

**DOCKETED**

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<b>Project Title:</b>	Pecho Energy Storage Center
<b>TN #:</b>	240712-4
<b>Document Title:</b>	Pecho Energy Center's Application for Certification - 30 Electric Transmission
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<b>Docketed Date:</b>	11/23/2021

## 3.0 ELECTRIC TRANSMISSION

### 3.1 Introduction

This section discusses the transmission interconnection between the Pecho Project (Pecho) and the existing electrical grid, and the potential effects that operation of the facility will have on the flow of electrical power in the project region. The following topics are discussed:

- The proposed electrical interconnection between Pecho and the electrical grid
- The impacts of the electrical interconnection on the existing transmission grid
- Potential nuisances (electrical effects, aviation safety, and fire hazards)
- Safety of the interconnection
- Description of applicable laws, ordinances, regulations, and standards (LORS)

The Pecho Project will be located in unincorporated San Luis Obispo County, California, on parcels totaling approximately 80 acres approximately 3 miles southeast of the Pacific Gas & Electric (PG&E) Morro Bay Switching Station. Pecho will interconnect via a new 230 kilovolt (kV) overhead transmission line with the preferred route approximately 3.4 miles in length.

Sections 3.2 and 3.3 discuss the details regarding the transmission alternatives investigated and the results of the transmission interconnection studies.

### 3.2 Transmission Lines Description, Design, and Operation

The Pecho Project will be interconnected with the regional electrical grid by a new, single-circuit, three-phase, 230 kV generator tie-line with the preferred route approximately 3.4 miles in length and a right-of-way width of 75 to 125 feet. The preferred 230 kV line runs west from the project site following existing PG&E transmission lines before terminating at the Morro Bay Switching Station. Section 1, Introduction, Figure 1-4 presents the preferred transmission route between the Pecho and the Morro Bay Switching Station along with alternatives.

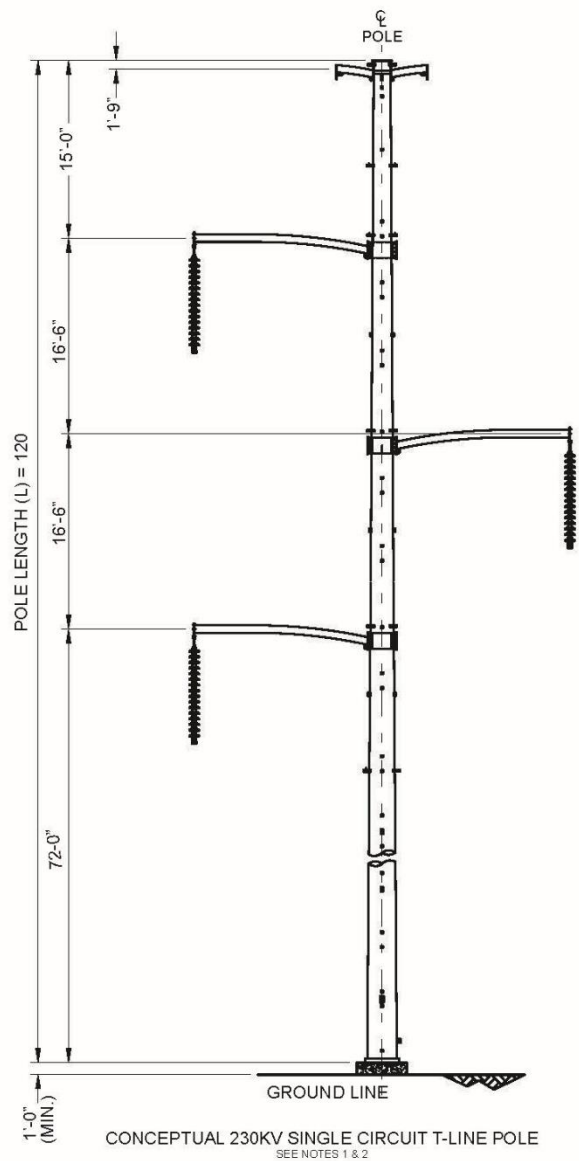
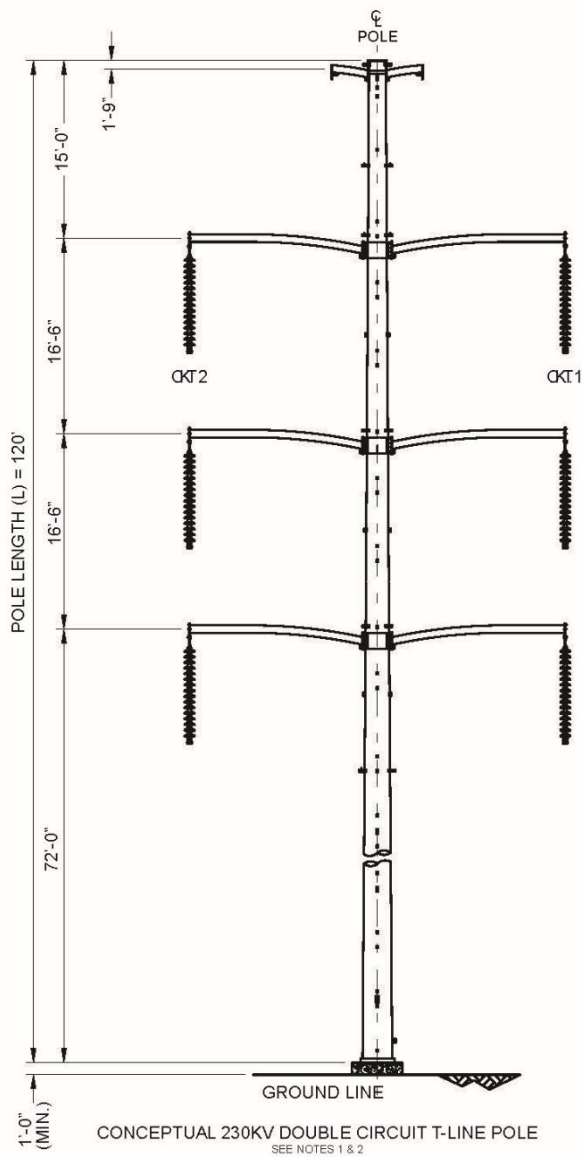
#### 3.2.1 Overhead Transmission Line Characteristics

The interconnecting 230 kV transmission circuit will consist of a single-circuit configuration constructed overhead except for a portion of the transmission line immediately east of the Morro Bay Switching Station where underground transmission may be utilized to cross Highway 1. Figure 3-1 shows a transmission pole like the Pecho poles to be used as part of the overhead transmission interconnection.

