California Energy Commission
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Environmental Performance Report

of California's Electric Generation Facilities

July 2001
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California Energy Commission

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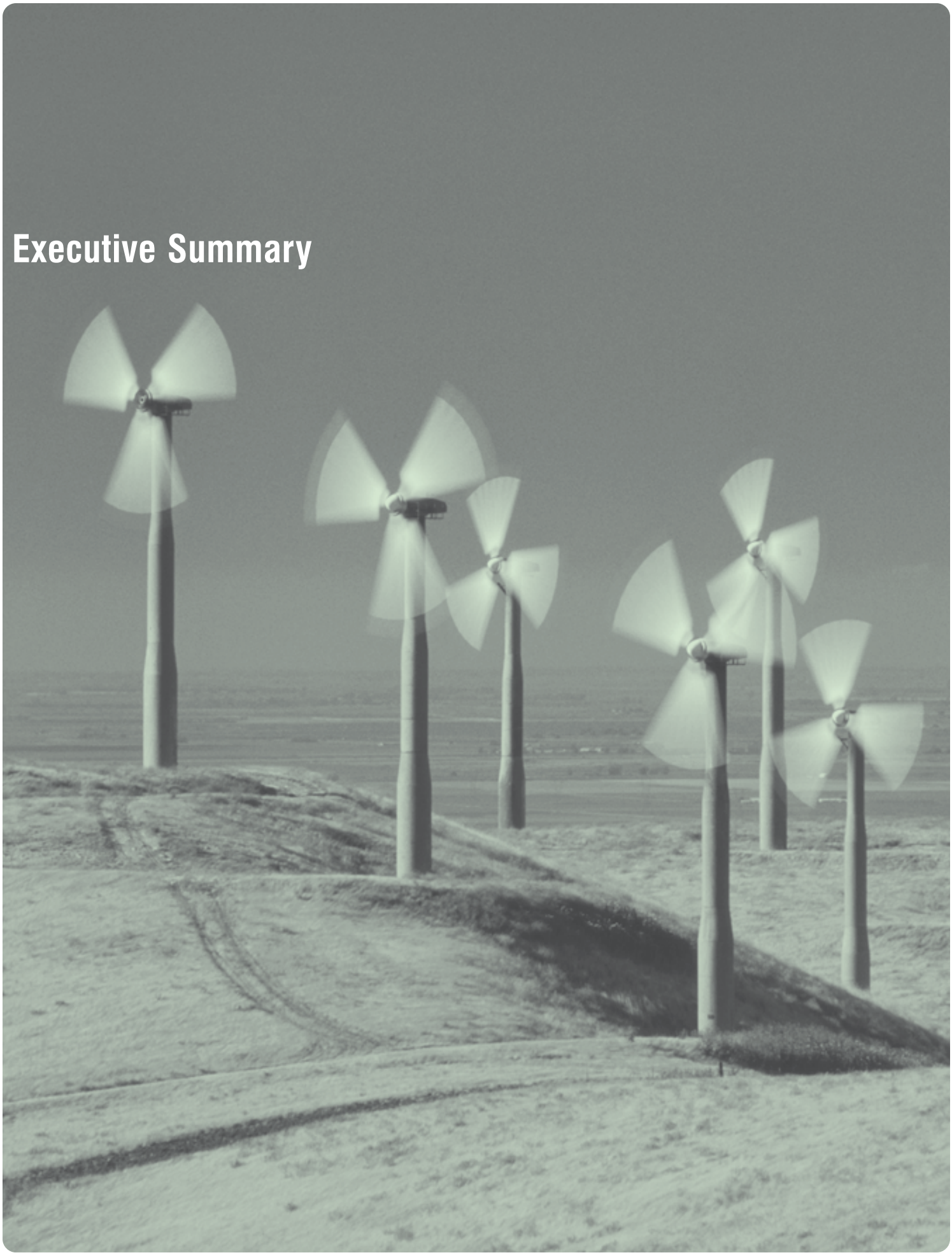
Executive Summary



Executive Summary

Introduction

This report assesses the environmental performance and related impacts of California's electric generation facilities, and responds to certain directives contained in Senate Bill (SB) 110, as enacted into law in 1999 (Cal. Stats. 1999, Chapter 581). Specifically, commencing July 1, 2001 and biennially thereafter, Public Resources Code Section 25309.3 (c) requires the California Energy Commission (Energy Commission) to report to the Governor and the Legislature concerning the following:

- The current status and historical trends in the environmental performance of California's electric generating facilities, including generation efficiency and air pollution control technologies in use;
- The geographic distribution of environmental impacts from electric facilities, including impacts to air quality, water resources, and wildlife habitat, and the geographic distribution of related socioeconomic benefits and drawbacks; and
- The extent to which the operation of existing electric generation facilities, and related environmental performance and impacts, could be displaced or reduced by new electric generation facilities. (As required by statute, subsequent reports will assess the extent to which displacement or reduced operations of the existing electric generation facilities has actually occurred.)

