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Interconnection Facilities Study Report

Replacement Generation Request # REPL-2021-1

2/28/2023

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1.0 Summary

This Interconnection Facilities Study Report for Replacement Generation Request REPL-2021-1, Comanche Unit 1 replacement, summarizes the analysis performed by Public Service Company of Colorado (PSCo) to specify and estimate the cost of the permitting, engineering, equipment procurement and construction needed to physically and electrically connect the REPL-2021-1 Generating Facility, that will be located in Pueblo County, Colorado, to the PSCo Transmission System. REPL-2021-1 is a 325 MW_{ac} net rated solar photovoltaic (PV) Generating Facility to replace the coal fired Comanche Power Plant Unit 1, 325 MW net generation.

The Point of Interconnection (POI) for REPL-2021-1 is the 230 kV bus within the PSCo-owned Comanche Substation. The 325 MW_{ac} net rated electrical output of the REPL-2021-1 solar PV Generating Facility will be delivered to the Comanche Substation 230 kV bus via a new Customer-owned approximately 6.5-mile 230 kV "gen-tie" line. A total of eighty-four (84) solar PV generator units rated 4.2 MW each will be connected to a 34.5 kV collector system bus, which in turn will connect to the 230 kV "gen-tie" via two 34.5/230kV main step-up transformers.

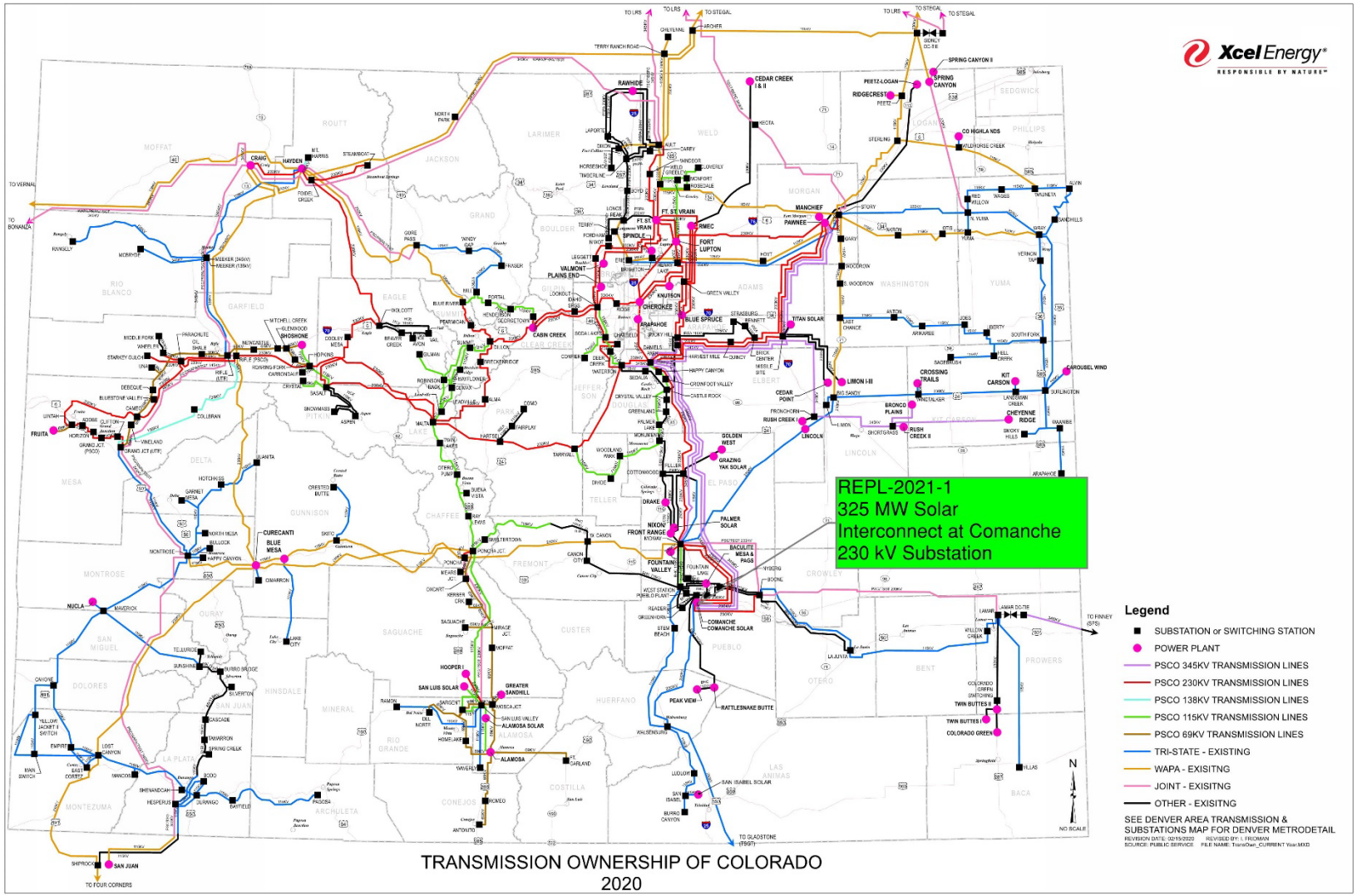
The total estimated cost of the transmission system improvements for REPL-2021-1: $5.060 million.

