



INTERCONNECTION FACILITIES STUDY REPORT

GENERATOR INTERCONNECTION REQUEST # GI-2017-5

**54.3 MW PV Solar Generating Facility
Interconnecting at
Hartsel Substation 230kV Bus**

**Xcel Energy – Public Service Company of Colorado (PSCo)
December 6, 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-2017-5 photovoltaic (PV) solar generation facility (GF) located in Park County, Colorado.

The Point of Interconnection (POI) requested for GI-2017-5 is the 230 kV bus within the Hartsel 230/115kV substation jointly-owned by PSCo and Intermountain Rural Electric Association (IREA). The Customer's GF will connect 54.3 MW of PV solar generation to the PSCo-owned Hartsel 230 kV bus via a Customer-owned 230 kV tie line. A total of nineteen (19) SunPower inverters rated 2.86 MW each will be connected to a 34.5kV collector system bus, which in turn will connect to the 230 kV tie-line via a 34.5/230kV Main Step-up Transformer (MST).

The original proposed Commercial Operation Date (COD¹) in the Interconnection Request was March 31, 2019. The Interconnection Customer and Transmission Provider have mutually agreed to a new COD of March 31, 2022 with a back feed date of September 30, 2021 (six months prior to the COD). The new COD allows for the estimated time-frame of 18 months required to site, engineer, procure and construct the transmission facilities (noted in Tables 1 and 2 of this report) 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-2017-5 interconnection station is shown in Figure 1 in the Appendix.

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.

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

The estimated costs of the recommended transmission system upgrades to interconnect the GI-2017-5 project include:

- \$1.127 million for Transmission Provider's Interconnection Facilities (cf. Table 1).
- \$1.413 million for Network Upgrades required for either ERIS or NRIS (cf. Table 2).
- \$0 million for additional Network Upgrades required for NRIS (cf. Table 3).

The total estimated cost of the transmission system improvements required for GI-2017-5 to qualify for:

- **ERIS is \$2.540 Million (Tables 1 and 2); and**
- **NRIS is \$2.540 Million (Tables 1, 2 and 3)**

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

For GI-2017-5 interconnection:

NRIS (after required transmission system improvements) = 54.3 MW

ERIS (after required transmission system improvements) = 54.3 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.

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

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-2017-5. 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-2017-5 to qualify for:

- ERIS is \$2.540 Million (Tables 1 and 2); and
- NRIS is \$2.540 Million (Tables 1, 2 and 3)

The following tables list the transmission system improvements required to accommodate the interconnection of GI-2017-5. 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 Hartsel 230kV Substation	Interconnect Customer to tap at the Hartsel 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 • Fiber Optic communications termination • 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 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)
PSCo's Hartsel 230kV Substation	Interconnect Customer to tap at the Hartsel 230kV Bus. The new equipment includes: <ul style="list-style-type: none"> • One 230kV breaker • Two 230kV disconnect switches • Station controls • Associated electrical equipment, bus, wiring and grounding • Associated foundations and structures • Associated transmission line communications, fiber, relaying and testing. 	\$1.393
	Siting and Land Rights support for siting and construction	\$0.020
	Total Cost Estimate for Network Upgrades for Interconnection	1.413
Time Frame	Site, design, procure and construct	18 Months

*** Not contingent on Network Upgrades required for any higher-queued Interconnection Request.**

Table 3: Additional Network Upgrades required for NRIS

Element	Description	Cost Est. (Millions)
N/A	N/A	\$0
	Total Cost Estimate for Network Upgrades for NRIS	\$0
Time Frame	Site, design, procure and construct	

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 with appropriate escalation and contingencies applied. AFUDC is not included.

- 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 not in PSCo's retail service territory. Therefore, costs for retail load metering are not included in these estimates.
- PSCo (or its Contractor) crews will perform all construction, wiring, and testing and commissioning for PSCo 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.
- 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 string optical ground wire (OPGW) cable into the substation as part of their 230 kV transmission line construction scope.
- Power Quality Metering (PQM) will be required on the Customer's 230 kV transmission line terminating into the POI.
- 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.

Appendix

Figure 1. GI-2017-5 Interconnection Facilities and Network Upgrades in Hartsel Substation