California's electricity supply system is comprised of a wide range of generating facilities located throughout the state, the western region of the United States, and in Canada and Mexico as well. This initial report will focus only on the environmental performance and related impacts of California's in-state electric generation facilities.

During the first three decades of the 20th century, hydroelectric power plants were the state's main source of electricity. Hydroelectric development continued in all decades, peaking in the 1960s. Oil-fired power plant development began in the late 1930s and peaked in the 1950s and 1960s. The oil shortage and air quality concerns of the 1970s caused these plants to switch to natural gas (keeping oil as a back up fuel to use when gas supplies were short).

A few nuclear power plants were added to California's utility system beginning in the late 1960s through the 1980s. Policies to increase the diversity of primary energy sources for electricity generation in the 1970s and 1980s led to the development of geothermal, wind, waste-to-energy, and solar energy facilities as well as cogeneration plants fueled by natural gas and coal.

Post-1996 power plant development in California has consisted almost exclusively of natural gas-fired simple-cycle combustion turbine power plants and combined-cycle combustion turbine facilities, including the expansion or repowering of older thermal power plants.

Key Findings

The electric generation system's efficiency and environmental performance have improved significantly. This improvement has been due to the increased use of renewable generation technologies, fuel switching from oil to natural gas, and more efficient fuel combustion and environmental control technologies.

Although older facilities have been displaced as the electric system has expanded, it is difficult to predict when, where, and to what extent individual facilities will be displaced in the future, because of market conditions, weather, and other factors.

The state's power plants continue to provide a critical service which supports our economy and standard of living without adversely affecting the socioeconomic and demographic characteristics of local communities.

Below are the key findings of this report, followed by recommended topics for future Environmental Performance Reports.

Thermal Efficiency of Oil/Gas Electric Generation

- The thermal efficiency of fossil-fueled generation technologies has improved significantly over the past 50 years, from less than 30 percent to as much as 53 percent. (Efficiency is expressed in higher heating value to enable comparisons between fossil-fueled technologies.) The most advanced gas turbines in a combined-cycle application have achieved a slightly higher efficiency — 54.1 percent. These new power plants may be nearing their thermodynamic limits of efficiency.

Air Resources

- Air pollution control technologies used for power plant emissions have improved significantly over the past 25 years. For example, retrofitting existing power plants with new controls may reduce oxides of nitrogen (NOx) emissions by up to 90 percent.
- The total air pollutant emissions from in-state fossil-fueled power plants has decreased significantly over the last 25 years. For example, the total annual NOx emissions from power plants in California has declined from 385 tons per day in 1975 to 79 tons per day in 2000.
- Strategies to improve local air quality, however, will continue to consider power plant emissions.
- The majority of California's power plants are located in the state's most severely polluted areas, South Coast and San Joaquin Valley; or most densely populated areas, San Francisco Bay Area and San Diego County.

Water Resources

- Competition for the state's limited fresh water supplies is increasing and demand may exceed supply by 2020.

- The amount of water used by power plants is less than one percent of total statewide water demand. Impacts to limited local water supplies from individual power plants, however, can be significant.
- Existing coastal or bay side steam-boiler power plants, which use once-through cooling, are being expanded, repowered, or replaced with more efficient combined-cycle facilities. These new power plants use 50 percent less cooling water per megawatt hour for once-through cooling than the old steam-boiler plants.
- No new power plants using once-through cooling have been proposed at coastal or bay side sites.
- New power plants are increasingly being sited away from the coast, in areas where fresh water supplies are limited.
- The increased demand for fresh water supplies by California's growing population has lead to a decline in fresh water available for use by new power plants. In response, new power plants have increased their use of alternative water supplies and dry-cooling technology.
- Improved wastewater treatment and disposal methods are reducing the adverse impacts of power generation on water quality. These improvements are due to reduced volumes of wastewater discharge and to improved wastewater quality.

Biological Resources

- The primary biological impacts from electrical generation development in California have been loss of terrestrial habitats and loss and alteration of aquatic habitats.
- Many hydroelectric and thermal power plants built prior to the adoption of environmental laws caused significant loss of and damage to sensitive terrestrial and aquatic habitats in the mountainous and coastal areas of the state.
- New simple-cycle and combined-cycle power plants cause less biological damage than older power plants, because they use much less land and are not typically sited in sensitive biological resource areas.
- The damage to aquatic biological resources continues at coastal power plant sites using once-through cooling, and at many hydroelectric facilities due to altered stream flows.
- Repowering or expanding power plants at existing coastal and bay side sites will perpetuate significant impacts on aquatic ecosystems through the continued use of once-through cooling water systems. Impacts on a megawatt hour basis, however, will be reduced due to the use of more efficient power plants.
- Existing and proposed power plants in the southwestern oil fields of San Joaquin Valley have caused and will continue to cause significant cumulative impacts to biological resources due to habitat loss. These impacts are mitigated in part by off-site habitat preservation programs.

