



INTERCONNECTION FACILITIES STUDY REPORT

(Revised to address GI-2014-11 withdrawal)

GENERATOR INTERCONNECTION REQUEST

GI-2016-9

480 MW PV Solar Generating Facility

Interconnecting at

San Luis Valley 230kV Substation

Xcel Energy – Public Service Company of Colorado (PSCo)

October 24, 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-2016-9 480 MW photovoltaic (PV) solar generation facility (GF) in Alamosa County, Colorado.

The Point of Interconnection (POI) requested for GI-2016-9 is the San Luis Valley 230 kV bus. The Customer's GF will connect 480 MW of solar generation to the SLV 230 kV bus via a Customer-owned generator tie line. A total of two-hundred forty (240) SMA Sunny Central 2200-US inverters will be connected to a common 34.5kV bus, which in turn will connect to the tie-line via a 34.5/230kV Main Step-up Transformer (MST).

The proposed Commercial Operation Date (COD¹) is June 1, 2023 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.

The estimated time required to site, engineer, procure and construct the described facilities is 60 months 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-2016-9 interconnection station is shown in Figure 1 in the Appendix.

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

¹ **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.

² **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

The estimated costs of the recommended transmission system upgrades to interconnect the GI-2016-9 project include:

- \$1.127 million for Transmission Provider's Interconnection Facilities (cf. Table 1).
- \$6.769 million for Network Upgrades required for either ERIS or NRIS (cf. Table 2).
- \$252.124 million for additional Network Upgrades required for NRIS (cf. Table 3).

The total estimated cost of the transmission system improvements required for GI-2016-9 to qualify for:

- **ERIS is \$7.896 8 Million (Tables 1 and 2); and**
- **NRIS is \$260.02 Million (Tables 1, 2 and 3)**

This is contingent upon completion of the Network Upgrades identified for all applicable higher-queued Interconnection Requests (see footnotes to Table 2 and 3).

For GI-2016-9 interconnection:

NRIS (after required transmission system improvements) = 480 MW

ERIS (after required transmission system improvements) = 480 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.

³ **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-2016-9. 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-2016-9 to qualify for:

- **ERIS is \$7.896 Million (Tables 1 and 2); and**
- **NRIS is \$260.02. Million (Tables 1, 2 and 3)**

The following tables list the transmission system improvements required to accommodate the interconnection of GI-2016-9. 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 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"> • One 230kV gang switch with MOD • Three 230kV arresters • Three 230kV metering CTs • Three 230kV metering PTs • Station controls • Associated electrical equipment, bus, wiring and grounding • Associated foundations and structures • Associated transmission line communications, fiber, relaying and testing. 	\$1.052
	Transmission line tap into substation	\$0.055
	Siting and Land Rights support for siting studies, land and ROW acquisition and construction	\$0.020
	Total Cost Estimate for Transmission Provider's Interconnection Facilities	\$1.127
Time Frame	Site, design, procure and construct	18 Months

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

Element	Description	Cost Est. (Millions)
Xcel's San Luis Valley 230kV Bus	Interconnect Customer to tap at the San Luis Valley 230kV Bus. Additional network upgrades required for NRIS plus TPIF termination bus position requires upgrading to Breaker and a Half bus configuration. The new equipment includes: <ul style="list-style-type: none"> • Five 230kV breakers • Ten 230kV switches • Associated foundations and structures • Associated electrical equipment, bus, wiring and grounding • Associated transmission line communications, fiber, relaying and testing. 	\$5.991
Xcel's San Luis Valley 230kV Switchyard	Communications scope to add a new EEE	\$0.758
	Siting and Land Rights support for siting studies, land and ROW acquisition and construction	\$0.020
	Total Cost Estimate for Network Upgrades	\$6.769
Time Frame	Site, design, procure and construct	18 Months

*** Contingent on completion of the Network Upgrades for Interconnection identified for higher-queued Interconnection Requests at the San Luis Valley 230kV Bus (i.e. GI-2014-13). For details, refer to:**

- (1) proposed one-line diagram in Figure 1 in the Appendix; and**
- (2) Table 2 in the Facilities Study reports for GI-2014-13.**

Table 3: Additional Network Upgrades required for NRIS *

Element	Description	Cost Est. (Millions)
New San Luis Valley – Poncha 230kV Line	New 230kV Transmission Line between San Luis Valley Substation and WAPA's Poncha Substation	\$109.712
San Luis Valley's 230kV Bus	230kV line terminal addition at San Luis Valley to WAPA Poncha in a new breaker and a half position	\$2.669
Xcel's Midway 230kV Bus	New Line Termination at Xcel's 230kV Midway Bus	\$2.001
New Midway – Poncha 230kV Line	New 230kV Transmission Line between Xcel's Midway Substation and WAPA's Poncha Substation	\$137.742
	Total Cost Estimate for Network Upgrades	\$252.124
Time Frame	Site, design, procure and construct	60 Months

*** Contingent on completion of the additional Network Upgrades for NRIS identified for higher-queued Interconnection Request GI-2015-1.
For details, refer to Table 3 in the Facilities Study report for GI-2015-1.**

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 18 months after authorization to proceed has been obtained.
- A CPCN will not be required for the construction of Transmission Provider's Interconnection Facilities and Network Upgrades required for Interconnection.
- A CPCN will be required for the additional Network Upgrades for NRIS. The time to secure the CPCN is included in the 60 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 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-2016-9 Interconnection Facilities and Network Upgrades in San Luis Valley Substation

