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| **Organization:** | Ch2mhill/Carrier |
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SECTION 10.0

# Engineering

In accordance with CEC regulations, this section and its related appendices and Sections 5.0, 6.0, and 7.0 present information concerning the design and engineering of CPP. Section 10.1 describes the design of the facility with reference to Section 2.0, Project Description. Section 10.2 discusses the reliability of CPP, and Section 10.3 presents the estimated thermal efficiency of the facility. Section 10.4 describes the LORS applicable to CPP engineering, identifies agencies that have jurisdiction, and provides the contact persons within those agencies.

## 10.1 Facility Design

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

A geotechnical assessment 0.5 mile north of CPP at the Ranch Seco Plant for the dry fuel storage facility was performed in 1993 (see Exhibit A to Appendix 10G). This report was the basis for estimating the geotechnical conditions at the CPP site.

Summary descriptions of the design criteria are included in: 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; and Appendix 10G, Geologic and Foundation 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 10C, Mechanical Engineering Design Criteria, and Sections 2.2.5 through 2.2.8 and 2.2.13, which describe the various plant auxiliaries.
- **Heat Dissipation –** See Section 2.2.8, Plant Cooling System, and Appendix 10C, Mechanical Engineering Design Criteria.
- **Cooling Water Supply System –** See Section 2.2.7, Water Supply and Use, Section 2.2.7.4.1, Water for the Circulating Water System, Section 2.2.7.4.3 and Section 2.2.8, which describe other water systems, and Appendix 10F, Chemical Engineering Design Criteria.
- **Air Emission Control System –** See Section 2.2.11 Emission Control and Monitoring, and Section 8.1, Air Quality.
- **Waste Disposal System –** See Sections 2.2.9 and 8.13, Waste Management.

- **Noise Abatement System –** See Section 8.5, Noise, and Appendix 10C, Mechanical Engineering Design Criteria.
- **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 Electrical Grid; Section 5, Electric Transmission; and Appendix 10D, 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 CPP.

## 10.2.1 Fuel Availability

The new, dedicated fuel supply pipeline to CPP will be an extension of the District's existing Line 700 at its Carson Ice-Gen Project. This line, in turn, is connected to PG&E lines 400 and 401 near Winters, California. It is conceivable that the District's line or the new branch pipeline from Line 700 to the CPP could become temporarily inoperable if there is a breach in one of the lines or from other causes, resulting in fuel being unavailable at CPP. The CPP facility has no backup fuel supply and would, therefore, have to be shut down until the situation was corrected.

## 10.2.2 Plant Availability

CPP will be a utility facility; it will operate as dictated by the District's power supply obligations and the relative cost of power generation from the facility compared to other mix of the District's generation. Due to the relatively high efficiency of CPP, it is anticipated that the facility will normally operate at a high average annual capacity. CPP will be designed to operate between approximately 25 and 100 percent of baseload to support supply to the District's system and to the northern California grid. CPP 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 status of plant components.

Each CPP combined-cycle power block will consist of two natural-gas-fired CTGs, two HRSGs, and one STG (two-on-one combined-cycle configuration). The plant will have two power blocks constructed in two phases.

Each combined-cycle power block is projected to operate between 50 and 100 percent of the time 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 CPP 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.

Cooling tower makeup water for CPP will be water from Lake Natoma reservoir via the Folsom-South Canal; backup supply will be the Rancho Seco Reservoir. Process makeup water and water for potable use at CPP will also be provided by the same sources and will be treated as necessary at the CPP site prior to use.

Waste disposal of nonhazardous cooling water will be a discharge into Clay Creek. Sanitary sewer wastes and other nonhazardous industrial wastewater streams will be discharged to an onsite packaged treatment system draining into a leach field, the sludge from which will be removed by truck for off-site disposal. A local nonhazardous waste collector will collect solid waste. Most hazardous wastes will be collected and recycled by permitted recycling firms, and hazardous wastes that cannot be recycled will be collected by a licensed hazardous waste hauler and deposited in a licensed hazardous waste landfill. For detailed information on the use of hazardous materials and management of wastes, see Sections 8.12 and 8.13.

There are no known geologic hazards other than the remote possibility of a major earthquake (see Section 8.15). The plant is located away from any 100-year flood zones (see Section 8.14).

