10. ENGINEERING

In accordance with CEC regulations, this section and its related appendices and Sections 2, 5, 6, and 7 present information concerning the design and engineering of the RCEC and the AWT plant. Section 10.1 describes the design of these project facilities with reference to Section 2, the Project Description. Section 10.2 discusses the reliability of the RCEC, and Section 10.3 presents the estimated thermal efficiency of the facility. Section 10.4 describes the LORS applicable to the RCEC engineering, and Section 10.5 identifies agencies that have jurisdiction, and provides the contact persons within those agencies.

10.1 FACILITY DESIGN

Detailed descriptions of the RCEC and the AWT plant are provided in Sections 2.2, and 2.3 respectively. Design for safety is provided in Section 2.2.17, Facility Safety Design.

A preliminary geotechnical assessment of the proposed site, including core borings, is in progress. Copies of the Preliminary Geotechnical Report will be provided to the CEC when it becomes available.

Summary descriptions of the design criteria are included in: Appendix 10-A, Civil Engineering Design Criteria; Appendix 10-B, Structural Engineering Design Criteria; Appendix 10-C, Mechanical Engineering Design Criteria; Appendix 10-D, Electrical Engineering Design Criteria; Appendix 10-E, Control Engineering Design Criteria; and Appendix 10-F, Chemical Engineering Design Criteria.

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

- **Power Generation**—See Section 2.2.4 regarding the CTG, HRSG, and STG. Also see Appendix 10-C and Sections 2.2.5 through 2.2.13, which describe the various plant auxiliaries.
- **Heat Dissipation**—See Section 2.2.8, Plant Cooling System, and Appendix 10-C.
- **Cooling Water Supply System**—See Section 2.2.7, Water Supply, Section 2.2.8, Plant Cooling System, and Appendix 10-F.
- **Air Emission Control System**—See Section 2.2.11 Emission Control and Monitoring, and Section 8.1, Air Quality.
- **Waste Disposal System**—See Section 2.2.9 and 8.14, Waste Management.
- **Noise Abatement System**—See Section 8.7, Noise, and Appendix 10-C.
- **Switchyards/Transformer Systems**—See Section 2.2.5, Major Electrical Equipment and Systems; 2.2.13.2, Grounding; Section 2.2.5.1, AC Power-Transmission; Section 2.2.14, Interconnect to Transmission Line; Section 6, Electrical Transmission; and Appendix 10-D, Electrical Engineering Design Criteria.

10.2 RELIABILITY

This section discusses the availability of fuel, the expected service life of the plant, and the degree of reliability to be achieved by the RCEC and the AWT plant.

10.2.1 Fuel Availability

The new dedicated gas supply pipeline to the RCEC will be connected to PG&E's line 153, about 1.1 miles east of the RCEC SITE. Line 153 is capable of delivering the required quantity of gas to the RCEC. It is conceivable that PG&E's transmission line or the new branch pipeline from the Line 153 to the RCEC could become temporarily inoperable if there is a breach in one of the lines or from other causes, resulting in fuel being unavailable at the RCEC. The RCEC facility has no backup fuel supply and would, therefore, have to be shut down until the situation was corrected.

10.2.2 Plant Availability

The RCEC will be a merchant facility and will therefore operate as dictated by contractual power supply obligations and the relative cost of power generation from the facility, rather than current market pricing for power. Due to the relatively high efficiency of the RCEC, it is anticipated that the facility will normally operate at a high average annual capacity. The RCEC will be designed to operate between approximately 50 and 100 percent of baseload to support sales to the power market. The RCEC will be designed for an operating life of 30 years. Reliability and availability projections are based on this operating life. O&M procedures will be consistent with industry standard practices to maintain the useful life status of plant components.

The RCEC combined-cycle power block will consist of two natural gas-fired CTGs, two HRSGs with natural gas-fired duct burners, and one STG.

The combined-cycle power block is projected to operate between 50 and 100 percent of each year during each of the 30 years. The percentage of time that the combined-cycle power block 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 combined-cycle power block, 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 RCEC 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 or partial load or on standby.

There are no known geologic hazards other than the remote possibility of a major earthquake (see Section 8.4).

The RCEC and the AWT plant will be designed to ensure high reliability, including the redundancy of critical components (see Section 2.2.18.2, Redundancy of Critical Components).

Deterioration of output capacity and efficiency of the RCEC over time, called maturation, 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.

