



INTERCONNECTION FACILITIES STUDY REPORT

GENERATOR INTERCONNECTION REQUEST # GI-2016-4

300 MW Wind Generating Facility Interconnecting to the Rush Creek Gen Tie with Point of Interconnection at Missile Site 345kV Substation

Xcel Energy – Public Service Company of Colorado (PSCo)
August 31, 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-2016-4, 300 MW wind generation facility (GF) in Elbert, Lincoln and Kit Carson Counties in Colorado.

The Point of Interconnection (POI) requested for GI-2016-4 is the Missile Site 345kV substation. The Customer's GF will interconnect 300 MW of generation to the POI via the 83 mile Rush Creek Gen Tie – a 345kV transmission line between the Missile Site 345kV substation and the Rush Creek II collector station – being constructed for the planned Rush Creek Generating Facility. The GF will consist of one-hundred fifty (150) Vestas 2.0 MW wind turbines that will be connected to a 34.5/345kV Main Step-up Transformer (MST) which, in turn, will connect to a new 345kV Rush Creek II switching station located near the far end of the Rush Creek Gen Tie.

The originally proposed Commercial Operation Date (COD¹) was December 31, 2018 which is not feasible based on the site, design, procure and construct time-frames noted in Tables 1 and 2 of this report. On August 22, 2018 – subsequent to the Interconnection Facilities Study Report review meeting – the Interconnection Customer requested a new COD of December 1, 2020, which is acceptable to PSCo as the Transmission Provider.

The December 1, 2020, COD is deemed feasible since it allows for the 36 months estimated time 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.

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.

The conceptual one-line diagram for GI-2016-4 interconnection and the proposed one-line diagram for the new 345kV Rush Creek II switching station are shown in Figures 1 and 2 respectively in the Appendix.

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-2016-4 project include:

- \$17.496 million for Transmission Provider's Interconnection Facilities required for the Physical Interconnection of GI-2016-4 (cf. Table 1).
- \$0 million for additional Network Upgrades required for NRIS (cf. Table 2).

The total estimated cost of the transmission system improvements required for GI-2016-4 to qualify for:

- **ERIS is \$17.496 Million (Table 1); and**
- **NRIS is \$17.496 Million (Tables 1 and 2)**

This is contingent upon completion of the Network Upgrades identified for all applicable higher-queued Interconnection Requests (see footnotes to Table 1 and 2).

For GI-2016-4 interconnection:

NRIS (after required transmission system improvements) = 300 MW

ERIS (after required transmission system improvements) = 300 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-2016-4. The results of the engineering analysis for Interconnection Facilities required to interconnect GI-2016-4 to the Rush Creek Gen Tie (owned by PSCo as the existing Interconnection Customer) are estimates and are summarized in Table 1.

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.

Upgrades identified in Table 1 are conceptually 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 via the Rush Creek Gen Tie. The one-line diagram in Figure 2 identifies the electrical switching configuration of the equipment comprising the Transmission Provider’s Interconnection Facilities (i.e. the new 345kV Rush Creek II switching station), 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 2.

Table 2: “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-2016-4 to qualify for:

- ERIS is \$17.496 Million (Table 1); and
- NRIS is \$17.496 Million (Tables 1 and 2)

The following tables list the transmission system improvements required to accommodate the interconnection of GI-2016-4. The cost responsibilities associated with these transmission system improvements shall be handled as per current FERC guidelines.

Table 1: Transmission Provider’s Interconnection Facilities required for the Physical Interconnection of GI-2016-4 to the Existing PSCo Owned Interconnection Customer Interconnection Facilities, i.e. to the 345kV Rush Creek Gen-Tie (applicable for either ERIS or NRIS) *

Element	Description	Cost Est. (Millions)
PSCo's New Rush Creek II 345kV Station	Build three-position ring bus 345kV station by tapping the planned Missile Site – Pronghorn – Rush Creek II 345kV line (i.e. Rush Creek Gen Tie). Major new equipment includes: <ul style="list-style-type: none"> • Three (3) 345kV SF6 Circuit Breakers, • Eight (8) 345kV Disconnect Switches, • Two (2) 345kV Motor operated Disconnect Switches, • Six (6) 345kV CCVTs, • Six (6) 345kV Surge Arresters, • Four (4) 345kV Wave traps, • Two (2) Dead Ends, • One (1) Electrical Equipment Enclosure. Estimate includes transmission line work, new communications equipment according to Xcel Energy's standards, and remote end relay settings	\$16.272

PSCo's New Rush Creek II 345kV Station	Interconnection Customer to tap at the New Rush Creek II 345kV Station The new equipment includes: <ul style="list-style-type: none"> • One 345kV motor operated gang switch • Three 345kV arresters • One set (of three) high side metering current transformers • One set (of three) high side CCVTs • Fiber Optic & PLC communications termination • 345kV line relaying panel • Station controls • Associated electrical equipment, bus, wiring and grounding • Associated foundations and structures • Associated transmission line communications, fiber, relaying and testing. 	\$1.149
	Transmission line tap into station	\$0.055
	Siting and Land Rights support for siting studies, land and ROW acquisition and construction	\$0.020
	Total Cost Estimate for Interconnection Facilities	\$17.496
Time Frame	Site, design, procure and construct	36 Months