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

Deterioration of output capacity and efficiency of CPP over time, called maturation, is expected to be on the order of 2 to 3 percent over a 5-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. The primary basis of CPP operations will be to provide electricity to customers at the best possible rates. Potential operating scenarios for the plant vary from a very low facility capacity factor to an essentially base-load plant. The number of plant startup and shutdown cycles is expected to range between zero and 180 per year per CTG. The actual number of hot startups and cold startups cannot be predicted at this time.

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 near a maximum at base load. Heat and mass balances are provided for peak and lowest expected temperatures (Figures 10.3-1 and 10.3-2). Heat and mass balances for average operation are found in Section 2.0 and described in Section 2.2.4.

CPP's net annual electrical production cannot be forecast accurately at the present time because the plant will operate in a highly variable electrical demand environment. The annual generation from the facility is estimated to be 4,290 gigawatt hours (GWh) per power block or 8,580 GWh from CPP. The number of hours CPP will operate at various logical load points will depend ultimately on power demand conditions. Possible operating scenarios are discussed in Section 2.2.16, Power Plant Operation.

# 10.4 Laws, Ordinances, Regulations, and Standards

The LORS that are applicable to the design of CPP are referenced in Table 10.4-1. 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 Section 10 contain the design criteria that will be used. Appendix 10A and Appendix 10B address the physical design criteria for the site-related features, structures, and foundations of the facility.

Appendices 10C through 10G provide the design criteria for CPP 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.

**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 10.0 | Meet Requirements |
| Environmental Protection Agency (EPA) – 40CFR60, 40CFR75, 40CFR112, 40CFR302, 40CFR423, 40CFR50, 40CFR100, 40CFR260, 40CFR300, and 40CFR400 | Sections 8.0 and 10.0 | Meet Requirements |
| Federal Aviation Agency (FAA) – Obstruction Marking and Lighting AC No. 70/74601H | Sections 6.0 and 10.0 | 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 10.0 | Meet Requirements |
| California Department of Transportation (Cal-DOT)-Standard Specifications | Section 10.0 | Meet Requirements |

**TABLE 10.4-1**
Applicable Laws, Ordinances, Regulations, and Standards

| LORS | Location in AFC for Facility Design Compliance | Conformance |
|---|---|---|
| California Occupational Safety and Health Administration (Cal-OSHA) – Regulations and Standards | Section 10.0 | Meet Requirement |
| California Business and Professions Code – Sections 6704, 5730, and 6736 | Section 10.0 | Meet Requirements |
| California Vehicle Code – Section 35780 | Section 10.0 | Meet Requirements |
| California Labor Code – Section 6500 | Section 10.0 | Meet Requirements |
| ***Local:*** | | |
| County of Sacramento – Regulations and Ordinances | Section 10.0 | 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 |

# 10.5 Involved Agencies and Agency Contacts

Any permits issued for design and construction would come through the appropriate Sacramento County Department. A point of contact is provided in Table 10.4-2.