- With the exception of hydroelectric generation, power plant impacts on biological resources are much less significant than impacts from urban, suburban, transportation, and agricultural development.

Socioeconomic Impacts

- A reliable and affordable electricity supply supports economic development and helps maintain the state's high standard of living.
- Southern California and the San Francisco Bay Area counties generate and consume the most electricity within the state.
- Electric generation facilities are valued for the electrical services they provide and their contributions to local tax revenues, particularly property tax revenues.
- Property tax revenues from merchant plants are paid only to the municipal jurisdiction in which they are located. Property tax revenues from utility-owned generations are distributed to multiple jurisdictions within a county.
- New electric generation facilities do not adversely impact local public services if these impacts are mitigated.
- Large power plant construction, although short-term, provides a significant number of local jobs (a peak workforce of approximately 250). Employment at new operating power plants will not be a significant economic benefit (approximately 25 jobs per new combined-cycle power plant).
- An analysis of communities near 13 major power plant sites did not reveal any significant differences in socioeconomic characteristics compared to communities in the same vicinity without power plants. Although the 13 communities changed their demographic and socioeconomic characteristics over time, the communities did not become predominantly minority or low-income populations.
- Socioeconomic benefits of electric generation facilities substantially outweigh their socioeconomic drawbacks when considered from a regional or statewide perspective.
- The Energy Commission has identified no significant disproportionate environmental justice impacts in any of the power plant projects it has approved since 1998.

Displacement

- Over time, older and less-efficient power plants have been displaced or have reduced their operations.
- The displacement of specific facilities in the future cannot be predicted with any certainty due to various factors, including rainfall, temperature, and market conditions, all of which will significantly influence how the electricity system is operated day-to-day.

Recommendations for Next Report

Some aspects of the state's electricity generation system, or critical factors that may affect it, were not fully considered in this report. The following is a preliminary list of topics that should be addressed in the next Environmental Performance Report.

- Questions have been raised regarding whether California's current electricity "crisis" may alter or delay the positive environmental trends noted in this report. The next report will evaluate the consequences (particularly air quality, water quality, and water supply) resulting from existing power plant operations and from constructing new power plant facilities during this "crisis" period.
- The improved collection of operating and environmental performance data for individual power plants is needed to conduct future assessments of the state's electricity generating system.
- The next report may address other aspects of the state's electricity supply system, such as transmission and gas pipeline infrastructure.

Air Resource Analysis

- Future assessments should address air quality impacts from distributed generation, including diesel-fired back up generators.
- The effect of power plant emissions on the new standard for particulate matter less than 2.5 microns in diameter should be evaluated.

Water Resource Analysis

- An evaluation is needed of the effects of using alternatives to fresh water cooling — including reclaimed water and dry-cooling — upon power plant thermal efficiency.

Biological Resource Analysis

- The cumulative biological resource impacts should be evaluated for the rapidly growing wind generation sector, small hydroelectric facilities, and thermal plants relying on once-through cooling.
- The watershed effects on biological resources from hydroelectric facilities need to be assessed for the large number of hydroelectric projects proposed for relicensing this decade.

Socioeconomic Impacts Analysis

- The socioeconomic impact assessment in this initial report focused on California's oldest and largest fossil-fueled power plants. The next report should also assess the impacts from hydroelectric facilities, particularly those in rural counties, as well as recently constructed peaking power plants.
- The next report should assess whether market mechanisms, such as air quality offset trading, are resulting in an inequitable allocation of limited natural resources with regard to regional economic development.

CHAPTER ONE

Introduction

I. Introduction

This report assesses the environmental performance and related impacts of California's electric generation facilities, and responds to certain directives contained in Senate Bill (SB) 110, as enacted into law in 1999 (Cal. Stats. 1999, Chapter 581). Specifically, commencing July 1, 2001 and biennially thereafter, Public Resources Code Section 25309.3(c) requires the California Energy Commission (Energy Commission) to report to the Governor and the Legislature concerning the following:

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- The extent to which the operation of existing electric generation facilities, and related environmental performance and impacts, *could be* displaced or reduced by new electric generation facilities. (As required by statute, subsequent reports will assess the extent to which displacement or reduced operations of the existing electric facilities *has actually occurred*.)

The historical and geographical development of the diverse facilities that comprise California's electrical generation system is described in Chapter II. The expansion of generation supplies out-of-state and the interdependence of the Western region as a whole are also described.

Chapter III describes the historical effects on air, water, and biological resources. Efficiency improvements in generation technologies have caused observed decreases in environmental effects over time. The passage of environmental regulations in the 1970s — including the federal Clean Water Act, Clean Air Act, and Endangered Species Act, and the California Environmental Quality Act and the California Clean Air Act — fostered many technology improvements.

Chapter IV discusses the socioeconomic impacts, both benefits and drawbacks, of the state's generation system and how socioeconomic and demographic factors of surrounding populations have changed since electric generation facilities were built.

