

2RSC-2020-05 Interconnection Facilities
Study Report
250MW Hybrid Generating Facility
Mirasol 230kV Station

12/14/2021



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1.0 Executive Summary

2RSC-2020-5 is a 250MW net rated Solar Photovoltaic plus Battery Energy Storage Hybrid Generating Facility requesting Energy Resource Interconnection Service (ERIS). The requested Point of Interconnection is Mirasol 230kV Station.

The total estimated cost of the transmission system improvements required for 2RSC-2020-5 to achieve ERIS is \$3.573 Million (Tables 1 and 2).

The output of the hybrid Generating Facility will be limited to 250MW at the Point of Interconnection using the power plant controller. Additional monitoring and control requirements may be added to the LGIA to ensure the Interconnection Service amount is not exceeded. The Generating Facility output will also be monitored by PSCo operations.

A CPCN is needed for the construction of the Mirasol 230kV Station, as described in the 2020 Spring DISIS (DISIS-2020-001). The estimated time frame for regulatory activities (CPCN) and to site, design, procure and construct the interconnection facilities is approximately 36 months after authorization to proceed has been obtained. Any delays in obtaining the CPCN may delay the COD of 2RSC-2020-5.

2.0 Introduction

The 2RSC-2020-5 is a 250MW net rated Solar Photovoltaic (PV) plus Battery Energy Storage (BES) Hybrid Generating Facility that will be located in Pueblo County, Colorado. The hybrid Generating Facility will consist of two distinct facility groups – 200MW Solar PV facility and 100MW BES facility. The 200MW Solar PV facility will consist of ninety-seven (97) GE LV5 2.3MVA, ± 0.90 PF inverters, each with its own 600V/34.5kV, 2.3MVA, Z=6.3% and X/R=7.5 pad-mount step-up transformer. The 100MW BES facility will consist of fifty-seven (57) Parker 890-GTB2200 2.2MVA, ± 0.95 PF inverters, each with its own 480V/34.5kV, 2.2MVA, Z=5.75% and X/R=7.5 pad-mount step-up transformer. The 34.5kV collector system of the PV and BES generators will connect to two (2) 34.5/13.8/230kV, 102/138/170MVA, Z=8.5%, X/R=40 wye-gnd/delta/wye-gnd main step-up transformer which in turn will connect to the Mirasol 230kV Station via a 0.1mile generation tie-line. The Mirasol 230kV Station is a new switching station identified in the higher-queued DISIS-2020-001.

The net output of 2RSC-2020-5 will not exceed 250MW at any time, which will be limited using the Plant Power Controller, and the PV and BES generators will be operated in back-feed voltage control mode.

The expected operating modes of 2RSC-2020-5 are:

- i. Generation mode - 250MW rated generation output at the POI via combination of PV and BES generators.
- ii. Grid Charging mode - 50MW for a maximum of 4 hours when the PV output is 0MW. The BES facility will not charge from the grid during the first five (5) years and three (3) months of the COD, but it may charge from the grid after that period.

The proposed Commercial Operation Date (COD) of 2RSC-2020-5 is September 30, 2022. Accordingly, based on the standard interconnection practices, the back-feed date is assumed to be April 1, 2022, approximately six (6) months before the COD.

The Phase 2 report of 2RSC-2020 Definitive Interconnection System Impact Study cluster (RSC) is posted at https://www.rmao.com/public/wtpp/Final_Studies/2RSC-2020%20Phase%20%20Study%20Report%20_07_9_2021_final.pdf

The request was studied for Energy Resource Interconnection Service (ERIS)¹.

3.0 Study Scope

The scope of the Interconnection Facilities Study which is Phase 4 of the Definitive Interconnection Study process includes standalone non-binding cost estimates and construction schedule of the Interconnection Facilities and Network Upgrades identified for 2RSC-2020-5 in the Phase 2 report.

4.0 Cost Estimates and Assumptions

The cost estimates are in 2021 dollars with escalation and contingencies applied. Allowances for Funds Used During Construction (AFUDC) is not included. The estimated costs include all

¹ 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. Energy Resource Interconnection Service in and of itself does not convey transmission service

applicable labor and overheads associated with the siting, engineering, design, and construction of these new PSCo facilities. The estimates do not include the cost for any Customer owned equipment and associated design and engineering.

Figure 1 below is a conceptual one-line of the 2RSC-2020-5 POI at the Mirasol 230kV Station.

Tables 1 and 2 list the improvements required to accommodate the interconnection and the delivery of the customer's 250MW Hybrid Generating Facility output. The cost responsibilities associated with these facilities shall be handled per current FERC guidelines.

System improvements are subject to revision as a more detailed and refined design is produced.

The total cost of the required transmission improvement required for 2RSC-2020-5 to interconnect at Mirasol 230kV Station for ERIS of 250MW is \$3.573 Million.