10.3 EFFICIENCY

The maximum thermal efficiency that can be expected from a large natural gas-fired combined-cycle plant is approximately 55 percent. This level of efficiency is achieved when a facility is base-loaded. Other types of operations, particularly those at less than full gas turbine output, will result in lower efficiencies. Potential operating scenarios for the plant vary virtually continuous base-load operation during its early life to a very low facility capacity factor near the end of its operating life as new technologies displace today's best. The number of plant startup and shutdown cycles is expected to range between zero and over 300 per year per CTG. The actual number of hot startups and cold startups cannot be predicted at this time.

The RCEC's net annual electrical production cannot be forecast accurately at the present time because the plant will operate in a deregulated environment. The maximum annual generation possible from the facility is estimated to be between 4,500 and 4,850 gigawatt hours (GWh). The amount of power generated during plant startups and shutdowns can also only be estimated roughly. The range of startup/shutdown generation possible begins near zero megawatt hours (MWh) per year and increases to a maximum of 250 to 300 GWh per year.

10.4 LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

The LORS that are applicable to the design of the RCEC and AWT plant are referenced in Table 10.4-1 below. LORS applicable to the environmental areas of the AFC (sections 8.1 through 8.16) are contained within each of the environmental sections. The project will conform to all of these LORS.

The Appendices to Chapter 10 contain the discipline design criteria that will be used in design. Appendix 10-A and Appendix 10-B address the physical design criteria for the site-related features, structures, and foundations of the RCEC.

Table 10.4-1. Applicable laws, ordinances, regulations, and standards.

LORS	Location in AFC for Facility Design Compliance	Conformance
Federal:		
Occupational Safety and Health Act (OSHA)—29CFR1910 and 29CFR126	Section 10	Meet Requirements
Environmental Protection Agency (EPA)—40CFR60, 40CFR75, 40CFR112, 40CFR302, 40CFR423, 40CFR50, 40CFR100, 40CFR260, 40CFR300, and 40CFR400	Section 8 & 10	Meet Requirements
Federal Aviation Agency (FAA)—Obstruction Marking and Lighting AC No. 70/74601H	Section 5 & 10	Meet Requirements
California:		
California Code of Regulations (CCR)— 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 (Cal-DOT)—Standard Specifications	Section 10	Meet Requirements

Table 10.4-1. (continued)

LORS	Location in AFC for Facility Design Compliance	Conformance
California Occupational Safety and Health Administration (Cal-OSHA)—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 Hayward—Regulations and Ordinances	Section 10	Meet Requirements
County of Alameda—Regulations and Ordinances	Section 10	Meet Requirements
Industrial:		
Civil Engineering Design Criteria	Appendix 10-A	Meet Design Criteria
Structural Engineering Design Criteria	Appendix 10-B	Meet Design Criteria
Mechanical Engineering Design Criteria	Appendix 10-C	Meet Design Criteria
Control Engineering Design Criteria	Appendix 10-E	Meet Design Criteria
Chemical Engineering Design Criteria	Appendix 10-F	Meet Design Criteria
Geologic and Foundation Design Criteria	Appendix 10-G	Meet Design Criteria

Appendices 10-C through 10-F provide the design criteria for the RCEC and AWT plant systems and equipment, including the codes and standards that apply to the design, materials, fabrication and erection of the systems and equipment. The project will also comply fully with these codes and standards.

Appendix 10-G, Geologic and Foundation Criteria, will be provided later and will include the results of the subsurface investigation, laboratory testing program, and preliminary geotechnical assessment of the RCEC. The preliminary foundation design considerations and criteria will be provided for the RCEC structures in Appendix 10-G when available.

10.5 INVOLVED AGENCIES AND AGENCY CONTACTS

Building Permits for the RCEC and the AWT plant would be issued by the Hayward Department of Community and Economic Development acting as a delegate CBO for CEC Compliance. A point of contact is provided in Table 10.4-2.

Table 10.4-2. Agency Contacts

Agency	Contact	Telephone
City of Hayward Department of Community and Economic Development	Dyana Anderly Planning Manager	(510) 583-4214

10.6 PERMITS AND PERMITTING SCHEDULE

A detailed schedule for submittal of all plans and specifications that require review by the local Chief Building Official (CBO) will be prepared well in advance of the start of construction of either the RCEC or the AWT plant.

Russell City Energy Center AFC

May 2001