*** Contingent on completion of the Interconnection Customer Interconnection Facilities required for GI-2016-3 (i.e. the 85 mile Missile Site – Pronghorn – Rush Creek II 345kV line, aka Rush Creek Gen Tie) and the Transmission Provider Interconnection Facilities required for GI-2016-3. For details, refer to the one-line diagrams in Figures 1 and 2 in the Appendix, and Tables 1 and 2 in the Facilities Study reports for GI-2016-3.**

Table 2: Additional Network Upgrades required for NRIS *

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

*** Contingent on completion of the Network Upgrades for NRIS identified for higher-queued Interconnection Requests GI-2016-3 and GI-2015-1. For details, refer to Table 3 in the Facilities Study reports for GI-2016-3 and 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 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 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. The time to secure the CPCN is included in the 36 months estimated duration 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. Conceptual One-Line for GI-2016-4 Interconnection

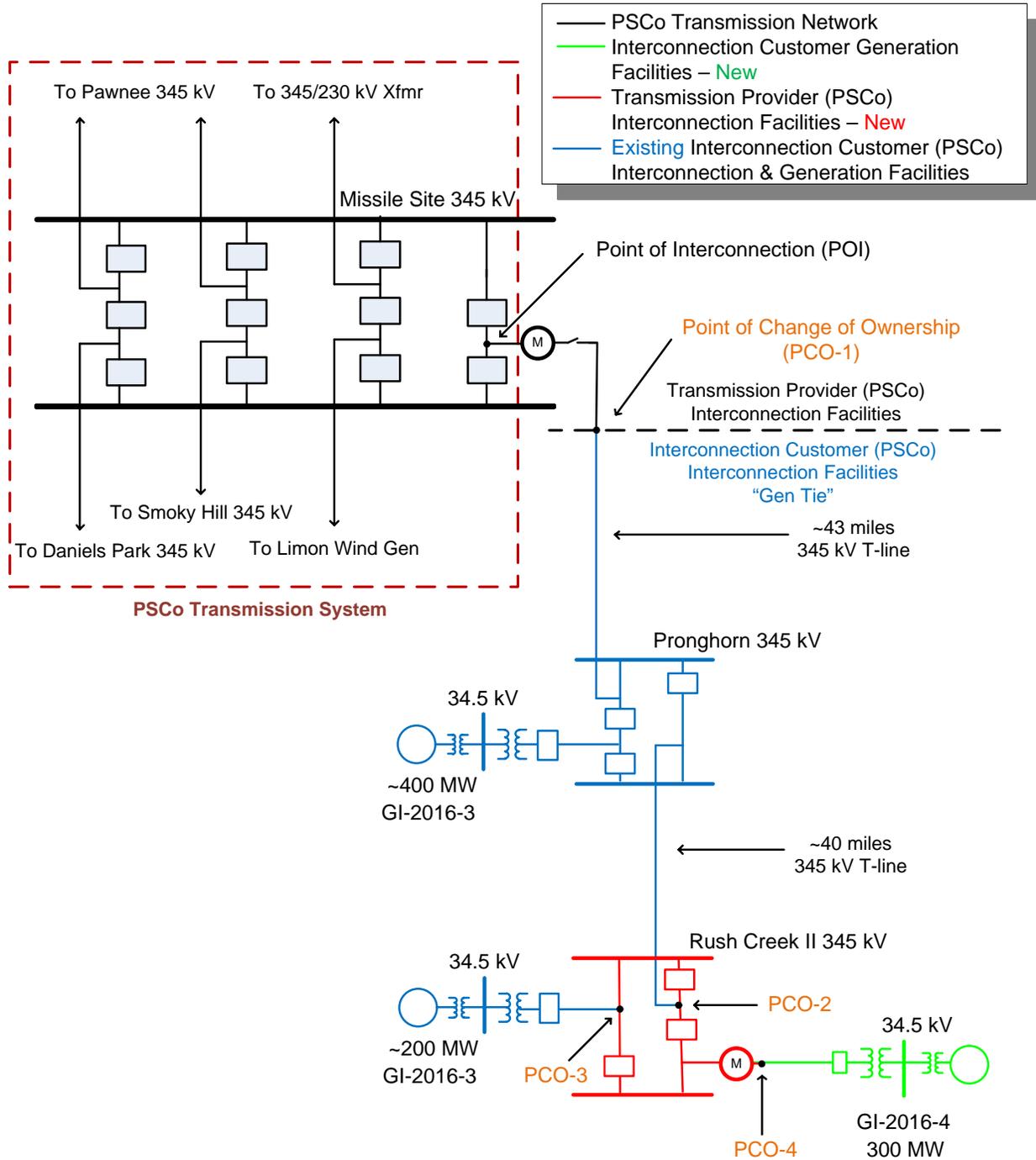


Figure 2. Interconnection Facilities required for GI-2016-4 Interconnection to the Rush Creek Gen-Tie (by tapping the Pronghorn – Rush Creek II line section)