- The cost of Transmission Provider's Interconnection Facilities is \$1.416 Million (Table 1)
- The cost of Station Network Upgrades for interconnection is \$2.157 Million (Table 2)

Table 1 – 2RSC-2020-5 Transmission Provider's Interconnection Facilities

Element	Description	Cost Est. (Millions)
PSCo's Mirasol 230kV Station	Interconnect Customer to tap the Mirasol Station 230kV bus. The new equipment includes: <ul style="list-style-type: none"> • Three (3) 230kV deadend structures • Three (3) 230kV arresters • One (1) 230kV 3000A Switch • One set (of three) high side metering units • Fiber communication equipment • Station controls • Associated electrical equipment, bus, wiring and grounding • Associated foundations and structures • Associated transmission line communications, fiber, relaying and testing. 	\$1.341
	Transmission line tap into station.	\$0.055
	Siting and Land Rights support for permitting and construction.	\$0.020
	Total Cost Estimate for Transmission Providers Interconnection Facilities	\$1.416
Time Frame	Site, design, procure and construct	18 Months

Table 2– Station Network Upgrades for Interconnection

Element	Description	Cost Est. (Millions)
Mirasol 230kV Station	2RSC-2020-5 Interconnection to the Mirasol 230kV Station. The new equipment includes: • Two (2) 230kV, 3000A Circuit Breakers • Five (5) 230kV 3000A Switches • One (1) 230kV Deadend Structure • Station controls and wiring • Associated electrical equipment, bus, wiring and grounding • Associated foundations and structures	\$2.137
	Siting and Land Rights support for station site acquisition, permitting, and construction	\$0.020
	Total Cost Estimate for Network Upgrades for Interconnection	\$2.157
Time Frame	Site, design, procure and construct	18 Months

- Labor is estimated for straight time only – no overtime included.
- Lead times for materials were considered for the schedule.
- The Generating Facility is not in PSCo’s retail service territory. Therefore, no costs for retail load metering are included in these estimates.
- PSCo (or it’s Contractor) crews will perform all construction, wiring, testing and commissioning for PSCo owned and maintained facilities.
- PSCo anticipates that a CPCN will not be required for the interconnection facilities construction. The estimated time to permit, design, procure and construct the interconnection facilities is approximately 18 months after authorization to proceed has been obtained.
- Customer will install two (2) redundant fiber optics circuits into the Transmission provider’s station
- Power Quality Metering (PQM) will be required on the Customer’s 230kV line terminating into the PSCo / Xcel Station.
- The Customer will be required to design, procure, install, own, operate and maintain a Load Frequency/Automated Generation Control (LF/AGC) RTU at their Customer Station. PSCo / Xcel will need indications, readings and data from the LFAGC RTU.

- Breaker duty study determined that no breaker replacements are needed in neighboring stations.

5.0 Conclusion

The total estimated cost of the transmission system improvements required for 2RSC-2020-5 to achieve ERIS is \$3.573 Million (Tables 1 and 2).

6.0 Contingent Facilities

The following is the list of the unbuilt Interconnection Facilities and Network Upgrades upon which the costs, timing, and study findings of 2RSC-2020-5 is dependent, and if delayed or not built, could cause a need for re-studies of the Interconnection Request or a reassessment of the Interconnection Facilities and/or Network Upgrades and/or costs and timing.

The contingent facilities identified for 2RSC-2020-5 are as follows:

1. The following unbuilt transmission projects/ planned facility rating uprates modeled in the Base case:
 - Mirasol 230kV Switching Station – ISD 2022
 - Tundra Switching Station 345kV – ISD 2022
 - Monument – Flying Horse 115kV Series Reactor – ISD 2024
 - Greenwood – Arapahoe - Denver Terminal 230kV line - ISD 2022
 - Upgrade Allison – Soda Lakes 115kV line to 318MVA - ISD 2022
 - Upgrade Buckley34 – Smoky Hill 230kV line to 506MVA - ISD 2021
 - Upgrade Daniels Park – Priarie1 230kV line to 576MVA - ISD 2023
 - Upgrade Greenwood – Priarie1 230kV line to 576MVA - ISD 2023
 - Upgrade Daniels Park – Priarie3 230kV line to 576MVA - ISD 2023
 - Upgrade Greenwood – Priarie3 230kV line to 576MVA - ISD 2023
 - Upgrade Waterton – Martin2 tap 115kV line to 189MVA - ISD 2021
 - Upgrade Daniels Park 345/230kV # T4 to 560MVA - ISD 2021
 - Upgrade Leetsdale – Monaco 230kV line to 560MVA - ISD 2020
 - Upgrade Greenwood – Monaco 230kV line to 560MVA - ISD 2020
 - Upgrade Waterton – Martin1 tap 115kV line to 189MVA - ISD 2021

- Fuller 230/115kV, 100MVA #2 transformer – ISD 2023
 - Briargate S 115/230kV transformer with the high end tapping the Cottonwood – Fuller 230kV line – ISD 2023
2. Interconnection Facilities and Station Network Upgrades assigned to 2RSC-2020-5
(See Table 1 and 2)

Figure 1 – Preliminary One-line of the 2RSC-2020-5 POI at the Mirasol 230kV Station