**TABLE 10.4-2**
Agency Contacts

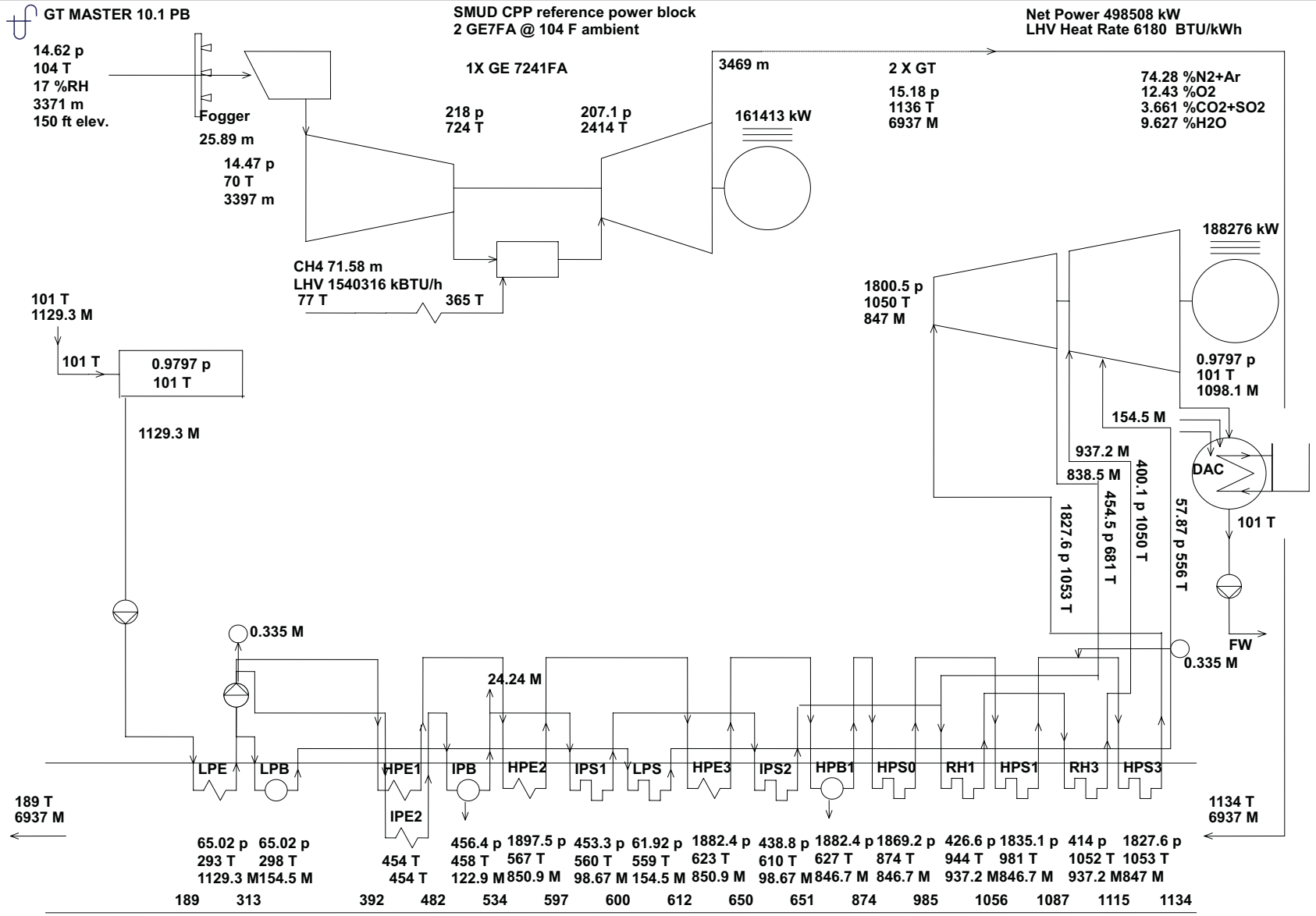
| Agency | Contact | Telephone |
|---|---|---|
| Sacramento County Public Works Agency<br>827 7th Street<br>Sacramento, CA 95814 | | |
| Encroachment permits for natural gas line (Room 304) | Staff | (916) 875-6581 |
| Building permits (Room 102) | Michelle Matthews | (916) 874-6487 |
| Grading/erosion control permit (Room 105) | Norman Novak | (916) 874-6873 |

**TABLE 10.4-2**
Agency Contacts

| Agency | Contact | Telephone |
|---|---|---|
| Land use and ordinances | | |
| Sacramento County Planning and Community Development<br>827 7th Street<br>Sacramento, CA 95814 | Tricia Stevens<br>Principal Planner | (916) 874-6141 |
| Hazardous materials permit | | |
| Sacramento County Environmental Management Department<br>Hazardous Materials Division<br>8475 Jackson Road, Suite 230<br>Sacramento, CA 85826 | Ralph Roberts<br>Anthony Chu | (916) 875-8476<br>(916) 875-8405 |

