5.1 INTRODUCTION

This chapter discusses alternatives to the proposed Canyon Power Plant (CPP) project. Alternatives were evaluated and considered as part of the initial project assessment. In addition, the California Energy Commission (CEC) requires a review of reasonable alternatives to satisfy the requirements of the California Environmental Quality Act (CEQA).

According to CEQA, the focus of the alternatives analysis is on alternatives that could "feasibly accomplish most of the basic objectives of the project and could avoid or substantially lessen one or more of the significant effects" (CEQA, 14 CCR 1516.6(c)). A range of alternatives that could feasibly accomplish most of the project's objectives are described below. In addition to the project alternatives considered, CEQA requires an evaluation of a No Project Alternative, which is also described below. The alternatives are:

- No Project Alternative (no project would be undertaken), described in Section 5.3
- Alternative site locations, described in Section 5.4
- Alternative energy generation technologies, described in Section 5.5

5.2 PROJECT OBJECTIVES

The objective of the CPP is to design, build and operate a 200 MW natural gas-fired simple-cycle generating facility that can provide peak load generation to support the local peak demand and reserve margins for the City of Anaheim (COA). The CPP will assist the COA in meeting its reliability mandates for load serving entities in California. The COA is required to carry 15 percent above its peak demand as capacity reserves by both AB 380 (Resource Adequacy) and by the California Independent System Operator (CAISO). In addition, the CAISO requires considerable generation be provided in the Los Angeles Basin for local reliability purposes. Based on 2008 Local Capacity technical assessment study by the CAISO, the COA is obligated to have 350 MW as Basin generation (CAISO, 2007). The COA has just one 46 MW peaking facility at this time. The objectives for the CPP are summarized below:

- Construct and operate a natural gas-fired simple-cycle generating facility that can provide peak load generation to support the local peak demand, local reliability, and reserve margins for the COA.
- Develop a site consistent with the goals and policies of the community planning documents and supported by the local community.
- To site the project with ready access to natural gas and electrical interconnection.
- Safely produce electricity without creating significant environmental impacts.
- Reduce the current reliance on out-of-state energy.

- Provide a backup for as-available wind energy.
- To build new generation that requires minimal additional project-specific transmission system upgrades.

5.3 NO PROJECT ALTERNATIVE

The No Project Alternative is an alternative required by CEC's regulations and CEQA. Denial of this application by the CEC would, in effect, be the No Project Alternative. Should this occur, the primary result would be the loss of a 200 MW power generation facility to provide energy to the State of California. If the No Project Alternative was selected:

- Approximately 10 acres of land would be developed with another use.
- Approximately one acre of right-of-way would remain undisturbed from the installation of pipelines and transmission lines.

The No Project Alternative would result in continued reliance on out of state energy resources for supplying existing and certainly future peak load demands for the COA. In summary, this alternative would not serve the needs of the COA and California businesses and residents for economical, reliable and environmentally sound generation resources.

5.4 ALTERNATIVE SITE LOCATIONS

The COA Public Utility Department conducted two siting studies and evaluated nine locations within the COA before selecting and purchasing the proposed CPP project site for development (URS, 2003, 2006). The nine sites that were studied are identified in Table 5.4-1 and their locations illustrated on Figure 5-1. Site 9 is the proposed CPP site described in this AFC. The proposed site was determined to be the least environmentally sensitive site based on the proximity of sensitive receptors, biological resources and land use compatibility issues.

Sites 1 thru 8 were evaluated in the 2003 study but a second siting study was conducted in 2006 because three sites evaluated in 2003 had to be eliminated (Sites 4, 5, and 8), one site was modified (Site 6), and a new site was identified (Site 9). Site 4 was eliminated because it had been developed with residential units, Site 5 was eliminated because it became unavailable for development, and Site 8 was eliminated at the onset of the 2003 siting study because it is crossed by an overhead Southern California Edison 500 kV line, rendering it unusable for the construction of a power generation facility. As a result of these changes, the 2006 siting study focused on the feasibility of Sites 1, 2, 3, 6, 7, and 9. However, since site 6 is currently utilized as a power facility, it is excluded from further review.