2.0 Introduction

PSCo has completed the Replacement Generation Interconnection Facilities Study for REPL-2021-1 and the results are provided through this Interconnection Facilities Study Report. This Interconnection Facilities Study Report provides the information specific to REPL-2021-1 to connect the Generating Facility physically and electrically to the transmission system and contains the results of the non-binding cost estimates, the electrical switching configuration of the connection equipment, and an estimate of the time required to complete the construction and installation to implement the conclusions of the *Xcel Energy Services, Inc. Public Service Company of Colorado Comanche Unit 1 (Repl-2021-1) Replacement and Reliability Study* dated 6/28/2022.

REPL-2021-1 is a 325 MW_{ac} net rated AC-coupled solar Generating Facility located in Pueblo County, Colorado. The Generating Facility is composed of a 325 MW_{ac} solar PV Generating Facility with the net output at the POI limited to 325 MW. The solar PV Generating Facility will consist of eighty-four (84) 4.2 MVA inverters and each inverter will utilize the built-in 0.66/34.5 kV, Wye/Delta Z_1=8.9%, Z_0=8.01%, X/R=12.4 pad-mount transformer to interface with the 34.5 kV collector system. The 34.5 kV collector system of the PV units will connect to two (2) 108/144/180 MVA, 34.5/230 kV Wye-grounded/Wye-grounded/Delta, Z_1=9.5%, Z_0=8.55%, X/R=68.4 main step-up transformers, which will connect to PSCo's Comanche Substation 230 kV bus via an approximately 6.5-mile "gen-tie". The Generating Facility configuration also includes four (4) 15 Mvar capacitor banks for a total of 60 Mvar installed on the 34.5 kV collector system. The approximate location of the REPL-2021-1 Generating Facility and POI is shown on Figure 1.

Figure 1 – Approximate Location of REPL-2021-1



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3.0 Description of Upgrades and Cost Estimates

This section provides information for the physical and electrical interconnection of the customer's Generating Facility to the Transmission System and contains the results of the non-binding cost estimates and the electrical switching configuration of the connection equipment. Figure 2 provides a one-line diagram showing the REPL-2021-1 interconnection at the Comanche Substation 230 kV bus.

3.1 Transmission Provider Interconnection Facilities

Transmission Provider's Interconnection Facilities are all facilities and equipment owned, controlled, or operated by the Transmission Provider from the Point of Change of Ownership (PCO) to the POI, including any modifications, additions or upgrades to such facilities and equipment. Transmission Provider's Interconnection Facilities are sole use facilities (e.g., for generator interconnection) and shall not include Distribution Upgrades, Stand Alone Network Upgrades or Network Upgrades. Costs of Transmission Provider Interconnection Facilities are directly assigned to the Interconnection Customer using such facilities.

The facilities and estimated costs for the Transmission Provider Interconnection Facilities required for REPL-2021-1 to interconnect at the Comanche Substation 230 kV bus are included in Table 1.

Table 1 – REPL-2021-1 Transmission Provider's Interconnection Facilities

Element	Description	Cost Est. (million)
PSCo's Comanche 230 kV Substation	Interconnection of REPL-2021-1 at the Comanche Substation 230 kV bus. The new equipment includes: • One (1) 230 kV transition structure underground to above ground • One (1) 230 kV deadend structure • One (1) 230kV, 900kV BIL, 3000A rated, VEE double end break line disconnect switch • Three (3) 245kV, 1050kV BIL, Potential Transformers • Three (3) 245kV, 1050kV BIL, Current Transformers • Three (3) 230kV, 152kV MCOV, lightning arresters (LA's) mounted on the new transition structure • Fiber communication equipment • Station controls • Associated electrical equipment, bus, wiring and grounding • Associated foundations and structures • Associated transmission line communications, fiber, relaying and testing.	$1.755
Total Cost Estimate for Interconnection Customer-Funded, PSCo-Owned Interconnection Facilities		**$1.755**

