following tables list the transmission system improvements required to accommodate the interconnection of GI-2014-11. The cost responsibilities associated with these transmission system improvements shall be handled as per current FERC guidelines.

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

<b>Element</b>	<b>Description</b>	<b>Cost Est. (Millions)</b>
PSCo's San Luis Valley 230kV Bus	Interconnect Customer to tap at the San Luis Valley 230kV Bus The new equipment includes: <ul style="list-style-type: none"> <li>• One 230kV gang switch with MOD</li> <li>• Three 230kV arresters</li> <li>• Three 230kV metering CTs</li> <li>• Three 230kV metering PTs</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>	\$0.985
	Transmission line tap into substation:	\$0.055
	Siting and Land Rights support for siting studies, land and ROW acquisition and construction:	\$0.030
	<b>Total Cost Estimate for Transmission Provider’s Interconnection Facilities</b>	<b>\$1.070</b>
<b>Time Frame</b>	<b>Site, design, procure and construct</b>	<b>18 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 San Luis Valley 230kV Bus	Interconnect Customer to tap at the San Luis Valley 230kV Bus The new equipment includes: <ul style="list-style-type: none"> <li>• One 230kV breaker</li> <li>• Two 230kV gang switches</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>	\$1.263
	<b>Total Cost Estimate for Network Upgrades</b>	<b>\$1.263</b>
<b>Time Frame</b>	<b>Site, design, procure and construct</b>	<b>18 Months</b>

**\* For GI-2014-11, ERIS is not contingent upon completion of Network Upgrades for Interconnection identified for higher queued projects.**

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

<b>Element</b>	<b>Description</b>	<b>Cost Est. (Millions)</b>
PSCo's San Luis Valley 230kV Bus	New 230kV Terminal at PSCo's San Luis Valley Substation	\$2.004
New 230kV Line	New 230kV line between WAPA's Poncha substation and PSCo's San Luis Valley substation	\$109.712
	<b>Total Cost Estimate for Network Upgrades</b>	<b>\$111.716</b>
<b>Time Frame</b>	<b>Site, design, procure and construct</b>	<b>48 Months</b>

**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 its 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 18 months after authorization to proceed has been obtained.
- A CPCN will not be required for the construction of Transmission Provider Interconnection Facilities and the Network Upgrades required for Interconnection.
- A CPCN will be required for the Network Upgrades for NRIS. The time to secure the CPCN is included in the 48 months duration estimated for site, design, procure and construct.
- Line and substation bus outages will be necessary during the construction period. Outage availability could potentially be problematic and extend requested backfeed date due.
- 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-2014-11 Interconnection Facilities and Network Upgrades in San Luis Valley Substation**