The sites were evaluated to assess the feasibility of constructing and operating a power project in the COA. Factors considered were proximity to gas, transmission and water

TABLE 5.4-1
ALTERNATIVE SITE LOCATIONS

Site Number	Site Name	Site Location
1	Maintenance Yard	Near Vermont Avenue and East Street
2	Metal Site	Along the south side of SR 91, east of Kraemer Boulevard
3	OCWD Site	North of the 91 Freeway, west of Richfield Road
4	Disney Parking Lot	At the intersection of Katella Avenue and Haster Street
5	San Farrel	At 3000 La Jolla Street
6	Dowling and CT	At Dowling Substation and existing combustion turbine site, at Kraemer Boulevard and Coronado Street
7	Lewis Street	Near the Intersection of Lewis Street and Cerritos Avenue
8	Car Lot Site	At La Palma Avenue and Yorba Linda Boulevard
9	OC Food Services	Along East Miraloma Avenue, west of Kraemer Boulevard

infrastructure that would minimize construction impacts. In addition, the sites were reviewed based on the potential for site related environmental impacts. These would include land use inconsistencies, community cohesion, biological concerns and other environmental concerns. Generally, an industrial site was preferred due to the proximity of infrastructure and land use consistency.

5.4.1 Site 1

Site 1 is currently used as the Utility Department storage and maintenance yard. The entire site is paved and a warehouse is located on the property. The site has reasonable access to infrastructure including transmission. No biological or cultural resources were identified in the area.

The site does include sensitive receptors in the vicinity. These sensitive receptors include residential uses, elementary schools and plans for a multi-family residential development. These sensitive receptors are closer to Site 1 than the proposed CPP site and therefore, this site was not considered further.

5.4.2 Site 2

Site 2 is currently used by Adams Metal, a metal recycling facility, a lumber yard, and rail car area. The site is partially paved and the rest is covered by gravel and dirt. The site is within the Specific Plan area 94-1 and is zoned as Zone 1 industrial. Infrastructure requirements can be reasonably obtained nearby. The property abuts the Santa Ana River to the south and residential development is located further south along the river. Development of this site would have the potential for impacts to sensitive biological resources due to the

close proximity of the Santa Ana River. This site was removed from further consideration since the proposed CPP site would have less potential impacts to biological resources and sensitive receptors.

5.4.3 Site 3

Site 3 is currently owned by the Orange County Water District and is surrounded by the Warner Recharge Basin. The buildable area within this site is limited by water and is not continuous. Most of this site is currently used as a park. It may be possible to construct a facility on the south end of the site away from the park, but there currently is only a narrow road down to this location. The site is within the Specific Plan Area 94-1 and is zoned conservation/water uses. In addition, the area is within a State-designated scenic corridor. The COA General Plan Land Use map also shows that this site is designated parks and water uses. Site 3 abuts park/water uses to the east and west, the Santa Ana River to the south, and light industrial and offices to the north and northeast. Infrastructure needs are reasonably met within the area.

Use of this site for a 200 MW power facility would require a minimum of 4 acres. This site cannot provide that amount of contiguous area and was no longer considered viable. In addition, there would be a requirement for a rezone and General Plan Amendment in order to use this site for power generation. Due to these issues the CPP site would have fewer potential impacts to the surrounding area, and is more compatible for Land Use purposes.

5.4.4 Site 7

Site 7 is currently a vacant lot where the Salvation Army stores delivery/pickup trucks. Immediately adjacent to the northern border of the site is a ministry facility that includes a shelter with 50 or more beds, which is considered a sensitive use. The surrounding land use is light industrial. The land use designation and zoning for Site 7 is industrial. Infrastructure needs can be reasonably obtained in the area, however, the pipeline for GWRS water would be much longer than the proposed CPP site. The sensitive receptor location would be much closer than the CPP site and therefore, this site was not considered further.

5.5 ALTERNATIVE ENERGY GENERATION TECHNOLOGIES

The CPP will provide electricity for the COA’s customers. It’s operation would allow COA to keep its rates as low as possible. Alternate electrical generation technologies were considered using the selection methodology described below, however, these technologies were rejected in favor of the natural gas-fired, simple-cycle technology, which is the basis of this application.

5.5.1 Selection Methodology

Technologies considered were primarily those that would provide peak or intermittent electric power. The reason for using this screening criterion was the COA's mission to maintain its electrical rates as low as possible for its customers. Two intermittent technologies with no fuel cost namely solar and wind power were also examined to see if they might be economically viable.

