SECTION 10.0

Engineering

10.1 Introduction

In accordance with California Energy Commission (CEC) regulations, this section, together with the engineering appendices and Sections 6.0 and 7.0 (Gas Supply and Water Supply, respectively), presents information concerning the design and engineering of the Vernon Power Plant (VPP). It describes the design of the facility with reference to Section 2.0, Project Description and discusses the reliability and estimated thermal efficiency of the facility. The laws, ordinances, regulations, and standards (LORS) applicable to the engineering of the VPP are provided along with a list of agencies that have jurisdiction, the contact persons within those agencies, and a list of the permits that will be required.

10.2 Facility Design

A detailed description of the VPP project is provided in Subsection 2.2, Generating Facility Description, Design, and Operation. Design for safety is provided in Subsection 2.3, Facility Safety Design.

Appendix 8.15A contains an Initial Geotechnical Report for the VPP site based on borings taken at the project site.

Summary descriptions of the design criteria are included in the following appendices:

- Appendix 10A, Civil Engineering Design Criteria
- Appendix 10B, Structural Engineering Design Criteria
- Appendix 10C, Mechanical Engineering Design Criteria
- Appendix 10D, Electrical Engineering Design Criteria
- Appendix 10E, Control Engineering Design Criteria
- Appendix 10F, Chemical Engineering Design Criteria
- Appendix 10G, Geologic and Foundation Design Criteria

Design and engineering information and data for the following systems are found in the following subsections of this AFC:

- **Power Generation**—See Subsection 2.2.4, Combustion Turbine Generators (CTGs), Heat Recovery Steam Generators (HRSGs), Steam Turbine Generator (STG), and Condenser. Also see Appendix 10C and Subsections 2.2.5 through 2.2.9, which describe the various plant auxiliaries.
- **Heat Dissipation**—See Subsection 2.2.8, Plant Cooling Systems, and Appendix 10C.
- **Cooling Water Supply System**—See Subsection 2.2.7, Water Supply and Use; Subsection 2.2.7.4.1, Water for the Circulating Water System; and Appendix 10F.

- **Air Emission Control System**—See Subsection 2.2.11, Emission Control and Monitoring, and Subsection 8.1, Air Quality.
- **Waste Disposal System**—See Subsection 2.2.9 and Subsection 8.13, Waste Management.
- **Noise Abatement System**—See Subsection 8.5, Noise.
- **Switchyards/Transformer Systems**—See Subsection 2.2.5, Major Electrical Equipment and Systems; Subsection 2.2.13.2, Grounding; Subsection 2.2.5.1, AC Power-Transmission; Subsection 2.2.14, Interconnect to Electrical Grid; Section 5.0, Electric Transmission; and Appendix 10D.

10.3 Facility Reliability

This subsection discusses the availability of fuel, and the expected service life of the plant and the degree of reliability to be achieved by the VPP.

10.3.1 Fuel Availability

Natural gas will be purchased from numerous gas suppliers and delivered to the VPP through the City of Vernon's high pressure transmission pipeline that is connected to Southern California Gas Company's (SoCalGas') transmission pipeline. SoCalGas is the major transporter of natural gas in Southern California. The proposed 24-inch steel gas pipeline will go east from the plant site along Fruitland Avenue to Alcoa Avenue and then north on Alcoa Avenue to East 50th Street and extend east along East 50th Street to a city gate metering station at the Fruitland Regulator Station, where it will connect to SoCalGas Line 765. SoCalGas Line 765 runs north and south along in South Downey Road (see Section 6.0). The total length of the proposed pipeline is about 2,300 feet. VPP has no backup supply of natural gas or other fuel.

10.3.2 Plant Availability

The VPP will be operated as an integral part of California's overall generation and transmission system and will be economically dispatched depending on system demand, generating cost, availability of other generating units, contractual agreements and other factors. Due to the relatively high efficiency of the VPP, it is anticipated that for normal operations, the facility will operate at high average annual capacity. The VPP will be designed to operate between approximately 25 and 100 percent of base load to support dispatch service. The VPP will be designed for an operating life of 30 years. Reliability and availability projections are based on this operating life. Operation and maintenance procedures will be consistent with industry standard practices to maintain the useful life status of plant components.

The VPP combined-cycle power block will consist of three natural-gas-fired CTGs, three HRSGs, and one STG (i.e., three-on-one combined-cycle configuration).

The VPP is projected to operate between 50 and 100 percent of the time during each of the 30 years. The percent of time that the VPP is projected to operate is defined as the "service factor." The service factor considers the amount of time that a unit is operating and generating power, whether at full or partial load. The projected service factor for the VPP,

which considers projected percentage of time of operation, differs from the equivalent availability factor (EAF), which considers the projected percentage of energy production capacity achievable. EAF is defined as a weighted average of the percentage of full energy production capacity achievable. The projected EAF for the VPP is estimated to be in the range of 92 to 98 percent. EAF differs from the "availability of a unit," which is the percentage of time that a unit is available for operation, whether at full load, partial load, or standby.

The VPP project will use up to 6,266 acre feet per year (afy) of recycled water provided by the Central Basin Municipal Water District (CBMWD) for cooling tower make-up. Cooling water will be cycled in the cooling tower approximately five times. The blowdown will be returned to the Sanitation Districts of Los Angeles County via the city's sanitary sewer.

