

DRAFT

**Interconnection Facilities Study Report
Generation Interconnection Request # GI-2021-6**

12/13/2022



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1.0 Summary

This report provides the Facilities Study Report for Generation Interconnection Request (GIR) GI-2021-6.

GI-2021-6 is a 199 MWac net rated solar photovoltaic (PV) plus battery energy storage system (BESS) hybrid Generating Facility requesting Network Resource Interconnection Service (NRIS). The requested Point of Interconnection (POI) is a tap on the Green Valley – Sky Ranch 230 kV line, at approximately 2.16 miles from the Sky Ranch Substation.

The total estimated cost of the transmission system improvements for GI-2021-6: \$29.961 million.

NRIS of GI-2021-6 is: 199 MW (after required transmission system improvements identified in Tables 1 and 2 for the Transmission Provider Interconnection Facilities and Station Network Upgrades.

The Generation Interconnection Service identified in this report in and of itself does not convey transmission service.



2.0 Introduction

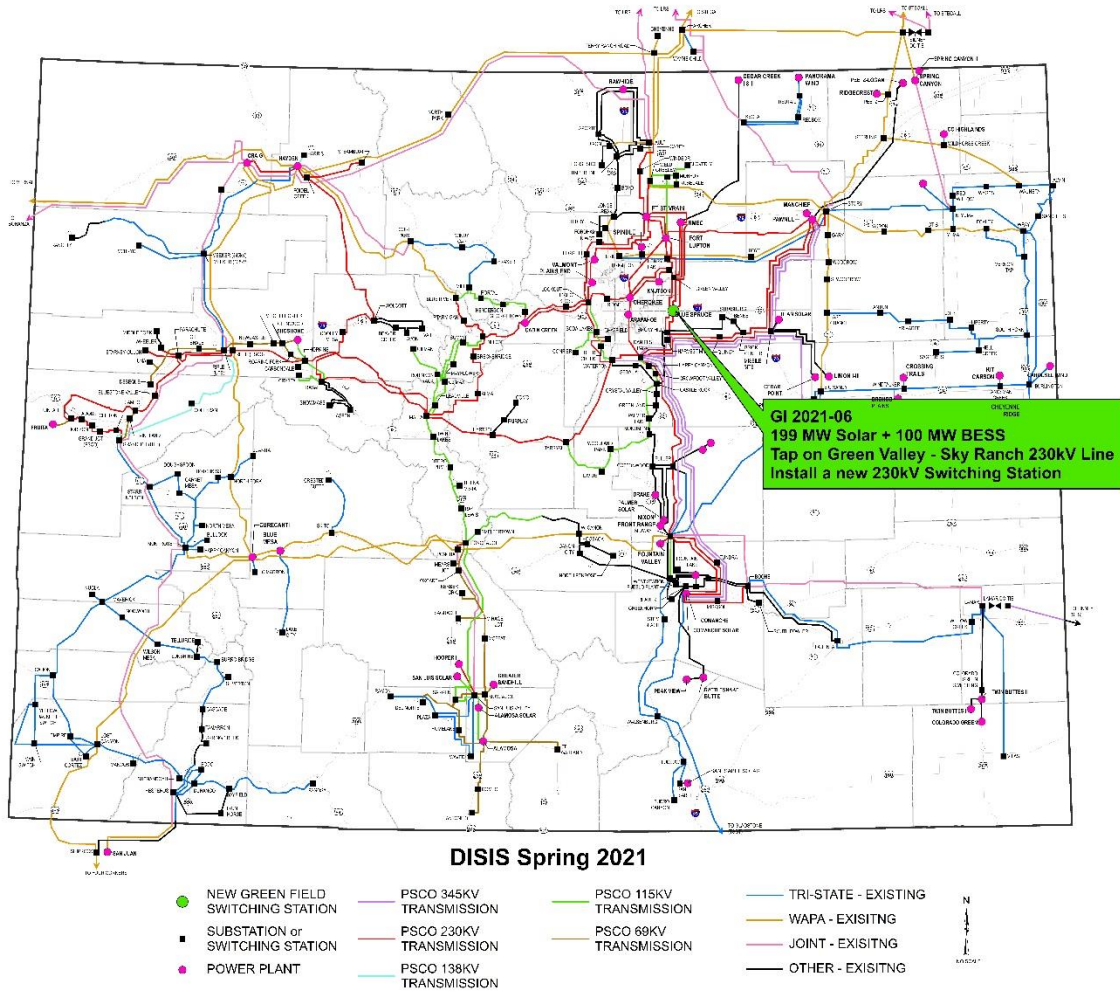
PSCo has completed the Interconnection Facilities Study for GI-2021-6, part of the Definitive Interconnection System Impact Study (DISIS) Cluster 3DISIS-2021-001. The results of the Interconnection Facilities Study for GI-2021-6 are provided through this Interconnection Facilities Study Phase 4 Report. This Facilities Study Report provides the information specific to GI-2021-6 to connect the Interconnection Facilities 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 *3DISIS-2021-001 Phase 2 Study Report (Rev. 1)* dated 8/25/2022.