The selection methodology included a stepped approach with each step containing a number of criteria. The selected technology would have to pass Steps 1 and 2 and provide the lowest or near lowest cost in Step 3. The steps are as follows:

- **Step 1 – Commercial Availability.** The technology had to be proven commercially practical with readily available and reliable equipment at an acceptable cost.
- **Step 2 – Implementable.** The technology had to be implementable; specifically, it could meet environmental, public safety, public acceptability, fuel availability, financial, and system integration requirements.
- **Step 3 – Cost-effective.** The technology had to be cost-effective when compared with existing peaking generating units. Cost included both capital as well as operation and maintenance costs, which would translate into a bus bar cost represented in cents per kilowatt-hour. The methodology was applied to a number of peaking electrical generation technologies in the following subsections.

5.5.2 Technologies Reviewed

The technologies reviewed can be grouped according to the fuel used. Fuels included were oil and natural gas, coal, nuclear reactions (usually using radioactive materials as fuel), water (hydro, ocean conversion, and geothermal), biomass, municipal solid waste, and solar radiation. However, due to the type of generating facility (a peaking generating facility) that the COA is proposing, several technologies were immediately rejected due to the infeasibility of these technologies to provide cost-effective peaking electricity. These technologies were steam generator boilers that generated electrical power by passing steam through a steam turbine (including natural gas fired, coal fired, oil fired, biomass, and nuclear), hydroelectric, and ocean energy.

5.5.2.1 Oil and Natural Gas

These technologies use oil or natural gas and include combustion turbines in various configurations, and fuel cells. The description of these technologies includes the proposed alternative of a simple-cycle combustion turbine.

5.5.2.2 Simple-cycle Combustion Turbine

This technology uses a combustion turbine to drive a generator. Air is compressed in the compressor section of the combustion turbine, passes into the combustion section where fuel is added and ignited, and the hot combustion gases pass through a turbine, which drives a generator and the compressor section of the combustion turbine. The combustion turbines have a relatively low capital cost with efficiencies approaching 40 percent in the larger units. Because the combustion turbines are fast starting and have a relatively low capital cost, they are used primarily for meeting high-peak demand, when their relatively low efficiency is not as great a concern. Applying the review methodology, this technology is commercially available, and could be easily implemented. The variable cost of generation is relatively high, approximately 5.5 to 7.5 cents per kilowatt-hour, depending on fuel costs. However, this technology typically is used to generate electrical power during peak-demand periods, when electricity costs are typically higher. Therefore, this technology satisfies Steps 1, 2, and 3.

5.5.2.3 Conventional Combined-cycle

This technology integrates combustion turbines and steam turbines to achieve higher overall plant efficiencies. The combustion turbine, which drives a generator, would normally exhaust its hot combustion gas directly to the atmosphere. However, with combined-cycle technology, the combustion turbine exhaust gas is passed through a heat recovery steam generator creating steam that is used to drive a steam turbine/generator thereby producing additional electricity with no additional fuel consumed. The resulting efficiency for the combined cycle technology is 50 to 54 percent, which is considerably greater than most other alternatives. In addition, natural gas fuel emits little sulfur dioxide and little particulate matter. For these reasons, the system is considered the benchmark against which all other base load technologies are compared. Applying the review methodology, this technology is commercially available, but cannot be implemented due to the long startup periods required to preheat the steam generation equipment and steam turbine. Therefore, this technology fails Step 2 and was rejected from further consideration.

5.5.2.4 Kalina Combined-cycle

This technology is similar to the conventional combined-cycle except water in the heat recovery boiler is replaced with a mixture of water and ammonia. Overall efficiency is expected to be increased 10 to 15 percent. However, this technology is still in the testing phase, with tests recently completed on a 3-MW unit in Southern California. Applying the review methodology, the technology fails to pass Step 1 because it is not commercially available, and therefore, was eliminated from consideration.

5.5.2.5 Advanced Combustion Turbine Cycles

There are numerous efforts to enhance the performance and/or efficiency of combustion turbines by injecting steam, intercooling, and staged firing. These include the steam-injected combustion turbine (SICT), the intercooled steam-recuperated combustion turbine, the chemically recuperated combustion turbine, and the humid air turbine cycle. With the exception of the SICT, none of these technologies are commercially available, and therefore, fail to pass Step 1 of the review methodology. The SICT is marginally commercially available and does not pass Steps 1 and 2. Consequently, this technology was eliminated from consideration.

5.5.2.6 Fuel Cells

This technology uses an electrochemical processes to combine hydrogen and oxygen to liberate electrons, thereby providing a flow of electrical current. Types of fuel cells include phosphoric acid, molten carbonate, solid oxide, alkaline, and proton exchange membrane technologies. With the exception of the phosphoric acid fuel cell and possibly the molten carbonate fuel cell, none of these technologies are commercially available, and therefore, fail Step 1. The phosphoric acid fuel cell has been operated in smaller-size units, and the molten carbonate fuel cell has completed testing. However, currently neither of these technologies are cost-competitive with conventional simple-cycle technology, and therefore, fail Step 3 of the review methodology.

