SECTION 10.0

Engineering

10.1 Introduction

In accordance with California Energy Commission (CEC) regulations, this section, together with the engineering appendixes and Sections 6.0 and 7.0 (Gas Supply and Water Supply, respectively), presents information concerning the design and engineering of the AES Highgrove Project. Subsection 10.2 describes the design of the facility with reference to Section 2.0, Project Description. Subsection 10.3 discusses the reliability of the facility. Subsection 10.4 presents the estimated thermal efficiency of the facility. Subsection 10.5 describes the laws, ordinances, regulations, and standards (LORS) applicable to the engineering of the Highgrove Project. Subsection 10.6 identifies agencies that have jurisdiction and the contact persons within those agencies. Subsection 10.7 lists the permits that will be required.

10.2 Facility Design

A detailed description of the Highgrove 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.

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 sections of this AFC:

- **Power Generation**—See Subsection 2.2.4, Combustion Turbine Generators (CTGs). Also see Appendix 10C and Subsections 2.2.5 through 2.2.9, which describe plant auxiliaries.
- **Heat Dissipation**—See Subsection 2.2.8, Plant Cooling Systems, and Appendix 10C.
- **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, the expected service life of the plant, and the degree of reliability to be achieved by the Highgrove Project.

10.3.1 Fuel Availability

The Highgrove Project will be connected to Southern California Gas Company's (SoCalGas's) existing high-pressure pipeline (Line 2001) located approximately 7 miles south of the Project Site. There is sufficient capacity in SoCalGas' existing line to deliver the required quantity of gas to the project. It is conceivable that SoCalGas' pipeline could become temporarily inoperable if there is a breach in the pipeline upstream or from other causes such as a compressor failure, resulting in fuel being unavailable at the plant. Because the project has no backup supply of natural gas or other fuel, it would have to be shut down until the situation was corrected.

10.3.2 Plant Availability

Due to the Highgrove Project's predicted high efficiency relative to other units traditionally used for peaking service, it is anticipated that the facility will be called upon to operate at annual capacity factors between 20 and 40 percent. The facility will be designed to operate between approximately 50 to 100 percent of baseload to support dispatch service and automatic generation control in response to customer demands for electricity.

The Highgrove Project will be designed for an operating life of 30 years. Reliability and availability projections are based on this operating life. Operations and maintenance procedures will be consistent with industry standard practices to maintain the useful life of plant components.

The percent of time that the power plant is projected to be operated 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 simple-cycle power block, which is based on the percentage of time a unit or plant is operated, differs from the "equivalent availability factor" (EAF), which is based on the projected percentage of energy production capacity achievable at any point in time. The EAF may be defined as a weighted average of the percent of full energy production capacity achievable. The projected EAF for the Highgrove Project is estimated to be in the range of 92 to 98 percent. The 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.

There are no known geologic hazards other than the possibility of a major earthquake (see Subsection 8.15, Geologic Hazards and Resources).

The Highgrove Project will be designed to ensure high plant reliability, including the redundancy of critical components (see Subsection 2.4.2, Redundancy of Critical Components).

Deterioration of output capacity and efficiency of the project over time, called performance degradation, is expected to be on the order of 2 to 3 percent over a 3-year period, depending on the amount of time the unit is operated. Cleaning, maintenance, or overhaul will recapture most of the loss. Over the expected 30-year life of the facility, the estimated total, non-recoverable loss in output and efficiency is anticipated to be on the order of 1 to 2 percent.

10.4 Efficiency

The maximum thermal efficiency that can be expected from each individual CTG is approximately 44 to 47 percent on a higher heating value (HHV) basis. This level of efficiency will be achieved when the CTGs are operating at 100 percent of baseload. The Highgrove Project will be designed as a peaking facility to serve load during periods of high demand and is therefore expected to typically operate at no more than a 30 percent annual capacity factor. Because the capacity will be sold through contract and the prices that will be offered for spot market purchases are unknown at this time, the exact mode of operation cannot be prescribed. The maximum annual generation possible from the facility, based on the expected permitted operating limits, is estimated to be between 365 and 750 gigawatt hours (GWh).

10.5 Laws, Ordinances, Regulations, and Standards (LORS)

10.5.1 General LORS

The following LORS are generally applicable to the project.

TABLE 10.5-1
Applicable Laws, Ordinances, Regulations, and Standards

LORS	Location in AFC for Facility Design Compliance	Conformance
Federal		
Occupational Safety and Health Act— 29CFR1910 and 29CFR126	Section 10	Meet Requirements
Environmental Protection Agency— 40CFR60, 40CFR75, 40CFR112, 40CFR302, 40CFR423, 40CFR50, 40CFR100, 40CFR260, 40CFR300, and 40CFR400	Section 8 & 10	Meet Requirements
Federal Aviation Administration—Obstruction Marking and Lighting AC No. 70/74601H	Section 6 & 10	Meet Requirements
California		
California Code of Regulations— Title 8, Sections 450 and 750 and Title 24, 1995, Titles 14, 17, 19, 20, 22, 23, and 26.	Section 10	Meet Requirements
California Department of Transportation— Standard Specifications	Section 10	Meet Requirements

TABLE 10.5-1
Applicable Laws, Ordinances, Regulations, and Standards

LORS	Location in AFC for Facility Design Compliance	Conformance
California Occupational Safety and Health Administration—Regulations and Standards	Section 10	Meet Requirement
California Business and Professions Code—Sections 6704, 5730, and 6736	Section 10	Meet Requirements
California Vehicle Code—Section 35780	Section 10	Meet Requirements
California Labor Code—Section 6500	Section 10	Meet Requirements
Local		
City of Grand Terrace—Regulations and Ordinances	Section 10	Meet Requirements
Industrial		
Civil Engineering Design Criteria	Appendix 10A	Meet Design Criteria
Structural Engineering Design Criteria	Appendix 10B	Meet Design Criteria
Mechanical Engineering Design Criteria	Appendix 10C	Meet Design Criteria
Control Engineering Design Criteria	Appendix 10E	Meet Design Criteria
Chemical Engineering Design Criteria	Appendix 10F	Meet Design Criteria
Geologic and Foundation Design Criteria	Appendix 10G	Meet Design Criteria

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

Zoning for the Highgrove Project site is consistent with the development of a generating facility (see Section 8.4, Land Use).

The Highgrove Project site is located within the city limits of the City of Grand Terrace, in an area zoned for industrial use, and will therefore be subject to applicable regulations of the City of Grand Terrace. The project will conform to all of these LORS, as shown in Table 10.5-1.

10.6 Local Agency Contacts

Table 10.6-1 lists local agency contacts.

TABLE 10.6-1
Local Agency Contacts

Agency	Contact	Title	Telephone
San Bernardino County Fire Department	Carmen Conti	Fire Marshall	(909) 368-8465
City of Grand Terrace	Gary Koontz	Community Development Director	(909) 824-6621
San Bernardino County Fire Department	Doug Snyder	Supervisor, Hazardous Materials Division CUPA Program	(909) 386-8401

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. These three permits are described in the City of Grand Terrace's Municipal Ordinance.