#### 3.2.2 Pecho Switchyard Characteristics

A general arrangement for the proposed onsite Pecho 230 kV switchyard is shown in Figure 2-2, Section 2, Project Description. Electrical one-line diagrams of the proposed onsite Pecho 230 kV switchyard are shown in Figures 3-2 through Figure 3-4.

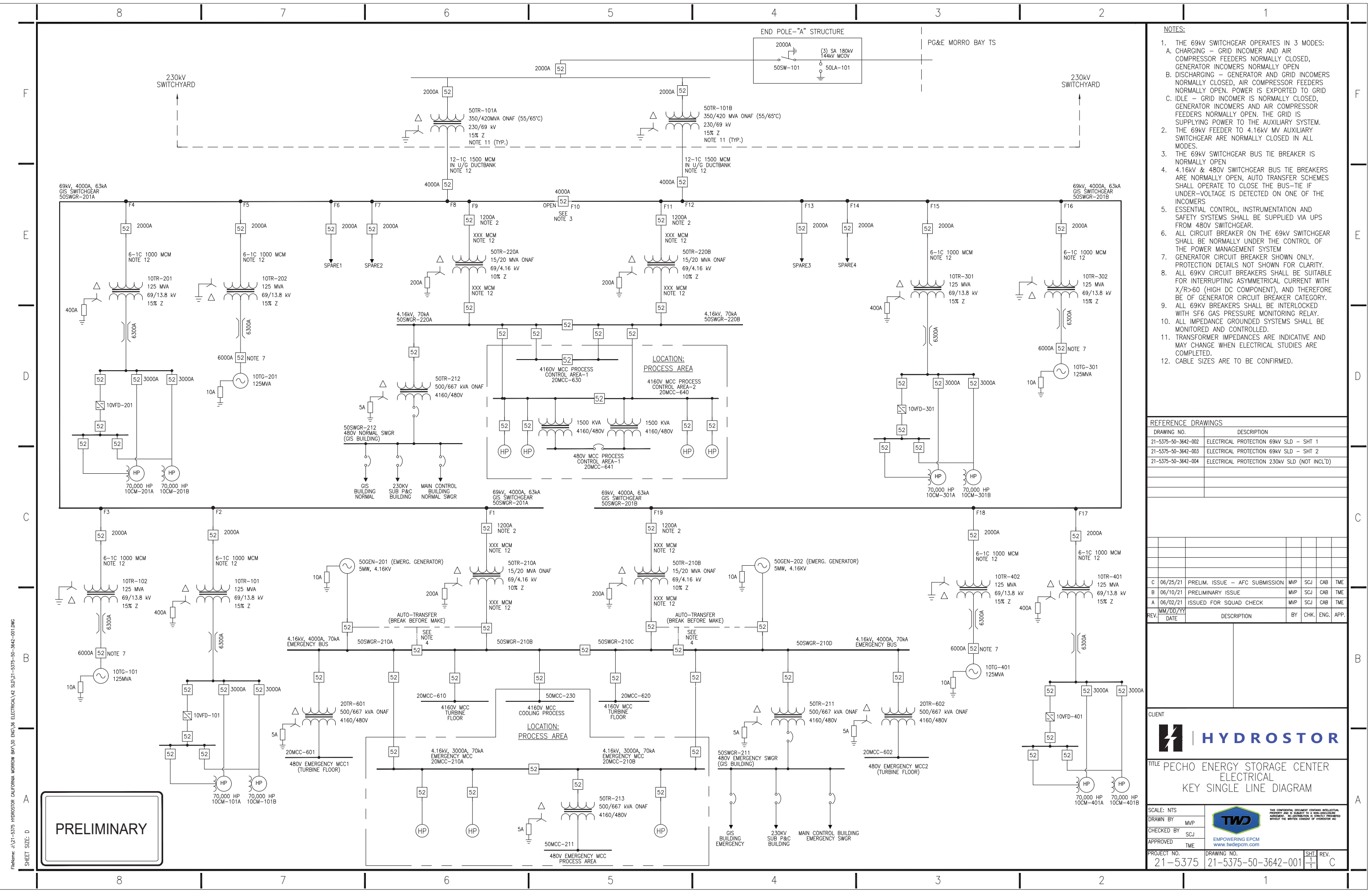
The Pecho switchyard will be on the western end of the project site. The substation will be of the tubular bus type with interconnecting conductors and will consist of high-voltage SF6-insulated dead-tank circuit breakers and no-load switches.



Notes

1. CONCEPTUAL TRANSMISSION LINE POLE DESIGN SHOWN IS TYPICAL. ACTUAL DESIGN WILL BE DETERMINED DURING DETAILED DESIGN.
2. APPROXIMATE DIAMETER OF CONCEPTUAL FOUNDATION IS 8'-0".