GI-2021-6 is a 199 MW_{ac} net rated AC-coupled Hybrid Generating Facility located in Adams County, Colorado. The Hybrid facility is composed of a 207.8 MW_{ac} Solar PV Generating Facility and a 100 MW_{ac}, 4-hour BESS Generating Facility, with the net output at the POI limited to 199 MW. The solar PV Generation Facility will consist of fifty-four (54) Power Electronics FS4200M inverters and the BESS Generating Facility will consist of twenty-eight (28) Power Electronics FP4200M inverters; each inverter will utilize the built-in 0.60/34.5 kV, 4.20 MVA Wye/Delta Z=6.5%, X/R=8 pad-mount transformer to interface with the 34.5 kV collector system. The 34.5 kV collector system of the PV and BESS units will connect to one (1) 150/188/250 MVA, 34.5/230 kV Wye-grounded/Wye-grounded/Delta, Z=9.5%, X/R=70 main step-up transformer, which will connect to PSCo's Green Valley—Sky Ranch 230 kV line, at approximately 2.16 miles from the Sky Ranch Substation. The tap point at the POI will require a new switching station which is referred to as "GI-2021-6 230 kV Switching Station" in this report. The Generating Facility configuration also includes a 31 Mvar capacitor bank installed on the 34.5 kV collector system.

Per the Interconnection Request, the NRIS output of GI-2021-6 will be serving PSCo native load.

The BESS facility has a maximum state of charge of 100% and minimum state of charge of 4%.

Figure 1 – Approximate Location of GI-2021-6 Generation Interconnection Request POI





3.0 Description of Upgrades and Cost Estimates

This section provides information for the physical and electrical interconnection of the customer's generating facilities 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 new GI-2021-6 230 kV Switching Station tapping the Green Valley – Sky Ranch 230 kV line.

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 to the Point of Interconnection, 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's Interconnection Facilities are directly assigned to the Interconnection Customer(s) using such facilities.

The facilities and estimated costs for the Transmission Provider's Interconnection Facilities required for GI-2021-6 to interconnect at a tap on PSCo's Green Valley – Sky Ranch 230 kV line are included in Table 1.

Table 1 – GI-2021-6 Transmission Provider’s Interconnection Facilities

Element	Description	Cost Est. (million)
PSCo’s GI-2021-6 230 kV Switching Station	Interconnection GI-2021-6 at the GI-2021-6 230kV Switching Station. The new equipment includes: <ul style="list-style-type: none"> • 230 kV deadend structure • 230 kV surge arresters • 230 kV 3000 A disconnect switch • CT/PTs • Fiber communication equipment • Station controls • Associated electrical equipment, bus, wiring and grounding • Associated foundations and structures • Associated transmission line communications, fiber, relaying and testing. 	\$1.175
Total Cost Estimate for Interconnection Customer-Funded, PSCo-Owned Interconnection Facilities		\$1.175

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 Large Generating 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 Station Network Upgrade costs, including all switching stations, are allocated on a per-capita basis (i.e., on a per Interconnection Request basis) in accordance with Section 4.2.4.a of Attachment N Revised LGIP. All Station Network Upgrade Costs associated with the new GI-2021-6 230 kV Switching Station are allocated to GI-2021-6.