The complexities of displacement and the inability to predict how deregulation will affect the short-term operations or development of new supplies are discussed in Chapter V.

Conclusions and recommendations for the next Environmental Performance Report are identified in Chapter VI.

References, a glossary, and acronyms are found at the end of this report. Appendices, numbered from I to V to correspond to each chapter, provide supporting data. All appendix materials are found only on a CD-ROM provided with this report or on the Energy Commission's Web Site at <www.energy.ca.gov>.

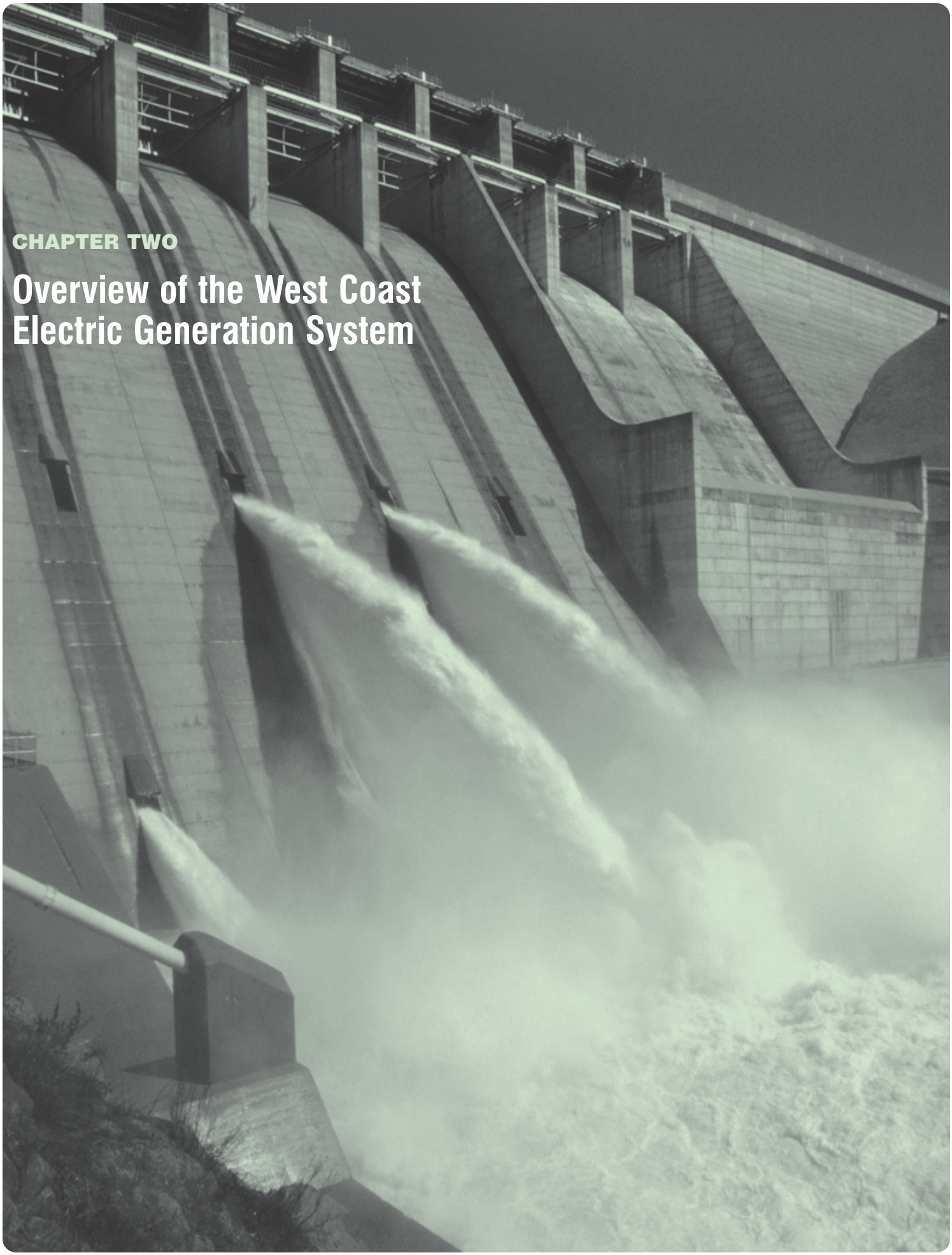
Scope

While California imports about 19 percent of its electricity from many electric facilities in other states, this report looks at in-state generation only. The analysis focuses on trends, rather than site-specific effects of individual plants, to provide historical changes over time. The effects of transmission lines are not included.

This report primarily discusses environmental and socioeconomic trends before the electrical system was deregulated in 1996. It also characterizes the new power plants approved or proposed since then.

The report does not predict which electric generation facilities may be displaced in the near future as new plants are built. Two factors make such predictions impossible: the current electricity "crisis" and the absence of computer models capable of incorporating all of the variables.

