4.0 SAFETY AND RELIABILITY

4.1 FACILITY SAFETY

The Palomar Energy Project will be designed for safe operation. This includes safety for the power plant operating personnel, who will be trained to properly respond to hazards and to avoid unsafe operating conditions. Potential hazards that could affect project facilities include earthquake, flood, and fire.

4.1.1 Natural Hazards

A discussion of geological issues is provided in Section 5.5. The discussion is based on a 1999 geotechnical study prepared by GEOCON and provided as Appendix C. The geologic hazards associated with the project site are seismic hazards, and the site is located in Seismic Zone 4. All project structures will be designed in conformance with Uniform Building Code (UBC) criteria for Seismic Zone 4 to ensure safety for operating personnel and adequate protection against structural and equipment damage. The structural and seismic design criteria for project buildings and equipment are provided in Appendix D-2.

The existing condition of the Palomar site varies in elevation from approximately 740 to 826 feet above mean sea level (amsl). The power plant grade will be at approximately 750 feet amsl. The site is located above the 500-year floodplain.

4.1.2 Onsite Fire Protection Systems

The power plant will be provided with onsite fire protection systems to limit personnel injury, property loss, and plant downtime resulting from a fire. The fire protection systems are described in Section 2.4.10.

4.1.3 Local Fire Protection Services

In the event of a serious fire, the Palomar project will receive fire protection services from the City of Escondido Fire Department. The Palomar project's Risk Management Plan, described in Section 5.12, will provide necessary information on hazardous materials to ensure that safe and effective fire fighting measures are used. Additional information on local emergency services is provided in Section 5.8.

4.1.4 Personnel Safety Programs

The Palomar project will implement the personnel safety programs described in Section 5.14 to provide for personnel safety and ensure compliance with federal and state occupational safety and health requirements.

4.2 TRANSMISSION LINE SAFETY AND NUISANCE

As no new transmission lines are needed for the Palomar project, there are no transmission line safety or nuisance issues to address.

4.3 RELIABILITY AND AVAILABILITY

This section discusses plant reliability and availability, project quality control measures, equipment redundancy, fuel availability, and water availability.

4.3.1 Plant Reliability and Availability

The planned operational life of the Palomar Energy Project is 30 years. In order for this life to be realized, and in order for the plant to operate reliably for this duration, the project will implement a preventive maintenance program. This program will begin during engineering and procurement for the project, when designs and specifications will be reviewed for reliability and maintainability of plant systems and equipment. During the operational phase of the Palomar project, the preventive maintenance program will consist of monitoring, record keeping, and maintenance work to detect and rectify deterioration in systems and equipment before such deterioration results in a forced outage or prolonged maintenance outage.

It is expected that the preventive maintenance program will result in high plant availability. Plant availability refers to the power plant's available generating capability during a given period of time, and is assessed using the Equivalent Availability Factor (EAF). The EAF is a weighted average measure of plant availability considering both full and partial outages. In determining the EAF, outages are weighted by magnitude (i.e., fractional reduction in available generating capacity) and duration. Outages consist of planned overhauls, maintenance outages, and forced outages. The Palomar plant's annual EAF is expected to be in the range of 92 to 96 percent.

4.3.2 Project Quality Control Measures

The Palomar project will require quality control measures to be implemented by suppliers and contractors providing equipment and services. This requirement will apply to the engineering, procurement, construction, and startup phases of the project. It is expected that such measures will be part of quality assurance programs previously established by the suppliers and contractors. The project will audit the quality assurance programs, and the project will also supplement the programs with independent design reviews, shop inspections, and construction site inspections.

4.3.3 Equipment Redundancy

Equipment redundancy provides means for avoiding outages and reducing the magnitude of outages. For example, because the plant will include two air compressors of 100 percent capacity each, an outage of a single air compressor would not result in a plant outage. As another example, because the cooling tower will consist of multiple cells, an outage of one cell would result in a minor partial outage (i.e., minor reduction in available generating capacity) rather than a full outage.

Equipment redundancy also provides for operating flexibility and efficiency. For example, although the turn down capability of individual CTGs is limited to about 50 percent, the plant will be able to turn down to approximately 25 percent load by shutting down one redundant CTG/HRSG train. Similarly, because of multiple CTG/HRSG trains, condensate pumps, boiler feed pumps, circulating water pumps, and cooling tower cells, plant efficiency at 50 percent load will be similar to efficiency at 100 percent load as a result of selectively shutting down redundant equipment. A summary of major equipment redundancy is presented in Table 4.3-1.