The estimated total cost and details of the Station Network Upgrades required at the GI-2021-6 230 kV Switching Station tapping the Green Valley – Sky Ranch 230 kV line are shown in Table 2. These Station Network Upgrade costs are 100% assigned to GI-2021-6 in accordance with Section 4.2.4.a. of Attachment N Revised LGIP. Figure 2 provides the preliminary one-line



diagram of the GI-2021-6 230 kV Switching Station showing the POI of GI-2021-6. Figure 3 provides a preliminary location of the POI relative to the customer's parcel location. Figure 4 provides a preliminary General Arrangement for the new GI-2021-6 Switching Station.

Table 2 – Station Network Upgrades – GI-2021-6 230 kV Switching Station

Element	Description	Cost Est. (million)
PSCo's GI-2021-6 230 kV Switching Station	Install new GI-2021-6 230kV Switching Station tapping the Green Valley - Sky Ranch 230kV line. The new equipment includes: <ul style="list-style-type: none"> • (3) 230 kV deadend structures • (3) 230 kV 3000 A circuit breaker • (8) 230 kV 3000 A disconnect switches • (6) 230 kV CCVTs • (2) 230 kV SSVTs • (6) 230 kV Surge Arresters • Electrical Equipment Enclosure • wave traps • Site grading and fencing • Station controls and wiring • Associated foundations and structures • Station permitting 	\$18.996
PSCo's GI-2021-6 230 kV Switching Station	Install required communication in the EEE at the GI-2021-6 230 kV Switching Station	\$0.945
PSCo's Sky Ranch 230 kV Substation	Remote end upgrade for 5275 line at Sky Ranch 230 kV Substation	\$1.409
PSCo's Green Valley 230 kV Substation	Remote end upgrade for 5275 line at Green Valley 230 kV Substation	\$1.437
Green Valley - Sky Ranch 230 kV Line (5775)	Line tap East side of new 230 kV Switching Station	\$1.036
Green Valley - Sky Ranch 230 kV Line (5775)	Line tap West side of new 230 kV Switching Station	\$1.001
Sky Ranch - IMBODEN 230 kV Line (5277)	Relocate Line 5277 to accommodate Line tap of 5275 into new 230 kV Switching Station	\$0.882
PSCo's GI-2021-6 230 kV Switching Station	Siting & Land Rights land acquisition	\$3.080
Total Cost Estimate for PSCo-Funded, PSCo-Owned Interconnection Facilities		\$28.786

3.2.2 System Network Upgrades

All Network Upgrades other than those identified as Station Network Upgrades will be allocated based on the proportional impact of each individual Generating Facility in the Cluster Studies on such Network Upgrades. The System Network Upgrade costs are allocated based on the proportional impact of each individual Generation Facility in the Cluster Study in accordance with Section 4.2.4.b of Attachment N Revised LGIP.

No System Network Upgrades were identified in the 3DISIS-2021-001 Phase 2 Study Report (Rev. 1) dated 08/25/2022 for GI-2021-6.

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 2022 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.
- Land for new switching station can be acquired at fair market value.
- 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.
- 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 of the GI-2021-6 230 kV Switching Station showing GI-2021-6 POI