This report also does not discuss the environmental consequences of the current electricity "crisis."



CHAPTER TWO

Overview of the West Coast Electric Generation System

Photo:California Department of Water Resources

II. Overview of the West Coast Electric Generation System

This chapter describes the historical and geographic development of California's electric generation system, and trends in generation system efficiency. California's system, however, must be viewed first within a West Coast context.

California's electricity generation, transmission, and distribution system is a conglomeration of systems developed over the past century by investor-owned utilities, publicly owned utilities (federal, state, and municipal), irrigation districts, and independent power producers. Cumulatively, these entities have built power plants, transmission lines, and distribution systems that cover the state, linking sources of electrical energy to end users of it.

Geography Influences Power System Development

As with all economic activities, geography has had a strong influence on power system development in California. During the first three decades of the 20th century, abundant hydrological resources were the main sources of electricity (Figure II-1). Hydroelectric development has continued in all decades, peaking in the 1960s. Today, most of the cost-effective hydroelectric sites have been developed.

Oil-fired power plant development began in the late 1930s and peaked in the 1950s and 1960s. Because of the international energy crises of the 1970s as well as air quality concerns, existing oil-fired plants were converted to burn natural gas as a fuel (keeping oil as a back up when gas supplies were short), while newly-built fossil-fired plants have predominantly used natural gas. Government policies to improve fuel efficiency led to significant additions of cogeneration during the 1980s and 1990s; these cogeneration systems are fueled mostly by natural gas but some also by coal.

Beginning in the late 1960s through the 1980s, nuclear power plants were added to California's electric system.

Policies to increase the diversity of primary energy sources for electricity generation gave rise in the 1970s and 1980s to generating capacity additions fueled by geothermal, wind, waste, and solar energy. Figure II-2 shows the cumulative amounts and types of power plants available each decade in California during the 20th century.

Transmission Lines Allow Resource Sharing

With the notable exception of a few projects like the Hoover Dam in Nevada, California power plant development remained largely in-state until the 1960s when the expansion of transmission lines and the interconnection of the utility systems in the West began in earnest. The interconnection movement was sparked by the 1965 blackout in the Northeast affecting more than 30 million customers.

But besides improving the reliability of delivering electricity, transmission lines allow utility systems to be interconnected and share generating resources.

Figure II-1 Generating Capacity Additions in California by Decade and Primary Energy Type

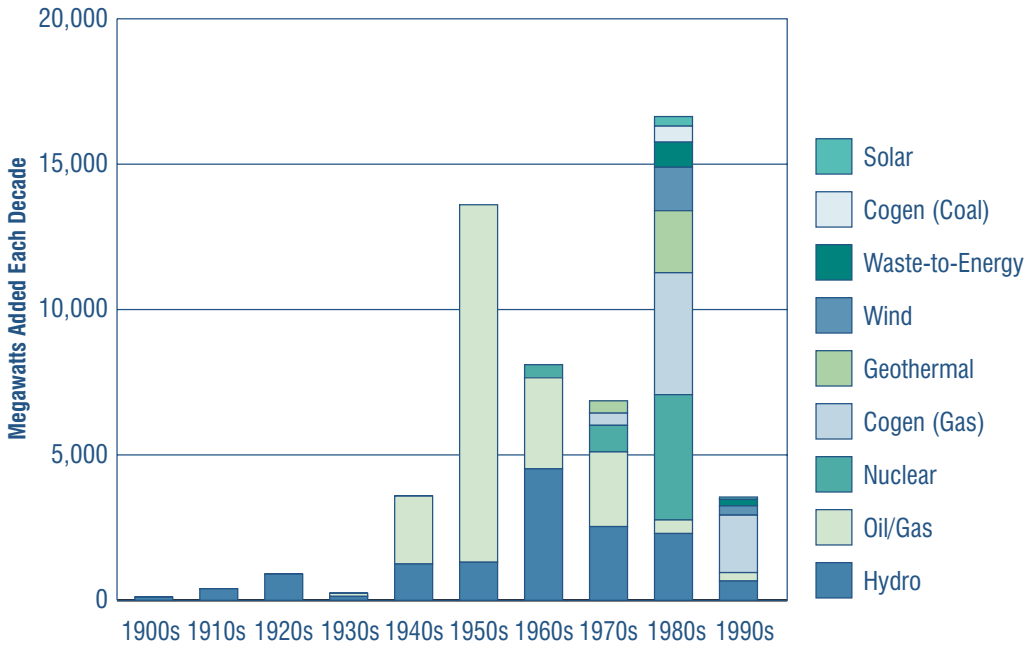
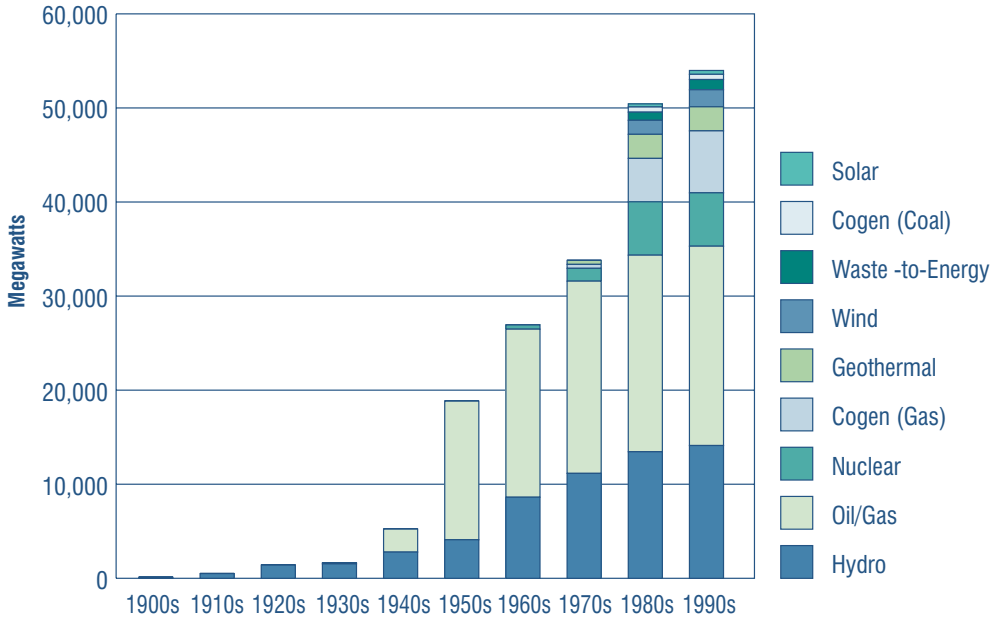