Table 4.3-1 Major Equipment Redundancy

Equipment	Number	Note
CTG/HRSG Trains	Two 50% capacity	As described in Section 2.0.
STG	One 100% capacity	A steam turbine bypass system will enable operation of the CTG/HRSG trains during STG outages of short duration.
Condenser	One 100% capacity	A design partitioned into two condenser halves will be considered during detailed engineering and procurement.
Condensate Pumps	Two 100% capacity	One spare pump stored on-site. Three 50% pumps will be considered during detailed engineering and procurement.
Boiler Feed Pumps	Four 100% capacity	Based on capacity serving each HRSG (four pumps total).
Circulating Water Pumps	Two 60% capacity	One spare pump stored onsite.
Cooling Tower	One w/multiple cells	Cooling tower will have seven cells.
Air compressors	Two 100% capacity	Redundant dryers will be provided for the instrument air system.
Reverse Osmosis Trains	Three 50% capacity	If reverse osmosis is included in final plant design.
Demineralizer Train	One 100% capacity	Backup provided by condensate storage tank capacity.
Distributed Control System	Partial redundancy	As described in Subsection 2.4.11.1.
Raw Water Storage Tank	730,000 gallons	Sufficient to cover a water supply outage of four hours.
Condensate Storage Tank	200,000 gallons	Sized for startup and sufficient to cover operation during an extended water treatment system outage.

4.3.4 Fuel Availability

The Palomar project will be fueled with natural gas conveyed to the power plant site via the SDG&E natural gas system. An existing 16-inch SDG&E natural gas pipeline with sufficient capacity to serve the project is located immediately adjacent to the northeast corner of the project site at the end of Enterprise Street. In order to relieve a bottleneck in a segment of the existing SDG&E gas system located about one mile northeast of the project site, SDG&E will construct an upgrade consisting of approximately 2,600 feet of 16-inch pipeline.

The expected minimum pressure of natural gas delivered to the power plant is 350 pounds per square inch, gauge (psig). When the SDG&E delivery pressure drops to less than 500 psig, two electric motor-driven gas compressors at the plant will operate to maintain an outlet pressure of 500 to 550 psig. The availability of reliable natural gas supplies to fuel the Palomar project depends on natural gas production, natural gas pipeline system capacity, and natural gas storage capacity. The following paragraphs discuss each of these factors.

Forecasts indicate that there are adequate natural gas resources (proven reserves and reserves that can be developed economically) to provide affordable natural gas supplies to the United States for the next 50 years (USGS, 1995). The USGS estimated the resource base at 917 trillion cubic feet (tcf) in the United States and 417 tcf in Canada. In 1998, natural gas production in the United States was approximately 19 tcf. Other natural gas resources not included in the above totals, and that potentially could supply California, include resources in northern Canada and Alaska that could be transported by new pipeline facilities, and liquefied natural gas (LNG) terminals that could import natural gas from outside North America.

Although natural gas production within California generally declined from a peak in the mid-1980s to a low point in 1996, since then it has increased from 800 million cubic feet per day (MMcf/day) in 1996 to 1,030 MMcf/day in 2000 (CEC, 2001). Gas production in California is expected to continue to increase in the coming years, in part because of new discoveries stimulated by prices that have increased from historic levels. The CEC forecasts that California natural gas production could reach 1,200 MMcf/day by 2020 (CEC, 2001).

While natural gas production within the state is important, natural gas availability to California has been more strongly affected by gas pipeline system capacity than by shortfalls in production. Of California's overall natural gas usage, 85 percent is transported by pipeline from out-of-state. Gas supply reliability is related to both the interstate pipelines that bring gas to California's borders, and the intra-state pipelines that deliver gas from the interstate pipelines to users throughout the state.

The current capacity of interstate pipelines that supply California is 7,040 MMcf/day. In response to market forces, there are a number of interstate pipeline expansion projects underway or planned (CEC, 2001). Table 4.3-2 lists the key projects that would expand pipeline capacity to California.

Table 4.3-2 Interstate Pipeline Projects

Project	Capacity (MMcf/day)	On-Line Date
Kern River Pipeline	135	July 2001
Expansion	900	May 2003
Kern/Mojave Pipeline	135	Summer 2001

Expansion at Daggett		
Kern River High Desert Lateral	282	September 2002
PG&E-GTN Pipeline Expansions	42 169 1,000	November 2001 Summer 2002 Within Next 10 Years
Questar Southern Trails Pipeline	90 126	Spring 2002 Undetermined
El Paso Plains- All American Pipeline	230	Winter 2001
Transwestern Pipeline	150	Winter 2001
Bajanorte Pipeline	500	September 2002
Otay Mesa Generating Company Pipeline	110	September 2002
Sonoran Pipeline		
Phase I to CA Border	750	Summer 2003
Phase II in CA	1,500	Undetermined
Ruby Pipeline	750	December 2004
Tuscarora Gas Transmission Company Pipeline	96	Early 2003
Sacramento Valley Project	Undetermined	Undetermined

Source: CEC, 2001

The intrastate pipeline and gas storage systems, particularly in southern California, are occasionally strained and create bottlenecks in delivering supplies from interstate pipelines to customers, including generating facilities (CEC 2001). Current interstate pipeline delivery capacity exceeds intrastate pipeline receipt capacity by about 300 MMcf/day. Ongoing and planned intrastate pipeline expansions would add 1,175 MMcf/day in total capacity, a roughly 15 percent increase. Almost half of this expansion (575 MMcf/day) would occur in the SoCal Gas and SDG&E services areas (CEC, 2001).