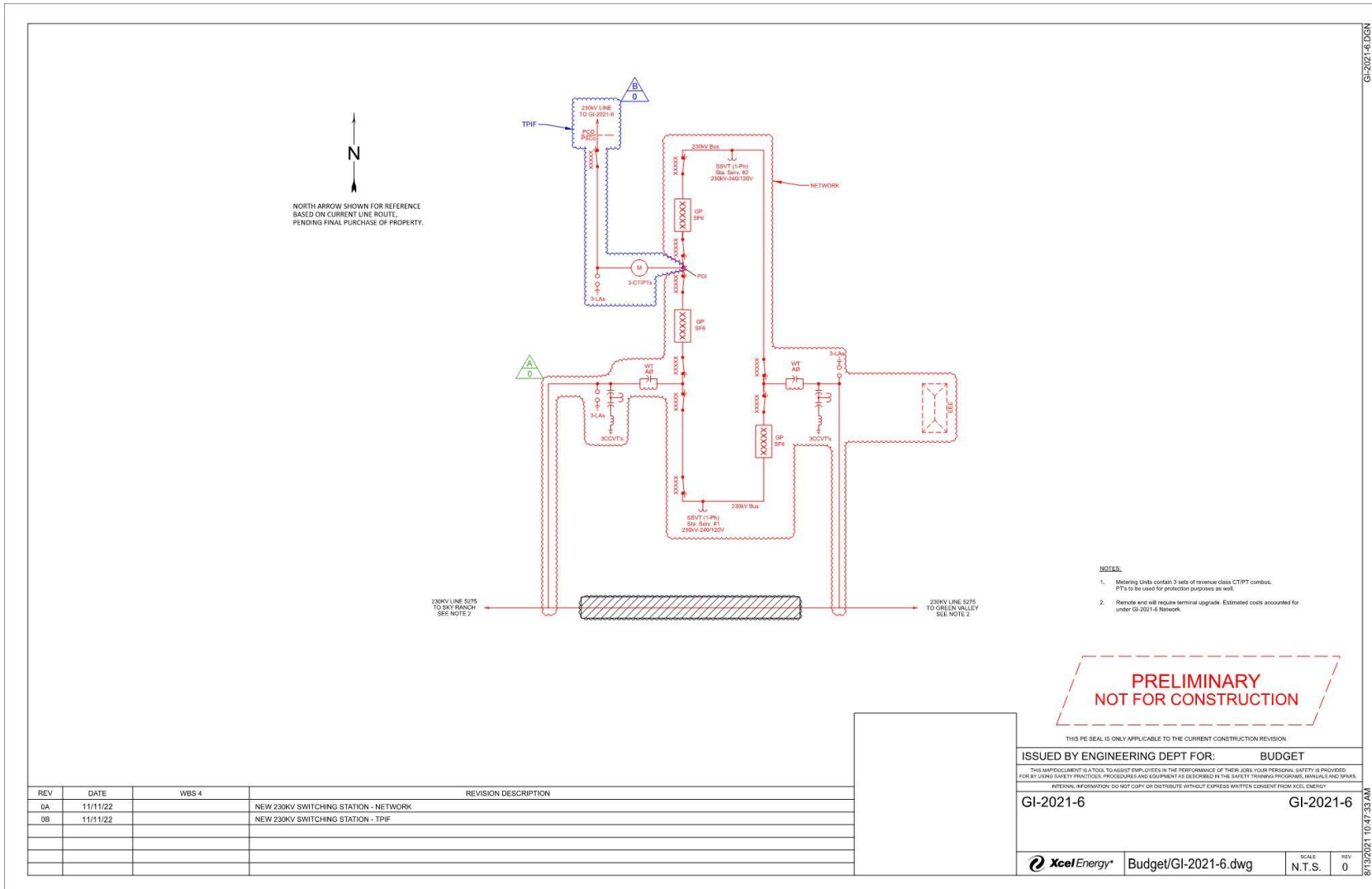


Figure 3 – Preliminary GI-2021-6 Parcel Location and POI