5.5.2.7 Water

These technologies use water as “fuel” and include geothermal. Other water technologies (hydroelectric and ocean energy conversion) were excluded due to the inherent limitations in these technologies to provide peaking electrical generation.

5.5.2.8 Geothermal

These technologies use steam or high-temperature hot water (HTHW) obtained from naturally occurring geothermal reservoirs to drive steam turbine/generators. Vapor-dominated resources (dry, super-heated steam) and liquid-dominated resources HTHW use a number of techniques to extract energy from the HTHW. Geothermal is a commercially available technology. However, geothermal resources are limited, and most, if not all, economical resources have been discovered and developed in California. Therefore, this technology fails Steps 2 and 3. In addition, there are transmission limitations from the geothermal area and the resource does not meet local reliability of the CAISO.

5.5.2.9 Solar Radiation Technologies

Solar radiation (sunlight) can be collected directly to generate electricity with solar thermal and solar photovoltaic technologies, or indirectly through wind generation technology in which the sunlight causes thermal imbalance in the air mass, thereby creating wind. Wind generation and two types of solar generation, thermal conversion and photovoltaics, were considered as alternative technologies to the simple-cycle. These are described in the following subsections.

5.5.2.9.1 Thermal. Most of these technologies collect solar radiation, heat water to create steam, and use the steam to power a conventional steam turbine generator. The primary systems that have been used in the United States capture and concentrate the solar radiation with a receiver. The three main receiver types are mirrors located around a central receiver (power tower), parabolic dishes, and parabolic troughs. An alternate technology collects solar radiation energy in a salt pond and then uses the heat collected to generate steam and drive a conventional steam turbine generator. While one of these technologies might be considered to be marginally commercial (parabolic trough), the others are still in the experimental stage.

All of these technologies require considerable land area for the collection receivers and are best located in areas of high solar incidence. In addition, power is only available while the sun shines; therefore, the units do not supply power when clouds obscure the sun or from early evening to late morning. These factors translate into high cost to the ultimate customer. These systems for the most part fail Step 1, commercial availability, and may not be implementable due to land unavailability and/or the ability to finance (Step 2). However, they all fail in being cost-effective (Step 3), and therefore, were eliminated from consideration.

5.5.2.9.2 Photovoltaic. This technology uses photovoltaic cells to convert solar radiation directly into electricity. Photovoltaic cells can be located wherever sunlight is available. This technology is environmentally benign and is commercially available, because panels of cells can theoretically be connected to achieve any desired capacity. Currently the cost for this technology is very high. This technology fails Step 3, cost-effectiveness, and therefore, was eliminated from consideration.

5.5.2.10 Wind Generation

This technology uses a wind-driven turbine to turn a generator and generate electricity. Only certain sites have adequate wind to allow for the installation of wind generators, and most of the sites that have not been developed are remote from electric load centers. Capacity from this technology is not always available because even in prime locations the wind does not blow continuously. In California, the average wind generation capacity factor has been relatively low in the range of 15 to 30 percent. In addition, this technology cannot be

depended upon to be available during periods of peak load because the peak may occur when the wind is not blowing. The technology is commercially available and probably implementable at the proposed sites, although financing may not be available due to its perceived risk. The technology is relatively benign environmentally although visual impacts, land consumption, and effects on raptors are a concern. The cost of generation is approximately 5 to 10 cents per kilowatt-hour, which is above the cost of the preferred alternative. The technology fails Step 3, cost effectiveness, and therefore was eliminated from consideration.

5.5.3 Conclusions

All feasible technologies that might be available for peaking load operation in California were reviewed using a methodology that considered commercial availability, ability to implement, and cost-effectiveness. Although some technologies, other than the simple-cycle combustion turbine, were commercially available and could be implemented, most would not result in fewer environmental effects than the natural gas-fired, simple-cycle technology. In addition, for all alternatives that are commercially available, implementable technologies were considered to be less cost-effective than the simple-cycle combustion turbine technology, and therefore, would not be consistent with the COA's fiduciary duty to provide low-cost power for its customers. Consequently, the conventional simple-cycle combustion turbine technology using natural gas as fuel is the best available technology for a peaking plant service and the one that should be employed for the CPP.

5.6 REFERENCES

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