Solid waste will be collected by the local nonhazardous waste collector. Most hazardous wastes will be collected and recycled by permitted recycling firms, and non-recyclable hazardous wastes will be collected by a licensed hazardous waste hauler and deposited in a hazardous waste landfill. For detailed information on the use of hazardous materials and management of wastes, see Subsections 8.12 and 8.13.

There are no known geologic hazards other than the remote possibility of a major earthquake (see Subsection 8.15).

Special design features are included in the VPP design to ensure power plant reliability, including redundancy of critical components (see Subsection 2.4.2, Redundancy of Critical Components).

Deterioration of output capacity and efficiency of the VPP over time, called degradation, is expected to be on the order of 2 to 3 percent over a 3-year period. Cleaning, maintenance, or overhaul will recapture most of the loss. Over the expected 30-year life of the facility, the estimated total, nonrecovered loss in output and efficiency will be on the order of 1 to 2 percent.

10.4 Thermal Efficiency

The maximum thermal efficiency that can be expected from a natural-gas-fired combined-cycle plant using Siemens SGT6-5000F combustion turbine units is approximately 47 to 53 percent on a higher heating value (HHV) basis. This level of efficiency is achieved when a facility is base-loaded. The VPP is estimated to have a thermal efficiency of 55 to 56 percent lower heating value (LHV) at base load and annual average ambient conditions. Other types of operations, particularly those at less than full gas turbine output, will result in lower efficiencies. The basis of the VPP operations will be system dispatch within California's power generation and transmission system. Although it is expected that VPP will be primarily operated as a base load unit, especially during summer months, there may be off-peak periods when the VPP will be operated in load following or cycling service. The number of startup and shutdown cycles is expected to range between zero and 365 per year per CTG.

Plant fuel consumption will depend on the operating profile of the power plant. It is estimated that the range of fuel consumed by the power plant will be from a minimum of near zero British thermal units (Btu) per hour to a maximum of approximately 6,229 million Btu per hour (higher heating value basis) at base load and minimum ambient conditions.

The net annual electrical production of the VPP cannot be accurately forecasted at the present time due to uncertainties in the system load dispatching model and the associated policies. However, due to the efficiency of the plant, its operating characteristics will be as described above. The maximum annual generation possible from the facility is estimated to be approximately 8,000 gigawatt hours (GWh) per year.

10.5 Laws, Ordinances, Regulations, and Standards

10.5.1 General Laws, Ordinances, Regulations, and Standards

The following LORS are generally applicable to the project:

- California Building Standards Code—2001
- Uniform Fire Code, Article 80
- Occupational Safety and Health Act—29 CFR 1910 and 29 CFR 1926
- Environmental Protection Agency—40 CFR 60, 40 CFR 75, 40 CFR 112, 40 CFR 302, 40 CFR 423, 40 CFR 50, 40 CFR 100, 40 CFR 260, 40 CFR 300, and 40 CFR 400
- California Code of Regulations—Title 8, Sections 450 and 750 and Title 24, 2001, Titles 14, 17, 19, 20, 22, 23, 26, and 27
- California Department of Transportation—Standard Specifications
- California Occupational Safety and Health Administration—Regulations and Standards
- California Business and Professions Code—Sections 6704, 6730, and 6736
- California Vehicle Code—Section 35780
- California Labor Code—Section 6500
- Federal Aviation Agency—Obstruction Marking and Lighting AC No. 70/7460-1H
- City of Vernon—Regulations and Ordinances

Codes and standards pertinent to the generating facility are presented in Engineering Appendices 10A through 10F. The applicable local LORS and local agency contacts involved in administration and enforcement are described below.

10.5.2 Local LORS

The VPP site zoning is consistent with the development of a generating facility (see Subsection 8.4, Land Use).

The VPP site is located within the city limits of the City of Vernon, in an area zoned for industrial use, and will therefore be subject to all applicable regulations of the City of Vernon.

10.6 Local Agency Contacts

Table 10.6-1 lists local agency contacts.

TABLE 10.6-1
Local Agency Contacts

Agency	Contact	Title	Telephone
City of Vernon Fire Services	Mark Whitworth	Fire Chief	(323) 583-8811 ext. 280
City of Vernon	Lewis Pozzebon	Director of Environmental Health	(323) 583-8811 ext. 229
City of Vernon	Kevin Wilson	Director of Community Services and Water	(323) 583 8811 ext. 245

10.7 Local Permits Required and Permit Schedule

After the receipt of the approval of project design, several permits will be required. These include a Building Permit, a Grading Permit, and a Certificate of Occupancy. The requirements of these three permits are summarized in Table 10.7-1.

TABLE 10.7-1
Permits and Agency Contacts

Permit or Approval	Schedule	Agency Contact	Applicability
Approval of Grading Plan; issuance of construction, grading, and building permits	Minimum of 30 days prior to construction	Mr. Kevin Wilson City of Vernon Community Services 4305 Santa Fe Avenue Vernon, CA 90058 (323) 583-8811 ext 243	Site grading, and excavation at site or along linear project features within public rights-of-way
Certificate of Occupancy	Completion of construction	Mr. Kevin Wilson City of Vernon Community Services 4305 Santa Fe Avenue Vernon, CA 90058 (323) 583-8811 ext 243	Occupancy of facilities once construction is completed.