**Figure 3-1 Representative Transmission Pole**  
**Pecho Energy Storage Center**



- NOTES:**
- THE 69KV SWITCHGEAR OPERATES IN 3 MODES:  
 A. CHARGING – GRID INCOMER AND AIR COMPRESSOR FEEDERS NORMALLY CLOSED, GENERATOR INCOMERS NORMALLY OPEN  
 B. DISCHARGING – GENERATOR AND GRID INCOMERS NORMALLY CLOSED, AIR COMPRESSOR FEEDERS NORMALLY OPEN. POWER IS EXPORTED TO GRID  
 C. IDLE – GRID INCOMER IS NORMALLY CLOSED, GENERATOR INCOMERS AND AIR COMPRESSOR FEEDERS NORMALLY OPEN. THE GRID IS SUPPLYING POWER TO THE AUXILIARY SYSTEM.  
 THE 69KV FEEDER TO 4.16KV MV AUXILIARY SWITCHGEAR ARE NORMALLY CLOSED IN ALL MODES.
  - THE 69KV SWITCHGEAR BUS TIE BREAKER IS NORMALLY OPEN
  - 4.16KV & 480V SWITCHGEAR BUS TIE BREAKERS ARE NORMALLY OPEN, AUTO TRANSFER SCHEMES SHALL OPERATE TO CLOSE THE BUS-TIE IF UNDER-VOLTAGE IS DETECTED ON ONE OF THE INCOMERS
  - ESSENTIAL CONTROL, INSTRUMENTATION AND SAFETY SYSTEMS SHALL BE SUPPLIED VIA UPS FROM 480V SWITCHGEAR.
  - ALL CIRCUIT BREAKER ON THE 69KV SWITCHGEAR SHALL BE NORMALLY UNDER THE CONTROL OF THE POWER MANAGEMENT SYSTEM
  - GENERATOR CIRCUIT BREAKER SHOWN ONLY. PROTECTION DETAILS NOT SHOWN FOR CLARITY.
  - ALL 69KV CIRCUIT BREAKERS SHALL BE SUITABLE FOR INTERRUPTING ASYMMETRICAL CURRENT WITH X/R>60 (HIGH DC COMPONENT), AND THEREFORE BE OF GENERATOR CIRCUIT BREAKER CATEGORY.
  - ALL 69KV BREAKERS SHALL BE INTERLOCKED WITH SF6 GAS PRESSURE MONITORING RELAY.
  - ALL IMPEDANCE GROUNDED SYSTEMS SHALL BE MONITORED AND CONTROLLED.
  - TRANSFORMER IMPEDANCES ARE INDICATIVE AND MAY CHANGE WHEN ELECTRICAL STUDIES ARE COMPLETED.
  - CABLE SIZES ARE TO BE CONFIRMED.

**REFERENCE DRAWINGS**

DRAWING NO.	DESCRIPTION
21-5375-50-3642-002	ELECTRICAL PROTECTION 69KV SLD - SHT 1
21-5375-50-3642-003	ELECTRICAL PROTECTION 69KV SLD - SHT 2
21-5375-50-3642-004	ELECTRICAL PROTECTION 230KV SLD (NOT INCL'D)

REV.	MM/DD/YY	DATE	DESCRIPTION	BY	CHK.	ENG.	APP.
C	06/25/21		PRELIM. ISSUE - AFC SUBMISSION	MVP	SCJ	CAB	TME
B	06/10/21		PRELIMINARY ISSUE	MVP	SCJ	CAB	TME
A	06/02/21		ISSUED FOR SQUAD CHECK	MVP	SCJ	CAB	TME

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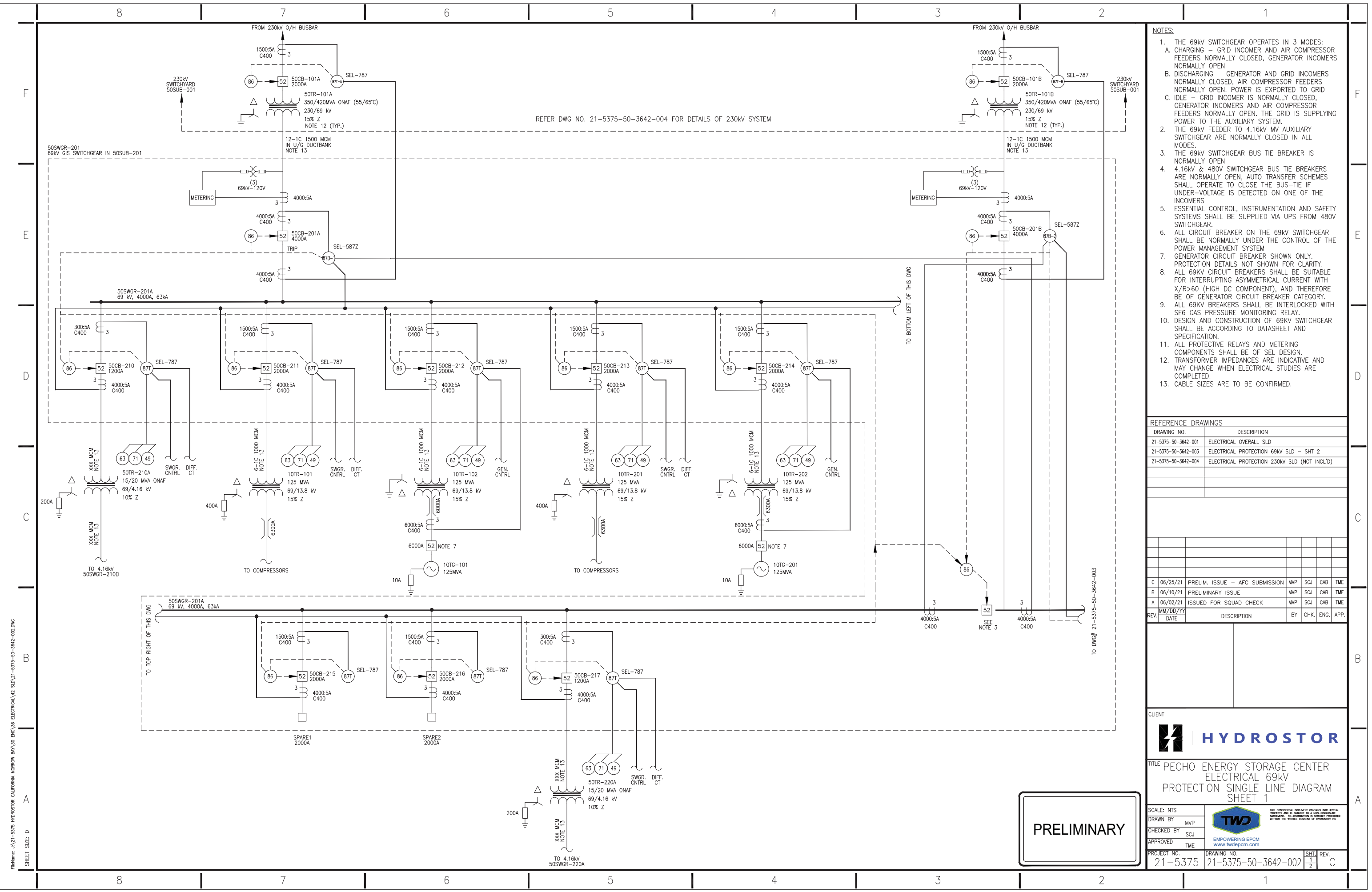
**TITLE** PECHO ENERGY STORAGE CENTER  
ELECTRICAL  
KEY SINGLE LINE DIAGRAM

**SCALE:** NTS

<b>DRAWN BY:</b> MVP			
<b>CHECKED BY:</b> SCJ			
<b>APPROVED:</b> TME			
<b>PROJECT NO.:</b> 21-5375	<b>DRAWING NO.:</b> 21-5375-50-3642-001	<b>SHT. NO.:</b> 1	<b>REV.:</b> C