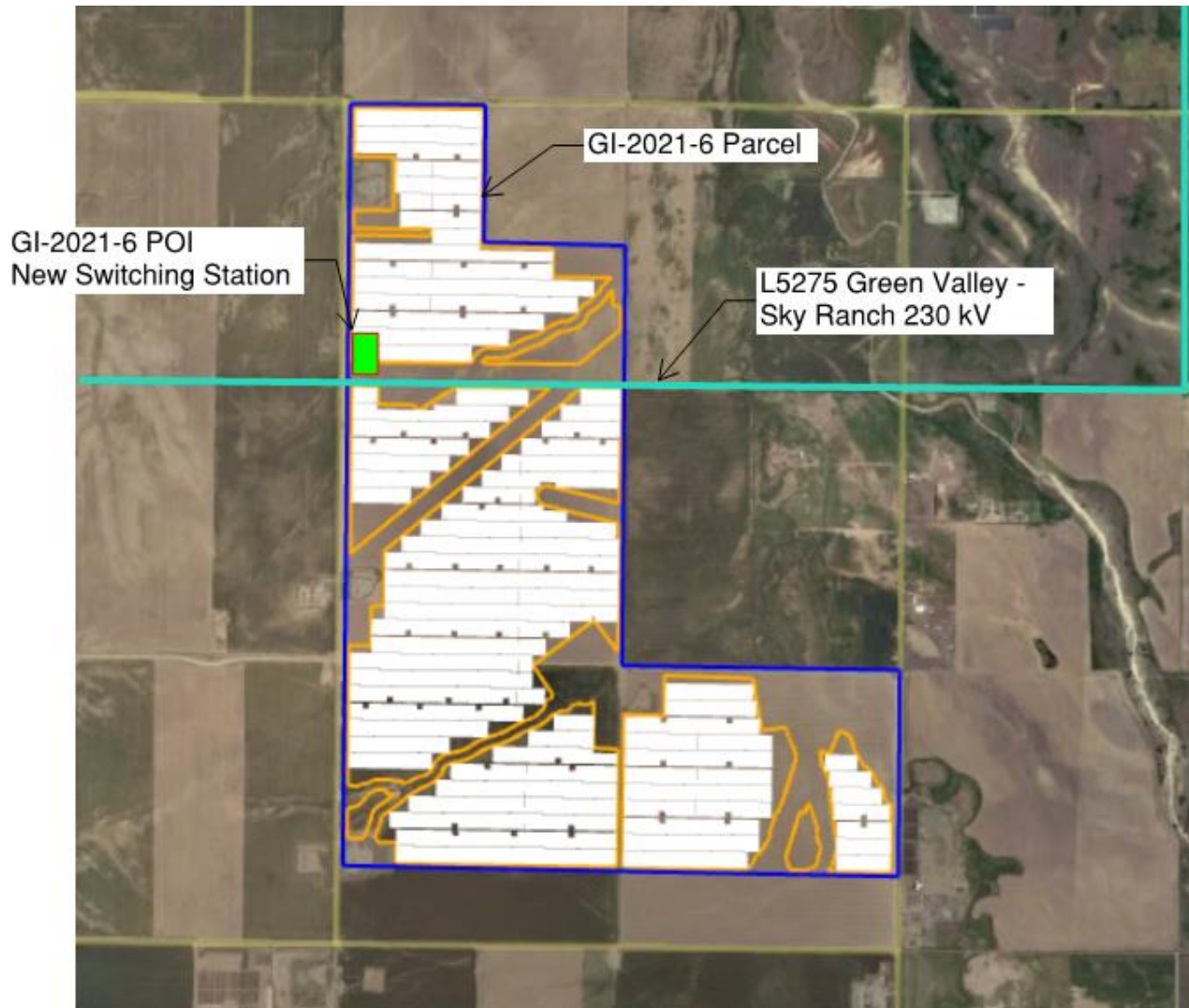
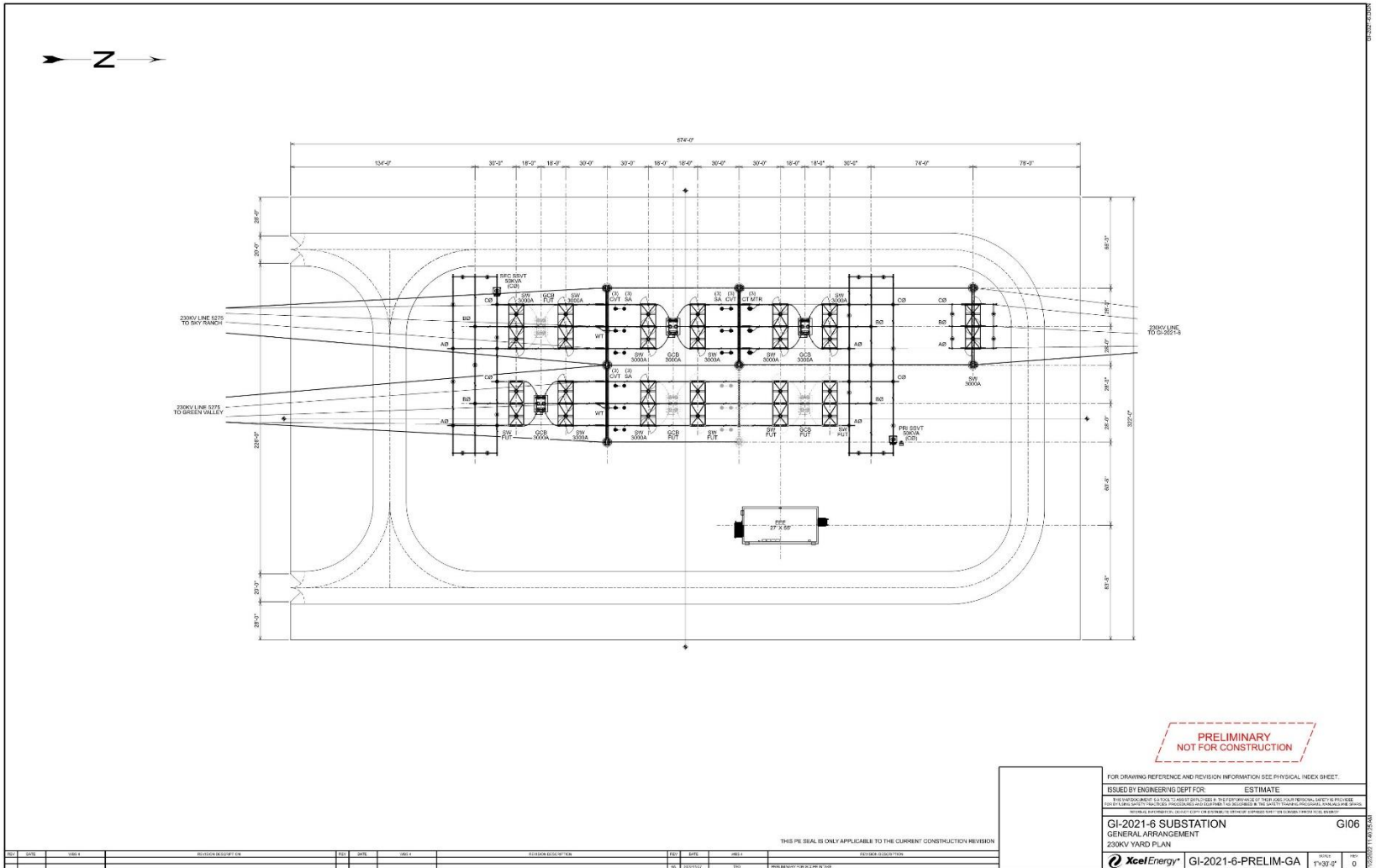


