APPENDIX D
ELECTRICAL ENGINEERING DESIGN AND CRITERIA

1.0 INTRODUCTION

This appendix summarizes the codes, standards, criteria, and practices that will be generally used in the design and construction of electrical engineering systems for the Pio Pico Energy Center (PPEC). More specific project information will be developed prior to construction of the project to support detailed design, engineering, material procurement, and construction specifications as required by the California Energy Commission (CEC).

2.0 CODES AND STANDARDS

The design of the electrical systems, subsystem, and components will be in accordance with the applicable laws, ordinances, and regulations of the federal government, State of California, and local agencies, as well as industry standards. The most current issue or revision of rules, regulations, codes, ordinances, and standards at the time of the filing of this Application for Certification will apply, unless otherwise noted. If conflicts exist between the cited documents, the more conservative requirement shall apply.

The following codes and standards are applicable to the electrical aspects of the power facility.

- American National Standards Institute (ANSI)
- American Society for Testing and Material (ASTM)
- Anti-Frication Bearing Manufacturers Association (AFBMA)
- California Electrical Code
- Illuminating Engineering Society (IES)
- Insulated Cable Engineers Association (ICEA)
- Institute of Electrical and Electronics Engineers (IEEE)
- National Electrical Manufacturers Association (NEMA)
- National Electrical Safety Code (NESC)
- National Fire Protection Association (NFPA)
- Underwriters Laboratories, Inc. (UL)

3.0 SWITCHYARD AND TRANSFORMERS

3.1 SWITCHYARD

The facility switchyard will be located on the project site's eastern portion, directly adjacent to the power block portion of the project site. It will be interconnected to the existing San Diego Gas and Electric Company (SDG&E) Otay Mesa switchyard located approximately

1,800' east of the facility switchyard and connected via overhead bare aerial cables. A portion of the 230kV transmission line to the SDG&E switchyard may be routed underground, depending on the detailed design of the final routing. The facility switchyard will be of the air-insulated aluminum bus type and consist of high-voltage sulfur hexafluoride (SF_6)-insulated dead-tank circuit breakers arranged in a radial configuration. Connections to the nodes will be provided for each generator and for interconnecting to the utility grid. Each circuit breaker will be equipped with a no load break, air-insulated, disconnect switch on each side. Air-insulated aluminum strain bus will be used as the primary bus construction and interconnection material within the switchyard. The strain buses will be attached to strain insulators on structural steel A frame supports.

Current and voltage transformers will be located at points within the switchyard to provide for metering and relaying.

Control, protection, and monitoring panel or devices for the switchyard will be in the electrical building and generation control module. Monitoring and alarms will be available to the distributed control system (DCS) operator workstations in the control room. The 125 volts DC (VDC)(direct current) battery system will provide control and protection voltage to circuit breakers.

The switchyard design will meet the requirements of the National Electrical Safety Code-ANSI C2.

A grounding grid will be provided to control step and touch potentials in accordance with IEEE Standard 80, Safety in Alternating Current (AC) Substation Grounding. All equipment, structures, and fencing will be connected to the grounding grid of buried bare copper conductors and ground rods, as required. The switchyard ground grid will be tied to the plant ground grid.

Lightning protection will be provided by shield wires and/or lightning masts for any overhead lines. The lightning protection system will be designed in accordance with IEEE 998 guidelines.

All electrical faults will be detected, isolated, and cleared in a safe and coordinated manner as soon as practical to ensure the safety of equipment, personnel, and the public. Protective relaying will meet IEEE requirements and will be coordinated with SDG&E's requirements.

The protection will be designed to maintain integrity when isolating a faulted node. Each circuit breaker will be provided with independent breaker failure relay protection schemes. Breaker failure protection will be accomplished by protective and timing relays for each breaker. Each 230-kilovolt (kV) circuit breaker will have two redundant trip coils.

Interface with SDG&E's supervisory control and data acquisition (SCADA) system will be provided. Interface will be at the interface terminal box and remote terminal unit (RTU). Communication between the facility switchyard and the SDG&E switchyard will be included.

3.2 TRANSFORMERS

Each generator will be connected to the 230kV switchyard through a separate 230kV - 13.8kV generator step-up transformer (GSU). Each GSU will be designed in accordance with ANSI standards C57.12.00, C57.12.90, and C57.116. GSU transformers will be two-winding, delta-wye, oil nonforced air nonforced (ONAN)/oil nonforced air forced (ONAF)/ONAF cooling, and 65 degrees Celsius (°C) oil temperature rise. The neutral point of the high-voltage wye-connected winding will be solidly grounded. Each GSU will have metal oxide surge arrestors adjacent to the high-voltage bushing terminals. Each GSU will have manual de-energized (“no-load”) tap changer located in the high-voltage windings.

Two of the three generators will be connected to the GSUs through low-side generator breakers to allow taps for unit auxiliary transformers. The other generator will be connected directly to its respective GSU. The unit auxiliary transformers step the 13.8kV down to 4,160 volts (V) and connect to 4,160V switchgear via a nonsegregated phase bus duct to main circuit breakers to supply facility 4160V loads. A normally open tiebreaker between the two 4160V switchgears will allow a single unit auxiliary transformer to supply the entire facility load. Each unit auxiliary transformer’s 4160V winding neutrals will be connected to the ground grid through low-impedance grounding resistors to limit the system ground fault current.