**PRELIMINARY**

Figure 3-2: Electrical Key Single Line Diagram



REFER DWG NO. 21-5375-50-3642-004 FOR DETAILS OF 230KV SYSTEM

- NOTES:**
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  - ESSENTIAL CONTROL, INSTRUMENTATION AND SAFETY SYSTEMS SHALL BE SUPPLIED VIA UPS FROM 480V SWITCHGEAR.
  - ALL CIRCUIT BREAKER ON THE 69KV SWITCHGEAR SHALL BE NORMALLY UNDER THE CONTROL OF THE POWER MANAGEMENT SYSTEM
  - GENERATOR CIRCUIT BREAKER SHOWN ONLY. PROTECTION DETAILS NOT SHOWN FOR CLARITY.
  - ALL 69KV CIRCUIT BREAKERS SHALL BE SUITABLE FOR INTERRUPTING ASYMMETRICAL CURRENT WITH  $X/R > 60$  (HIGH DC COMPONENT), AND THEREFORE BE OF GENERATOR CIRCUIT BREAKER CATEGORY.
  - ALL 69KV BREAKERS SHALL BE INTERLOCKED WITH SF6 GAS PRESSURE MONITORING RELAY.
  - DESIGN AND CONSTRUCTION OF 69KV SWITCHGEAR SHALL BE ACCORDING TO DATASHEET AND SPECIFICATION.
  - ALL PROTECTIVE RELAYS AND METERING COMPONENTS SHALL BE OF SEL DESIGN.
  - TRANSFORMER IMPEDANCES ARE INDICATIVE AND MAY CHANGE WHEN ELECTRICAL STUDIES ARE COMPLETED.
  - CABLE SIZES ARE TO BE CONFIRMED.

**REFERENCE DRAWINGS**

DRAWING NO.	DESCRIPTION
21-5375-50-3642-001	ELECTRICAL OVERALL SLD
21-5375-50-3642-003	ELECTRICAL PROTECTION 69KV SLD - SHT 2
21-5375-50-3642-004	ELECTRICAL PROTECTION 230KV SLD (NOT INCL'D)

REV.	MM/DD/YY	DATE	DESCRIPTION	BY	CHK.	ENG.	APP.
C	06/25/21		PRELIM. ISSUE - AFC SUBMISSION	MVP	SCJ	CAB	TME
B	06/10/21		PRELIMINARY ISSUE	MVP	SCJ	CAB	TME
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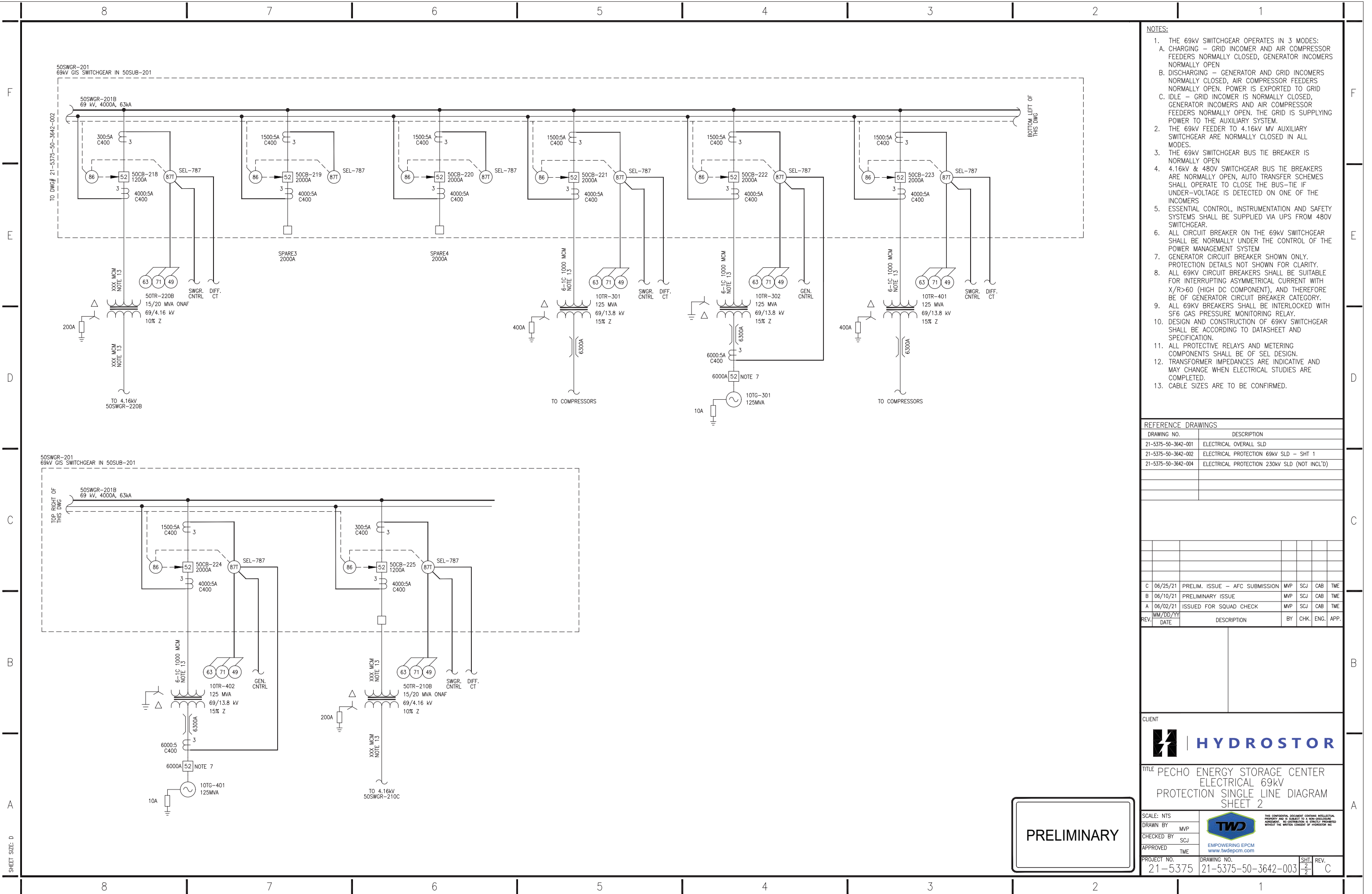
TITLE PECHO ENERGY STORAGE CENTER  
ELECTRICAL 69kV  
PROTECTION SINGLE LINE DIAGRAM  
SHEET 1