SDG&E has no direct connection to any interstate pipelines, nor does it have any storage capacity in its service area. The SDG&E gas system is supplied solely via its connection with the SoCal Gas system, and the capacity of this connection was increased to over 1,000 MMcf/day by the Line 6900 Expansion project completed in mid-2001 (SDG&E and SoCal Gas, 2001). Although the connection with SoCal Gas was not a constraint, SDG&E system demand exceeded its own internal capacity to serve load a number of times in the winter of 2000-2001, which led to curtailments of non-core natural gas customers including electric generators. However, subsequent to these curtailments, the Line 6900 Expansion project added 70 MMcf/day to the internal capacity of the SDG&E system, resulting in this capacity increasing from 530 MMcf/day to 600 MMcf/day (SDG&E and SoCal Gas, 2001).

Further enhancement of the SDG&E system capacity is expected to result from redistribution of customer loads on the SDG&E system. This redistribution will result from the Bajanorte Pipeline project subtracting load from the southern end of SDG&E system (i.e., far from the SoCal Gas source), and the Palomar project adding load to the north end of the system (i.e., near the SoCal Gas source). A gas system capacity study conducted by SDG&E indicates that, given this redistribution of customer loads, the SDG&E system capacity will increase to 685 MMcf/day in the summer and 745 MMcf/day in the winter. The study further indicates that the potential for future curtailment by SDG&E of natural gas deliveries to electric generation customers (including the Palomar project) is minimal, predicting only one pro rata curtailment of just 2 percent of electric generation gas load for less than 24 hours, based on a worst-case year. A study report prepared by SDG&E is provided as Appendix K.

Natural gas storage is a key element in meeting peak gas demand. During periods of low demand, unused pipeline capacity is utilized to transport gas for injection into depleted oil and gas fields that serve as storage facilities. During periods of high demand, the gas is withdrawn from storage and supplied to customers. There are a number of natural gas storage expansion projects planned in California, including several projects by SoCal Gas (CEC, 2001). There also have been a number of relatively small independent (non-utility) gas storage facilities recently developed in northern California, although there are none in southern California. A recent draft CEC staff report urges the CEC and the California Public Utilities Commission to jointly investigate the possibility of developing additional independent storage facilities, particularly in southern California where none currently exist (CEC, 2001).

In summary, the reliability of natural gas supplies involves the interplay of natural gas production, interstate pipeline systems, intrastate pipeline systems, and natural gas storage facilities. Overall natural gas production appears to be adequate for decades to come, and the gas production within California is increasing after a period of decline. Interstate pipeline expansions will increase the capacity for deliveries to California from natural gas resources located outside of the state. Intrastate pipeline and gas storage expansion projects will increase the ability to supply gas reliably to locations within the state. Improvements in all of these areas, as discussed above, directly and indirectly benefit the Palomar Energy Project and increase the reliability of natural gas supplies to fuel the power plant.

4.3.5 Water Availability

Reclaimed water will be supplied to the Palomar project by the City of Escondido's Hale Avenue Resource Recovery Facility (HARRF). Water requirements amount to approximately 3,624 acre-feet per year, as presented in Table 2.4-2. The water will be conveyed by a new 1.1 mile, 16-inch pipeline extending from an existing City of Escondido reclaimed water main.

At the power plant site, a raw water storage tank with a capacity of 730,000 gallons will hold 530,000 gallons of reclaimed water for plant operations. This quantity is sufficient to cover a 4-hour interruption of water supplied to the power plant. In addition, the raw water storage tank will hold 200,000 gallons of reclaimed water dedicated to the plant's fire protection water system. Demineralized product water will be stored in a condensate storage tank with a capacity of 200,000 gallons, which is sized for startup purposes and also provides sufficient capacity for an extended outage of the water treatment system.

4.4 APPLICABLE LORS

Design, construction, and operation of the Palomar Energy Project including its linear facilities (natural gas and water pipelines) will be conducted in accordance with all laws, ordinances, regulations, and standards (LORS) pertinent to safety and reliability. The applicable LORS are discussed in Section 6.4.

4.5 REFERENCES

CEC. 2001. Staff Report: Natural Gas Infrastructure Issues. October 2001.

United States Geological Survey (USGS). 1995. 1995 Assessment of the United States Oil and Gas Resources.

SDG&E and SoCal Gas. 2001. Direct Testimony of San Diego Gas & Electric Company and Southern California Gas Company in Response to Order Instituting Investigation. March 23, 2001.