3.2 Network Upgrades

Network Upgrades include the additions, modifications, and upgrades to the Transmission Provider's Transmission System required at or beyond the point at which the Transmission Provider's Interconnection Facilities connect to the Transmission Provider's Transmission System to accommodate the interconnection of the Replacement Generation Facility to the Transmission Provider's Transmission System. The Network Upgrades include both Station Network Upgrades and System Network Upgrades.

3.2.1 Station Network Upgrades

The estimated total cost and details of the Station Network Upgrades required at the Comanche Substation 230 kV bus are shown in Table 2. Figure 2 provides the preliminary one-line diagram of the Comanche Substation 230 kV bus showing the POI of REPL-2021-1. Figure 3 provides the location of the POI relative to the customer's development location. Figure 4 provides a

preliminary General Arrangement for the Station Network Upgrades at the Comanche Substation for the REPL-2021-1 interconnection.

Table 2 – Station Network Upgrades –
REPL-2021-1 at the Comanche Substation 230 kV bus

Element	Description	Cost Est. (million)
PSCo's Comanche 230 kV Substation	Interconnection of REPL-2021-1 at the Comanche Substation 230 kV bus. The new equipment includes: • New 27' x 55' EEE • AC Auxiliary System - New AC Panels will be installed in the new EEE • DC Auxiliary System - New DC Panels will be installed in the new EEE • Grounding - All equipment will be connected to the ground grid per IEEE Std 80-2013 and present Xcel Energy standards • Lightning Protection - All new substation equipment will be completely protected from direct stroke lightning per Xcel Energy standards • Station controls and wiring • Associated foundations and structures • Permitting	$2.733
PSCo's Comanche 230 kV Substation	Install required communication in the EEE	$0.572
Total Cost Estimate for PSCo-Funded, PSCo-Owned Interconnection Facilities		**$3.305**

3.2.2 System Network Upgrades

No System Network Upgrades were identified in the *Xcel Energy Services, Inc. Public Service Company of Colorado Comanche Unit 1 (Repl-2021-1) Replacement and Reliability Study* dated 6/28/2022 for REPL-2021-1.

3.3 Cost Estimate Assumptions

The cost estimates provided in this Interconnection Facilities Study Report are based on the following assumptions:

- The cost estimates are in 2023 dollars with an escalation percentage and contingencies applied to the cost estimates.

- The cost estimates do not include an Allowance for Funds Used During Construction (AFUDC).
- The estimated costs include all applicable labor and overheads associated with the siting, engineering, design, and construction of the PSCo facilities to facilitate interconnection.
- No land acquisition or land use permitting required, all work within the existing Comanche Substation.
- The estimated costs do not include the cost for any Customer owned equipment and associated design and engineering.
- Labor is estimated at straight time only, no overtime work is included.
- No costs for retail load metering are included in these estimates.
- PSCo (or its Contractor) will perform all construction, wiring, testing and commissioning for PSCo owned and maintained facilities.
- A Certificate of Public Convenience and Necessity (CPCN) may be required for the construction of the Interconnection Facilities and Station Network Upgrades. The expected time to obtain a CPCN approval is 18 months, if required.
- Customer will install two (2) redundant fiber optic circuits into the Transmission Provider's substation as part of its interconnection facilities construction scope.
- Power Quality Metering (PQM) will be required on the Customer's generation tie-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 their Customer substation. PSCo will be provided with indications, readings and data from the LF/AGC RTU.
- The Interconnection Customer will comply with the Interconnection Guidelines for Transmission Interconnected Producer-Owned Generation Greater Than 20 MW, as amended from time to time, and available at: https://www.transmission.xcelenergy.com/staticfiles/microsites/Transmission/Files/PDF/Interconnection/Interconnections-POL-TransmissionInterconnectionGuidelineGreat20MW.pdf

Figure 2 – Preliminary One-line for REPL-2021-1 Interconnection at Comanche 230 kV Substation