SCALE: NTS	THIS CONFIDENTIAL DOCUMENT CONTAINS INTELLECTUAL PROPERTY AND IS SUBJECT TO A NON-DISCLOSURE AGREEMENT. RE-DISTRIBUTION IS STRICTLY PROHIBITED WITHOUT THE WRITTEN CONSENT OF HYDROSTOR INC.	
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PROJECT NO. 21-5375	DRAWING NO. 21-5375-50-3642-002	SHT. REV. 1/2 C

Figure 3-3: Electrical 69kV Protection Single Line Diagram (Sheet 1)

Filename: I:\21-5375-HYDROSTOR CALIFORNIA MORGAN BAY\_3D\_ENCL\_36 ELECTRICAL\4.8 SLD\21-5375-50-3642-002.DWG  
 SHEET SIZE: D

Filename: \\1\21-5375-HYDROSTOR CALIFORNIA MORGAN BAY\_3D ENCL\_36 ELECTRICAL\4.8 SLD\21-5375-50-3642-003.DWG  
SHEET SIZE: D



- NOTES:**
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    - CHARGING – GRID INCOMER AND AIR COMPRESSOR FEEDERS NORMALLY CLOSED, GENERATOR INCOMERS NORMALLY OPEN
    - DISCHARGING – GENERATOR AND GRID INCOMERS NORMALLY CLOSED, AIR COMPRESSOR FEEDERS NORMALLY OPEN. POWER IS EXPORTED TO GRID
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21-5375-50-3642-002	ELECTRICAL PROTECTION 69kV SLD - SHT 1
21-5375-50-3642-004	ELECTRICAL PROTECTION 230kV SLD (NOT INCL'D)

REV.	MM/DD/YY	DATE	DESCRIPTION	BY	CHK.	ENG.	APP.
C	06/25/21		PRELIM. ISSUE - AFC SUBMISSION	MVP	SCJ	CAB	TME
B	06/10/21		PRELIMINARY ISSUE	MVP	SCJ	CAB	TME
A	06/02/21		ISSUED FOR SQUAD CHECK	MVP	SCJ	CAB	TME

CLIENT
<b>HYDROSTOR</b>

**TITLE** PECHO ENERGY STORAGE CENTER  
ELECTRICAL 69kV  
PROTECTION SINGLE LINE DIAGRAM  
SHEET 2

SCALE:	DRAWN BY:	CHECKED BY:	APPROVED:	PROJECT NO.:	DRAWING NO.:	SHT.:	REV.:
NTS	MVP	SCJ	TME	21-5375	21-5375-50-3642-003	2	C

**PRELIMINARY**

Figure 3-4: Electrical 69kV Protection Single Line Diagram (Sheet 2)



Connections to the aerial conductor cable will be provided from the two dual-winding transformers for the inter-tie to the utility grid. The high-voltage circuit breaker will be equipped with a no-load break, air-insulated, disconnect switch. A transformer circuit breaker and isolating disconnect switch will also be installed in each transformer connection to allow for transformer protection and isolation when the corresponding transformer is out of service. Tubular IPS bus type with interconnecting conductors will be used as the primary interconnection material within the switchyard. The IPS and conductors will be attached to post-insulator columns on structural steel supports. The main substation transforms power from/to 230 kV to/from 69 kV.

Current and voltage transformers will be located at points within the substation to provide for metering and relaying. Control, protection, and monitoring for the substation will be in the substation protection and control building. Monitoring and alarms will be available to the supervisory control system operator workstations in the control module. All protection and circuit breaker control will be powered from the station battery-backed 125V DC system.

Each motor/generator substation will have two dual-winding transformers with wye-delta for the generator and delta-wye for the motors. The HV (69 kV) side will be fed with underground cables and the 13.8 kV side will be ISO Phase Bus Duct connections with SF6 circuit breakers.

### 3.2.3 230 kV Morro Bay Switching Station Characteristics

At this time, PG&E has not provided detailed drawings of the Morro Bay Switching Station showing a proposed point of interconnection. The proposed configuration of the interconnection is shown in Attachment 10 of the Phase I Interconnection Study Addendum in App 3ATransmission Interconnection Studies.

Hydrostor USA Holdings Inc. (formerly Hydrostor A-CAES USA Inc.), member of Pecho LD Energy Storage, LLC filed an Interconnection Request (IR) with the California Independent System Operator (CAISO) on April 15, 2020 (in the Cluster 13 Interconnection Request window). CAISO, in cooperation with PG&E, prepared the Phase I Interconnection Study (dated February 12, 2021, as modified by Addendum #1 dated March 1, 2021), which considered the potential system impacts of the proposed Pecho interconnect (Appendix 3A). As part of the Cluster 13 study process, Pecho was studied alongside other interconnection requests in Cluster 13 and, therefore, the Phase I Interconnection Study results represents the worst-case scenario in terms of potential effects on the transmission system. The results of the Phase I study provide the California Energy Commission (CEC) with the information that it needs to conduct an environmental assessment of the impacts of the transmission and interconnection facilities. As part of the interconnection process with CAISO and PG&E, Pecho LD Energy Storage, LLC will update the IR through the Material Modification Assessment (MMA) process to align the IR with the current proposed design.

### 3.2.4 New Equipment Installation

The IR Studies indicate that the following equipment will be installed by PG&E:

- Install bus selector switches and conductor in existing double bus bay structure.
- Install the following at the existing double bus bay to connect the generation-tie line:
  - One (1) 230 kV Circuit Breaker (CB) with maintenance switches.
  - Install current differential line relay package for the dedicated generation-tie line with associated new bay structure, coupling capacitor voltage transformer (CCVT), and line disconnect switch.

- Set A and SET B SEL 411L line current differential, step distance and directional ground overcurrent relays with the same firmware version as that installed at the project generator CB.
- Install, terminate, and test new fiber cable from substation fence to control building.
- Install three (3) spans of transmission line conductor and two (2) new tubular steel poles (TSP's) from the Morro Bay Switching Station dead-end to connect the Customer Gen-Tie Line.
  - Install two (2) single-circuit dead-end TSP's.
  - Install three (3) spans of transmission line conductor.
- Metering at the generator substation.
- One (1) remote terminal unit (RTU) and provide testing at the generator substation.