Figure II-2 Cumulative Generating Capacity in California by Decade and Primary Energy Type



Load diversity between regions exists when a region's peak demand period is during another region's low demand period. Similarly, resource diversity exists by virtue of geographical differences. For example, some regions have large coal deposits while others have large hydrological resources. By sharing generation resources regionally, fewer power plants need to be built overall, with corresponding cost savings and avoided environmental impacts.

The Western System Has Diverse Electric Resources

Figure II-3 shows the amount of power plant capacity and the mix of resource types for each of the sub-areas of the Western System, as of January 2000. Figure II-4 defines the Western Systems Coordinating Council (WSCC) sub-areas. In the Northwest Power Pool Area (NWPP), where peak electricity demand occurs during winter evenings, hydroelectric resources dominate, with coal being the second largest portion of supply. Coal-fired generation dominates the Rocky Mountain Power Pool Area (RMPA). The Arizona-New Mexico-Southern Nevada Power Area (AZ/NM/SNV), with electricity demand patterns similar to California, has a more diversified mix of generation, still dominated by coal, but with large portions of hydroelectric, nuclear, and natural gas-fired resources. Consistent with the discussion above, the California-Mexico Power Area (CA/MX) has a very diversified mix of generating resources, dominated by gas-fired capacity with significant amounts of hydroelectric, both conventional and pumped-storage, (imported) coal, nuclear, and geothermal capacity.

Given the regional diversity in patterns of demand and types of electricity resources, an active bulk power purchase and exchange market developed among utilities of the West, facilitated by regional high-voltage transmission line interconnections. The utilities in one state also participated in the development of power plants in other states from which power could be exported to their customers (e.g., Southwest coal-fired power plants owned in part by a variety of Southern California utilities).

Today, California utilities rely on imports of out-of-state power to meet a significant part of their customers' demand for electricity. Other sub-areas of the West, for example the NWPP, rely on exports from California as well.

Electrical Energy Resources Supplying California between 1990 and 2000

Figures II-5 shows the mixture of resources that have provided electrical energy to California from 1983 to 1999. It is important to examine the reasons for the annual variation in electrical energy supply that has occurred historically. Those same reasons will affect the sources of California's annual energy supplies in the future, as well as the ability to predict future sources and the environmental implications of them.

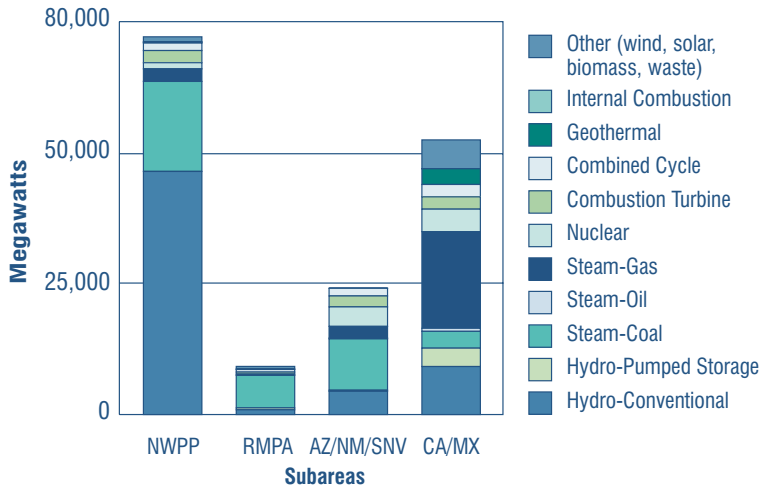
COAL

Facilities: 15
MW: 560
Ave. size: 37 MW
Avg. age: 13 years

RIO BRAVO POSO

Photo: Constellation Operating Services, Inc.