Figure 4 – Preliminary General Arrangement of the GI-2021-6 230 kV Switching Station





4.0 Schedule

This section provides proposed milestones for the interconnection of GI-2021-6 to the Transmission Provider’s Transmission System. The customer’s proposed “Generator step-up transformer back feed power” date of August 29, 2025 is not attainable by the Transmission Provider, based upon the current schedule developed for this GIR. The Transmission Provider proposes the milestones provided below:

Milestone	Responsible Party	Estimated Completion Date
LGIA Execution	Interconnection Customer and Transmission Provider	January 2023
In-Service Date for Transmission Provider Interconnection Facilities and Network Upgrades required for interconnection	Transmission Provider	November 30, 2025
In-Service Date & Energization of Interconnection Customer’s Interconnection Facilities	Interconnection Customer	November 30, 2025
Initial Synchronization Date	Interconnection Customer	January 1, 2026
Begin trial operation & testing	Interconnection Customer and Transmission Provider	January 1, 2026
Commercial Operation Date	Interconnection Customer	January 31, 2026

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:

- Permitting for new facilities will be completed within 18 months of LGIA execution.
- Land acquisition will be completed within 18 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 following is the list of the unbuilt Interconnection Facilities and Network Upgrades upon which the costs, timing, and study findings of DISIS-2021-003 is dependent, and if delayed or not built, could cause a need for re-studies of the Interconnection Service or a reassessment of the Interconnection Facilities and/or Network Upgrades and/or costs and timing. The individual GIR maximum allowable output may be decreased if these Contingent Facilities are not in-service

There are no unbuilt facilities modeled in the Northern Colorado study pocket analysis. The Contingent Facilities identified for GI-2021-6 include the Interconnection Facilities and Station Network Upgrades for GI-2021-6 identified in Table 1 and Table 2, respectively.