### 3.2.5 System Impact Studies

The IR Studies assessed the effects of the addition of Cluster 13, including Pecho (at 500 MW), to the local electrical system under various conditions of stress. It should be noted that going into Phase II of the interconnection studies that the A-CAES component was reduced to 400 MW consistent with the current project size.

It is anticipated that many of the overloads and issues identified as part of the Cluster 13 Phase I will be reduced when Cluster 13 proceeds through Phase II of the interconnection process.

#### 3.2.5.1 Power Flow Reliability Assessment

##### 3.2.5.1.1 Discharging Analysis

- **Thermal Overload:** The IR Studies indicate that no steady-state thermal violations were observed in the PG&E transmission system due to the addition of Pecho, along with other Cluster 13 projects, after curtailment.
  - Additional details of the IR Studies are included in the Area Report (provided as part of Appendix 3A).
- **Bus Flow Analysis:** The IR Studies indicate that no bus flow violations identified in the reliability analysis for the PG&E West Kern Interconnection Area due to the addition of Pecho, along with other Cluster 13 projects. Please see the Area Report of the IR Studies (included as part of Appendix 3A) for additional details.
- **Steady State Voltage Results:** The IR Studies indicate that there were no steady-state voltage violations identified in the reliability analysis for this project.
- **Post Transient Stability Results:** The IR Studies indicate that there were no post-transient voltage stability violations identified in the reliability analysis for this project.
- **Reactive Power Deficiency Results:** The IR Studies indicate that no reactive power deficiencies identified in the reliability analysis for this project.
- **Mitigation:** The IR Studies indicate that several General Reliability Network Upgrades (GRNU's) are required to accommodate the Cluster 13 Phase I projects.

The upgrades assigned to the project include:

- Replace Mesa Substation 115 kV CBs 132 and 142 with 63 kA interrupting capability.



- Install series bus reactors between Midway Substation 230 kV bus sections D and E.
- Replace Morro Bay Substation 230 kV CB 472 with 63 kA interrupting capability.
- Modify existing Midway 500/230 kV transformer overload RAS to include transformer outage detection and transformer overload detection.

Additional details are provided in Appendix 3A.

### 3.2.5.1.2 Charging Analysis

The IR Studies indicated that there were no adverse impacts from the Generating Facility under charging analysis given that the energy storage follows CAISO market dispatch instruction.

### 3.2.5.2 Short Circuit Duty

#### 3.2.5.2.1 Short-circuit Study Results

Short circuit studies were performed to determine the impact of adding the Cluster 13 Phase I PG&E West Kern Interconnection Area projects to the transmission system. These studies are also needed to perform relay coordination among adjacent substations. The short circuit duty assessment found that the addition of Cluster 13 projects and/or associated Network Upgrades in the PG&E Fresno Interconnection Area resulted in short circuit duty violations.

The IR Studies note that the GRNU's identified above are sufficient mitigation for the short circuit duty issues.

The project is being studied again as part of Phase II and each project in the cluster will be responsible for its share of the upgrade cost after Phase II. It is expected that the issues identified as part of Cluster 13 Phase I will be reduced when Cluster 13 proceeds through Phase II of the interconnection process.

Additional details are provided in Appendix 3A.

### 3.2.5.3 Transient Stability Evaluation

The IR Studies find transient stability performance to be acceptable.

### 3.2.5.4 Power Factor Requirements

Pecho will be designed to maintain a composite power delivery at continuous rated power at the Point of Interconnection at a power factor within the range of 0.95 lead/lag for asynchronous generation and

0.90 lagging to 0.95 leading at generator terminals for synchronous generators. Additionally, the Pecho will be designed to accommodate a voltage-ampere reactive schedule provided by PG&E. PG&E will determine whether the voltage-ampere reactive schedule is necessary based on future rearrangements of PG&E's transmission.

### 3.2.5.5 Deliverability Assessments

Pecho, along with the other projects in Cluster 13 Phase I, contributed to the following overloads and mitigation that were identified in the Phase I Study.

- **Local Delivery Network Upgrades:** The IR Studies indicate that several Local Deliverability Network Upgrades (LDNU's) are required to accommodate the Cluster 13 Phase I projects.

The upgrades assigned to the project include:

- Coalinga 1-Coalinga 2 70 kV Line (Tornado Jct-Pennzier Jct) Reconductor: Reconductor a total of 3.3 miles of 3/0 all aluminum conductor (AAC) of Coalinga 1-Coalinga 2 70 kV Line (Tornado Jct-Pennzier Jct) with 1113 AAC.
- Gates-Jayne Sw Sta 70 kV Line Reconductor: Reconductor a total of 0.68 mile of Gates-Jayne Sw Sta 70 kV Line with 1113 AAC.
- Jayne Sw Sta-Coalinga #1 70 kV Line (Jayne Sw Sta-Jacalito-Coalinga #1): Re-conductor Jayne Sw Sta-Coalinga #1 70 kV Line (Jayne Sw Sta-Jacalito-Coalinga #1) 11.8 miles with 1113 AAC.
- Area Delivery Network Upgrades: The IR Studies indicate that several Area Deliverability Network Upgrades (ADNU's) are required to accommodate the Cluster 13 Phase I projects.

The upgrades assigned to the project include:

- New Gates-Arco-Midway 230 kV path looping new project.
- New Morro Bay-Gates/Morro Bay-Midway 230 kV lines.
- New Diablo-Midway #4 500 kV Line.
- Reconductor Gates-Panoche #1 and #2 230 kV Lines.
- Gates Bank #13.

It is anticipated that many of the overloads and issues identified as part of the Cluster 13 Phase I will be reduced when Cluster 13 proceeds through Phase II of the interconnection process. It should also be noted that the project selected Transmission Plan Deliverability (TPD) Option A as part of the Phase II Study and will not be funding the identified ADNU's and will seek Deliverability through the TPD allocation.

Additional details are provided in Appendix 3A.

### 3.3 Transmission Line Safety and Nuisances

This section discusses safety and nuisance issues associated with the proposed electrical interconnection.