Fig II-3 Existing WSCC Generation by Sub-Area



Operating Modes of Power Plants

The number, type, and location of power plants obviously affect the supply mix of electricity each year. Power plants in California and throughout the West operate in the following modes:

- Baseload duty cycle
- Intermittent duty cycle
- Intermediate or load-following duty cycle
- Peaking duty cycle

Some power plants operate in a baseload duty cycle. That is, once having started up, they operate continuously until shut down again for maintenance or refueling. Nuclear, coal-fired, and geothermal power plants fit into this category. So do some hydroelectric power plants with continuous water flows, such as on the Columbia River, and cogeneration power plants (where power production is secondary to another continuous thermal industrial process, such as oil refining). The amount of energy from baseload power plants is a function of how many of these plants exist or are to be built, although surprise breakdowns do affect all power plants.

In California, intermittent power plants — such as wind, solar, and many of the hydroelectric facilities — operate as much as they can, contributing to California's annual electric supplies when their primary source of energy is available.

Uncertain, Highly Variable Intermittent Resources Require Back Up

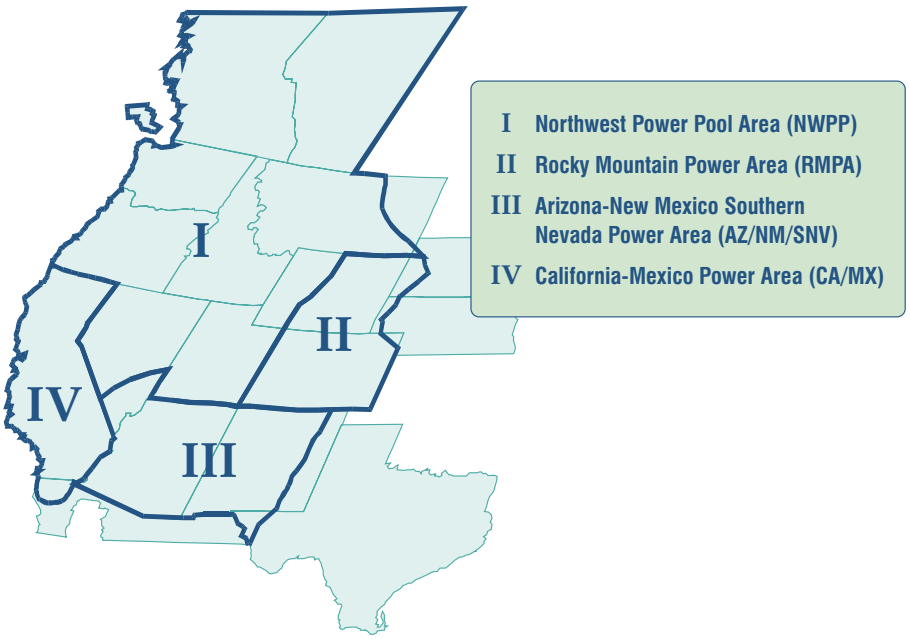
The range of variability in annual hydroelectric generation is a key source of annual electrical energy supply uncertainty. [1] Indeed, over the years, the design of the Western power grid has accommodated this variability. When precipitation runoff is bountiful, the hydroelectric generation is used and other "economic back up" or "swing" generating plants, mostly gas-fired, are idled. When hydroelectric generation is low, the "swing" generating plants will make up the difference. Annual hydrological variability necessarily complicates any attempt to predict the contribution of these swing gas-fired resources to future annual energy supplies and the environmental consequences of their use.

The magnitude of demand for electricity, or more precisely the balance between demand and available supply, affects the contribution of "intermediate" or "load following" energy sources to annual energy supplies. When the demand for energy is low enough that the generation from baseload and intermittent supplies are sufficient, then the intermediate generating resources, largely gas-fired power plants including the swing resources mentioned above, will make up the difference. Peaking

[1] The extreme range of hydroelectric energy availability from the current U.S. Pacific Northwest power plants (excluding interconnected British Columbia and Alberta), assuming the wettest and the driest historical hydrological conditions, is roughly equivalent to the energy output of five 2,000 MW Diablo Canyon nuclear power plants.

power plants are typically gas- or oil-fired plants and are typically used only when the level of demand reaches its maximum (or, for one reason or another, when the supply-demand balance is very tight). Factors that affect electricity demand from year to year, such as the weather, thus can affect the use of intermediate and peaking resources. Furthermore, many of the uncertainties associated with predicting the weather also affect predictions of the use of intermediate and peaking resources.