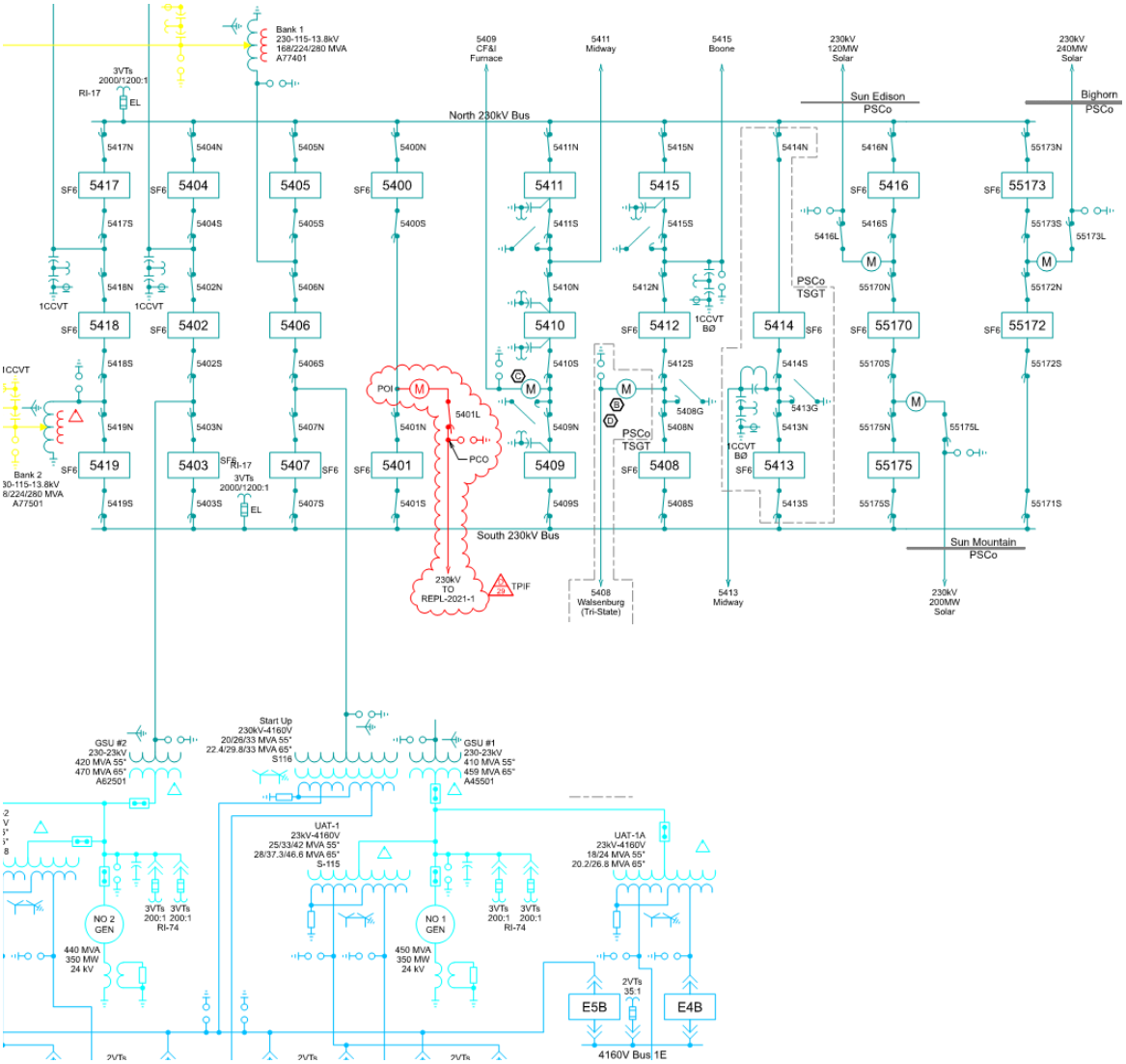


Figure 3 – Preliminary REPL-2021-1 Rocky Mountain Solar Development Location and POI