#### 3.3.1 Electrical Clearances

Typical high-voltage overhead transmission lines are composed of bare conductors connected to supporting structures by means of porcelain, glass, or plastic insulators. The air surrounding the energized conductor acts as the insulating medium. Maintaining sufficient clearances, or air space, around the conductors to protect the public and utility workers is paramount to the safe operation of the line. The required safety clearance required for the conductors is determined by considering factors such as the normal operating voltages, conductor temperatures, short-term abnormal voltages, windblown swinging conductors, contamination of the insulators, clearances for workers, and clearances for public safety. The line will conform to the minimum clearances specified in the California Public Utilities Commission (CPUC) General Order (GO) 95. Electric utilities, state regulators, and local ordinances may specify additional (more restrictive) clearances. Typically, clearances are specified for the following:

- Distance between the energized conductors themselves
- Distance between the energized conductors and the supporting structure

- Distance between the energized conductors and other power or communication wires on the same supporting structure, or between other power or communication wires above or below the conductors
- Distance from the energized conductors to the ground and features such as roadways, railroads, driveways, parking lots, navigable waterways, and airports
- Distance from the energized conductors to buildings and signs
- Distance from the energized conductors to other parallel power lines

The transmission interconnection for Pecho will be designed to meet applicable national, state, and local clearance requirements.

### 3.3.2 Electrical Effects

The electrical effects of high-voltage transmission lines fall into two broad categories: corona effects and field effects. Corona is the ionization of the air that occurs at the surface of the energized conductor and suspension hardware attributable to high electric field strength at the surface of the metal during certain conditions. Corona may result in radio and television reception interference, audible noise, light, and production of ozone. Field effects are the voltages and currents that may be induced in nearby conducting objects. A transmission line's inherent electric and magnetic fields cause these effects.

#### 3.3.2.1 Electric and Magnetic Fields

Operating power lines, like energized components of electrical motors, home wiring, lighting, and other electrical appliances, produce electric and magnetic fields commonly referred to as an electromagnetic field (EMF). The EMF produced by the alternating current (AC) electrical power system in the U.S. has a frequency of 60 hertz, meaning that the intensity and orientation of the field changes 60 times per second.

Electric fields around transmission lines are produced by electrical charges on the energized conductor. Electric field strength is directly proportional to the line's voltage (i.e., increased voltage produces a stronger electric field). At a given distance from the transmission line conductor, the electric field is inversely proportional to the distance from the conductors, so that the electric field strength declines as the distance from the conductor increases. The strength of the electric field is measured in units of kV per meter. The electric field around a transmission line remains steady and is not affected by the common daily and seasonal fluctuations in usage of electricity by customers.

Magnetic fields around transmission lines are produced by the level of current flow, measured in terms of amperes, through the conductors. The magnetic field strength is also directly proportional to the current (i.e., increased amperes produce a stronger magnetic field). The magnetic field is inversely proportional to the distance from the conductors. Thus, like the electric field, the magnetic field strength declines as the distance from the conductor increases. Magnetic fields are expressed in units of milligauss. The amperes, and therefore the magnetic field around a transmission line, fluctuate daily and seasonally as the usage of electricity varies.

Considerable research has been conducted over the last 30 years on the possible biological effects and human health effects from EMFs. This research has produced many studies that offer no uniform conclusions about whether long-term exposure to EMFs is harmful. In the absence of conclusive or evocative evidence, some states, including California, have chosen not to specify maximum acceptable levels of EMF. Instead, these states mandate a program of prudent avoidance whereby EMF exposure to the public would be minimized by encouraging electric utilities to use cost-effective techniques to reduce the levels of EMFs.

### **3.3.2.2 Audible Noise and Radio and Television Interference**

Corona from a transmission line may result in the production of audible noise or radio and television interference. Corona is a function of the voltage of the line, the diameter of the conductor, and the condition of the conductor and suspension hardware. The electric field gradient is the rate at which the electric field changes and is directly related to the line voltage.

The electric field gradient is greatest at the surface of the conductor. Large-diameter conductors have lower electric field gradients at the conductor surface and, hence, lower corona than smaller conductors, everything else being equal. Also, irregularities (such as nicks and scrapes on the conductor surface) or sharp edges on suspension hardware concentrate the electric field at these locations and, thus, increase corona at these spots. Similarly, contamination on the conductor surface such as dust or insects can cause irregularities that are a source for corona. Raindrops, snow, fog, and condensation are also sources of irregularities.

### **3.3.2.3 EMFs, Audible Noise, and Radio and Television Interference Assumptions**

It is important to remember that EMFs, audible noise, and radio and television interference near power lines vary regarding the line design, line loading, distance from the line, and other factors.

Electric fields, corona, audible noise, and radio and television interference depend on line voltage and not on the level of power flow. Because line voltage remains nearly constant for a transmission line during normal operation, the audible noise associated with the 230 kV lines in the area will be of the same magnitude before and after the project.

Corona typically becomes a design concern for transmission lines having voltages of 345 kV and above. Since Pecho will be connected at 230 kV voltage level, it is expected that no corona-related design issues will be encountered.

The magnetic field is proportional to line loading (amperes), which varies as demand for electrical power varies and as generation from the generating facility is changed by the system operators to meet changes in demand.

Construction and operation of Pecho, including the interconnection of the facility with PG&E'S transmission system, are not expected to result in significant increases in EMF levels, corona, audible noise, or radio and television interference.

### **3.3.2.4 Induced Current and Voltages**

A conducting object such as a vehicle or person in an electric field will experience induced voltages and currents. The strength of the induced current will depend on the electric field strength, the size and shape of the conducting object, and the object-to-ground resistance. When a conducting object is isolated from the ground and a grounded person touches the object, a perceptible current or shock may occur as the current flows to ground. The mitigation for hazardous and nuisance shocks is to ensure that metallic objects on or near the right-of-way are grounded and that sufficient clearances are provided at roadways and parking lots to keep electric fields at these locations low enough to prevent vehicle short-circuit currents from exceeding 5 milliamperes.

Magnetic fields can also induce voltages and currents in conducting objects. Typically, this requires a long metallic object, such as a wire fence or aboveground pipeline that is grounded at only one location. A person who closes an electrical loop by grounding the object at a different location will experience a shock like that described for an ungrounded object. Mitigation for this problem is to ensure multiple grounds on fences or pipelines, especially those oriented parallel to the transmission line.

The proposed 230 kV transmission interconnection line will be constructed in conformance with CPUC GO-95 and Title 8 California Code of Regulations (CCR) 2700 requirements. Therefore, hazardous shocks are unlikely to occur because of project construction, operation, or maintenance.