# 10.6 Permits and Permitting Schedule

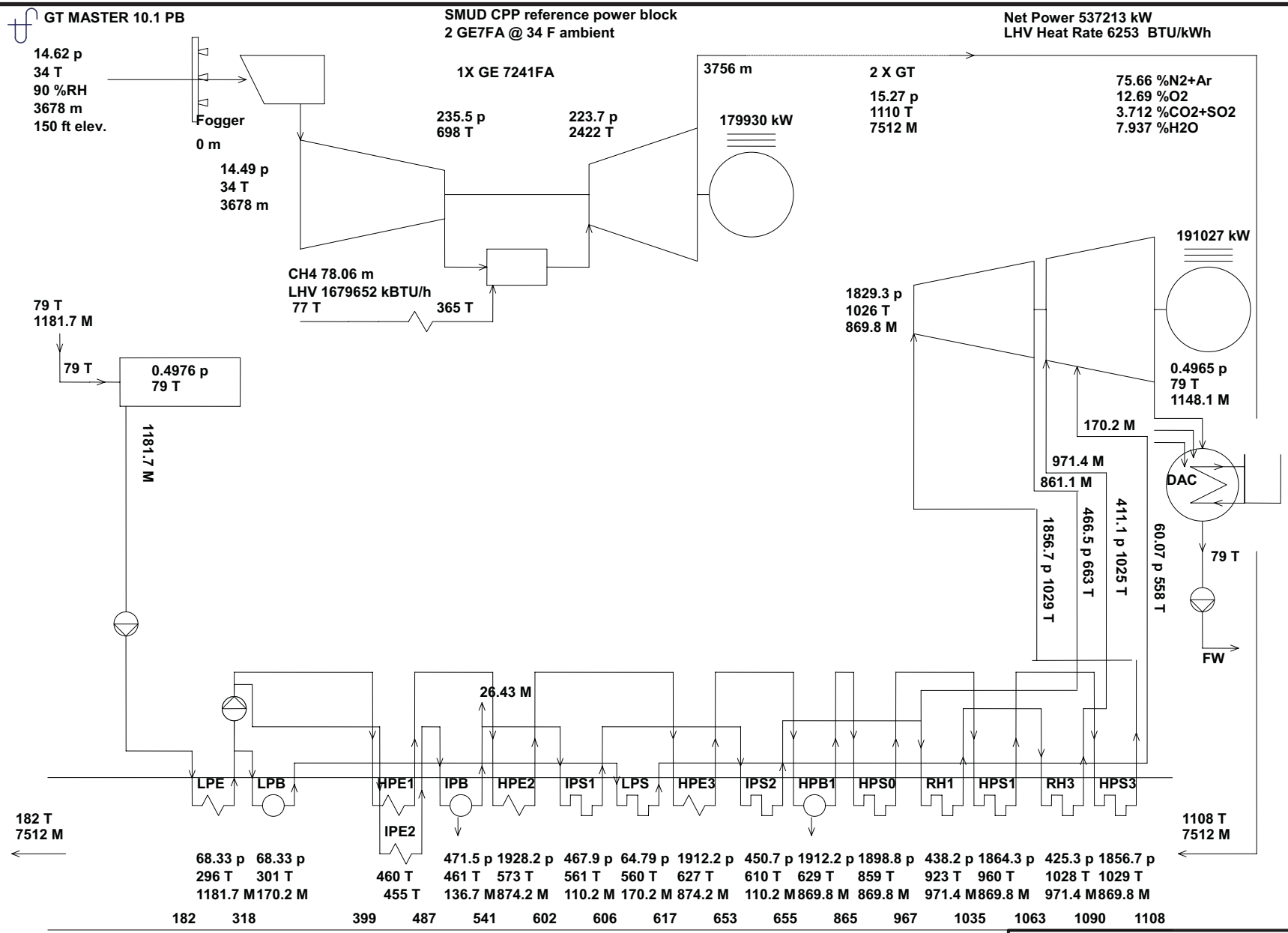
All engineering permits for design will be coordinated with the appropriate Sacramento County Department. Applications would likely be filed with the county in 2002 and could take up to 4 months to obtain.




SOURCE: PB POWER, INC.

**FIGURE 10.3-1**
**HEAT AND MASS BALANCE**
**AT 104 DEGREES FAHRENHEIT**
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION

CH2MHILL




p[psia], T[F], M[kpph], Steam Properties: Thermoflow - STQUIK

SOURCE: PB POWER, INC.

# FIGURE 10.3-2
# HEAT AND MASS BALANCE AT 34 DEGREES FAHRENHEIT

COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION

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