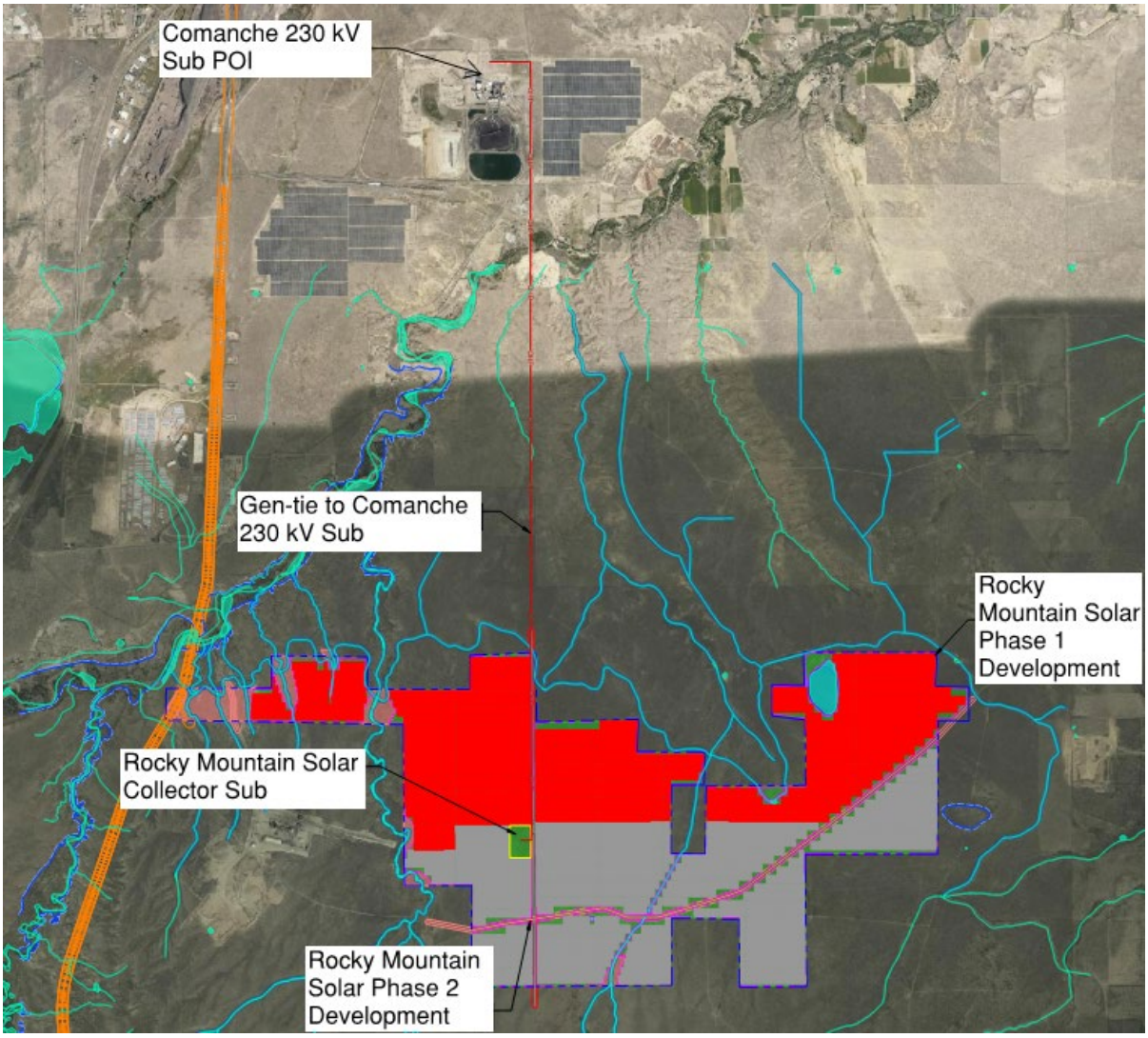
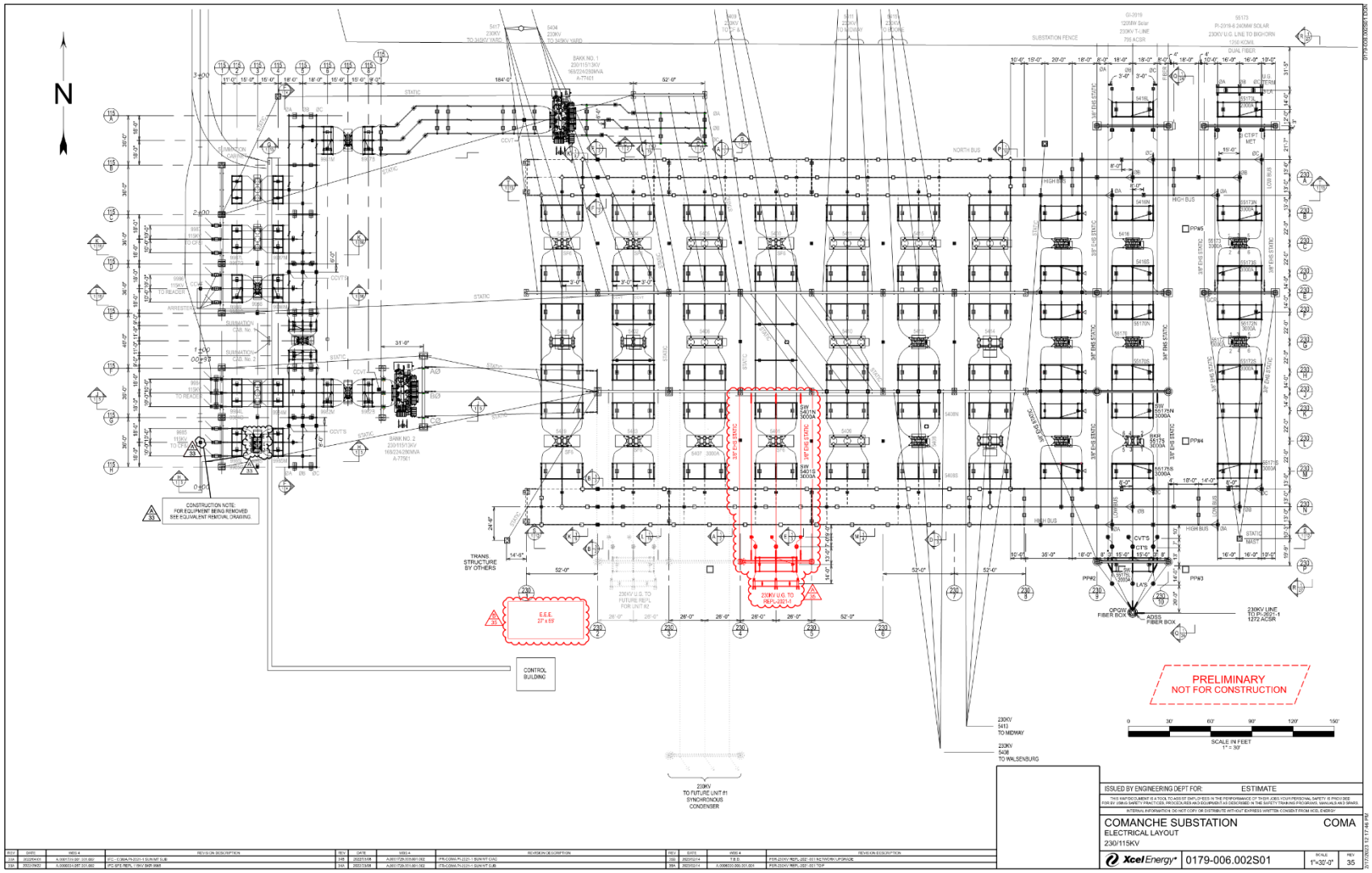


