APPENDIX 10D

Electrical Engineering Design Criteria

10D.1 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 Eastshore Energy Center Project. More specific project information will be developed during execution of the project to support detailed design, engineering, material procurement specification, and construction specifications.

10D.2 Codes and Standards

The design of the electrical systems and components will be in accordance with the laws and regulations of the federal government and the State of California, local ordinances, and industry standards. The current issue or revision of the documents at the time of filing this Application for Certification will apply, unless otherwise noted. If there are conflicts between the cited documents, the more conservative requirement will 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 Materials (ASTM)
- Anti-Friction Bearing Manufacturers Association (AFBMA)
- California Building Standards Code 2001
- California Public Utility Commission, General Order 95
- California Occupational Safety and Health Act (OSHA)
- National Electrical Testing Association (NETA)
- California Electrical Code 1998
- Insulated Cable Engineers Association (ICEA)
- Institute of Electrical and Electronics Engineers (IEEE)
- Illuminating Engineering Society (IES)
- National Association of Corrosion Engineers (NACE)
- National Electrical Code (NEC)
- National Electrical Manufacturers Association (NEMA)
- National Electrical Safety Code (NESC)
- National Fire Protection Association (NFPA)
- Underwriters Laboratories, Inc. (UL)

10D.3 Switchyard and Transformers

10D.3.1 115-kV Switchyard

The 13.8-kV power generated by each of the fourteen (14) Wartsila 20V34SG engine - generators is fed into the plant switchyard where it is stepped up to 115-kV for delivery into the new 115-kV transmission line, which will be connected to the existing PG&E Eastshore Substation. The plant 115-kV switchyard will consist of two step-up transformers (GSUs), circuit breakers, disconnect switches and other high-voltage equipment as described in Section 5.2.3. The proposed power distribution system for the power generating plant is illustrated on Figure 5.2-1.

The power plant auxiliary load will be powered by two redundant 13.8-kV/480V auxiliary transformers, connected to the generators and the GSUs on the auxiliary transformer's high side, and to the 480V distribution switchgear on the auxiliary transformer's low-side. The auxiliary transformers and the power distribution system will be sized to provide 100% redundant power to the auxiliary loads, in the event of failure of either one of the auxiliary transformers.

The auxiliary transformers will be oil-filled and will be installed such that the units will not present hazardous conditions to the surrounding equipment or structures in case of fire or catastrophic failure. These measures will include perimeter fencing around the units, an oil containment basin under the auxiliary transformers, and other safety provisions such as lockable compartments, warning signs and proper working clearance.

The generating units will be connected to two 15 kV busses in a cluster of seven engine-generating units for each bus, which are interconnected via a normally opened tie-circuit breaker. Each 15 kV bus is then connected to the respective auxiliary transformer and the GSU via underground cable-in-conduit feeders.

A grounding grid inside and around the power plant will be provided to control step and touch potentials in accordance with IEEE Standard 80, Safety in Substation Grounding. Metallic equipment, structures, and fencing will be connected to the grounding grid of buried conductors and ground rods, as required for personnel safety. The 115-kV switchyard ground grid will be tied to the plant ground grid.

Lightning protection will be provided by shield wires for the 115-kV switchyard only. The lightning protection system will be designed in accordance with IEEE 998 guidelines.

All 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 the utility.

Revenue metering will be provided on the 13.8-kV generator bus to record net power to or from the switchyard. Meters and a metering panel will be provided.

10D.3.2 Power Plant Electrical System

The low-voltage distribution system will power all of the auxiliary loads and house loads via motor control centers (MCCs), 480V distribution panels and conduit and cable systems.

Auxiliary equipment will be fed from the same source as its major equipment to the extent possible, or interconnected to permit proper startup and shutdown of such equipment.

The low-voltage equipment and devices will be rated and protected to ensure safe operation of the generating units and associated auxiliary equipment.

Under normal operating conditions, plant startup power will be fed back from the grid via the 115-kV switchyard and metered separately by PG&E. In addition, a separate 480 service from PG&E will provide house load power on a continuous basis and metered separately by PG&E. Alternatively, during emergency conditions power will be provided by a 225 kW, 480V black-start generator, which will be connected to the 480V distribution system and will enable the start-up of one engine-generator, which when operational will then provide sufficient power for all of the plant auxiliaries, and will allow shutdown of the black-start generator.

The electrical power system within the power plant will also include a 125V DC battery back-up power system for switchgear protection, metering and communication systems. The DC power supply will include batteries, chargers and distribution panels all rated and design to provide up to 8-hours of Dc power.

In addition, a 24V uninterruptible power system (UPS) will be provided to power emergency circuits, computer-based controls and California metering and monitoring equipment. The UPS system will be sized to provide a minimum of 60 minutes of fully rated power to the connected load.