### 3.3.3 Fire Hazards

The proposed 230 kV transmission interconnection will be designed, constructed, and maintained in accordance with applicable standards including GO-95, which establishes clearances from other man-made and natural structures as well as tree-trimming requirements to mitigate fire hazards.

The project will maintain the gen-tie corridor and immediate area in accordance with existing regulations and accepted industry practices that will include identification and abatement of fire hazards.

## 3.4 Laws, Ordinances, Regulations, and Standards

This section provides a list of applicable LORS that apply to the proposed transmission line, substations, and engineering.

### 3.4.1 Design and Construction

Table 3-1 lists the LORS for the design and construction of the proposed transmission line and switchyard.

**Table 3-1: Design and Construction LORS for the Proposed Transmission Line and Switchyard**

LORS	Applicability
Title 8 CCR, Section 2700 et seq. "High Voltage Electrical Safety Orders"	Establishes essential requirements and minimum standards for installation, operation, and maintenance of electrical installation and equipment to provide practical safety and freedom from danger.
GO-52, CPUC, "Construction and Operation of Power and Communication Lines"	Applies to the design of facilities subject to CPUC's jurisdiction to provide or mitigate inductive interference.
ANSI/IEEE 593, "IEEE Recommended Practices for Seismic Design of Substations"	Recommends design and construction practices.
IEEE 1119, "IEEE Guide for Fence Safety Clearances in Electric-Supply Stations"	Recommends clearance practices to protect persons outside the facility from electric shock.  Applies to the design of facilities subject to CPUC's jurisdiction to provide or mitigate inductive interference.
IEEE 980, "Containment of Oil Spills for Substations"	Recommends preventions for release of fluids into the environment.

ANSI = American National Standards Institute; IEEE = Institute of Electrical and Electronics Engineers

### 3.4.2 Electric and Magnetic Fields

The LORS pertaining to EMF are listed in Table 3-2.

**Table 3-2: Electric and Magnetic Field LORS**

LORS	Applicability
Decision 93-11-013, CPUC	CPUC position on EMF reduction.
GO-131-D, CPUC, "Rules for Planning and Construction of Electric Generation, Line, and Substation Facilities in California"	CPUC construction application requirements, including requirements related to EMF reduction.
ANSI/IEEE 544-1994, "Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines"	Standard procedure for measuring EMF from an electric line that is in service.

### 3.4.3 Hazardous Shock

Table 3-3 lists the LORS regarding hazardous shock protection that apply to the transmission interconnection and the overall project.

**Table 3-3: Hazardous Shock LORS**

LORS	Applicability
8 CCR 2700 et seq. "High Voltage Electrical Safety Orders"	Establishes essential requirements and minimum standards for installation, operation, and maintenance of electrical equipment to provide practical safety and freedom from danger.
ANSI/IEEE 80, "IEEE Guide for Safety in AC Substation Grounding"	Presents guidelines for assuring safety through proper grounding of AC outdoor substations.
NESC, ANSI C2, Section 9, Article 92, Paragraph E; Article 93, Paragraph C	Covers grounding methods for electrical supply and communications facilities.

NESC = National Electrical Safety Code

### 3.4.4 Communications Interference

The LORS pertaining to communications interference are listed in Table 3-4.

**Table 3-4: Communications Interference LORS**

LORS	Applicability
47 CFR 15.25, "Operating Requirements, Incidental Radiation"	Prohibits operations of any device emitting incidental radiation that causes interference to communications; the regulation also requires mitigation for any device that causes interference.
GO-52, CPUC	Covers all aspects of the construction, operation, and maintenance of power and communication lines, and specifically applies to the prevention or mitigation of inductive interference.



### 3.4.5 Avian Safety

Table 3-5 lists the aviation safety LORS that may apply to the proposed transmission interconnection and the overall project.

**Table 3-5: Avian Safety LORS**

LORS	Applicability
Title 14 CFR, Part 77, "Objects Affecting Navigable Airspace"	Describes the criteria used to determine whether a "Notice of Proposed Construction or Alteration" (FAA Form 7450-1) is required for potential obstruction hazards.
FAA Advisory Circular No. 70/7450-1G, "Obstruction Marking and Lighting"	Describes the FAA standards for marking and lighting of obstructions as identified by FAA Regulations Part 77.

NPCA = Notice of Proposed Construction or Alteration

### 3.4.6 Fire Hazards

Table 3-6 lists the LORS governing fire hazard protection for the proposed transmission interconnection and the overall project.

**Table 3-6: Fire Hazard LORS**

LORS	Applicability
14 CCR Sections 1250-1258, "Fire Prevention Standards for Electric Utilities"	Provides specific exemptions from electric pole and tower firebreak and electric conductor clearance standards and specifies when and where standards apply.
ANSI/IEEE 80, "IEEE Guide for Safety in AC Substation Grounding"	Presents guidelines for assuring safety through proper grounding of AC outdoor substations.
GO-95, CPUC, "Rules for Overhead Electric Line Construction," Section 35	CPUC rule covers all aspects of design, construction, operation, and maintenance of electric transmission line and fire safety (hazards).

### 3.4.7 Jurisdiction

Table 3-7 identifies national, state, and local agencies with jurisdiction to issue permits or approvals, conduct inspections, or enforce the above-referenced LORS. Table 3-7 also identifies the responsibilities of these agencies as they relate to Pecho Project construction, operation, and maintenance.

**Table 3-7: National, State, and Local Agencies with Jurisdiction over Applicable LORS**

LORS	Applicability
FAA	Establishes regulations for marking and lighting of obstructions in navigable airspace (AC No. 70/7450-1G).
CEC	Jurisdiction over new transmission lines associated with thermal power plants that are 50 MW or more (PRC 25500).
CEC	Jurisdiction of lines out of a thermal power plant to the first point of interconnection with the grid (PRC 25107).

LORS	Applicability
CPUC	Regulates construction and operation of overhead transmission lines (GO-95).
CPUC	Regulates construction and operation of power and communications lines for the prevention of inductive interference (GO-52).
Local Electrical Inspector	Jurisdiction over safety inspection of electrical installations that connect to the supply of electricity (NFPA 70).
San Luis Obispo County	<p>Establishes and enforces zoning regulations for specific land uses. Issues variances in accordance with zoning ordinances.</p> <p>Issues and enforces certain ordinances and regulations concerning fire prevention and electrical inspection.</p>

PRC = Public Resources Code