Figure 4 – Preliminary General Arrangement for REPL-2021-1 Interconnection at Comanche 230 kV Substation



4.0 Schedule

This section provides proposed milestones for the interconnection of REPL-2021-1 to the Transmission Provider's Transmission System. The customer requested a Commercial Operation Date for the Replacement Generating Facility of February 2025, this is not attainable by the Transmission Provider, based upon the current schedule developed for this interconnection request. The Transmission Provider proposes the milestones provided below:

Milestone	Responsible Party	Estimated Completion Date
LGIA Execution	Interconnection Customer and Transmission Provider	March 2023
In-Service Date for Transmission Provider Interconnection Facilities and Network Upgrades required for interconnection	Transmission Provider	May 31, 2025
In-Service Date & Energization of Interconnection Customer's Interconnection Facilities	Interconnection Customer	May 31, 2025
Initial Synchronization Date	Interconnection Customer	July 1, 2025
Begin trial operation & testing	Interconnection Customer and Transmission Provider	July 1, 2025
Commercial Operation Date	Interconnection Customer	July 31, 2025

Some schedule elements are outside of the Transmission Provider's control and could impact the overall schedule. The following schedule assumptions provide the basis for the schedule milestones:

- Construction permitting (if required) for new facilities will be completed within 12 months of LGIA execution.
- The Transmission Provider is currently experiencing continued increases to material lead times which could impact the schedule milestones. The schedule milestones are based upon material lead times known at this time.
- Availability of line outages to interconnect new facilities to the transmission system.

5.0 Contingent Facilities

The only Contingent Facilities identified for REPL-2021-1 include the Interconnection Facilities and Station Network Upgrades for REPL-2021-1 identified in Table 1 and Table 2, respectively.