Figure II-4 Map of Western Systems Coordinating Council Reporting Areas



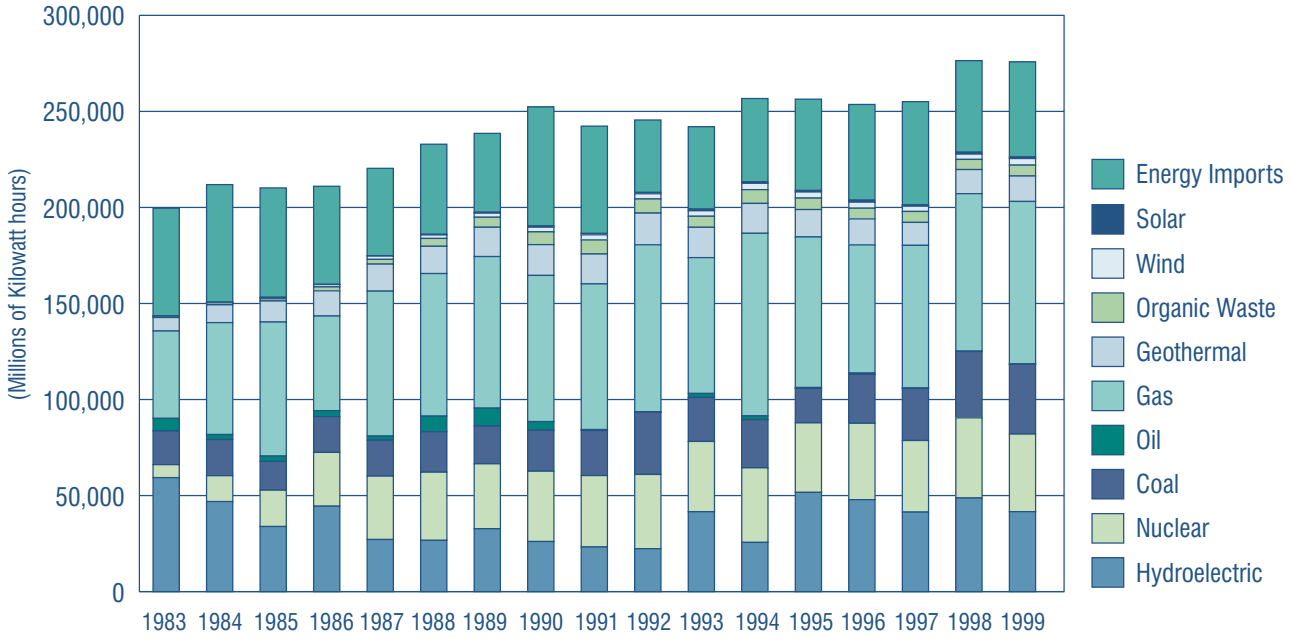
Economic Surplus from Areas Outside of California

Another source of electrical energy supply for one area would be the "economic surplus" of energy generation from another area. California typically imports power from the Pacific Northwest, including Canada, the Desert Southwest, and Mexico. The amount of surplus power available from these areas depends on these areas' own demand and supply balances, which, in part, depend on their weather, hydrological conditions, and availability of their power plants. Some amounts of economic surplus may consistently be available for import to California because of diversity in demand patterns and electricity supplies between regions. These amounts can be considered to function as "baseload" resources if available continuously, or intermediate or peaking resources, if available only for a limited number of hours. But additional amounts may or may not be available for import under certain conditions. These amounts can be considered to function more as "intermittent" resources.

Looking now at Figure II-5, a simple explanation of the patterns emerges, which can be used as a model, if not as a predictive tool. The annual mix of energy available to California depends on the availability of supply from the following:

- owned and imported baseload resources,
- owned and imported intermittent resources (including the sizeable portion of hydroelectric generation and economic surpluses that can exhibit high annual variability), and
- the amount of energy that must be generated from intermediate and peaking

Figure II-5 Sources of California Electrical Energy Consumption



resources to make up the difference between the energy supplies available from baseload and intermittent supplies and the overall demand.

Geographic Distribution of Power Plants in California by County and Facility Type

Los Angeles, San Diego, Contra Costa, and San Luis Obispo have the largest amount of installed generation (see Figure II-6).

Although most of these counties are along the Coast or the San Francisco Bay Delta, San Bernardino and Kern Counties are major electricity producers despite the lack of large bodies of surface water for power plant cooling.

All counties have some electric generating facilities — except Alpine, Del Norte, Marin, Modoc, and San Benito Counties. While Alpine, Del Norte, and Modoc are very remote and sparsely populated counties, Marin County is a relatively wealthy, suburban county. (Possibly, these counties may have electric generating facilities that the Energy Commission does not track or regulate, such as distributed generation systems less than 100 kW.)

Figure II-6 also shows a breakout between large and small-sized electric generating facilities. Counties with small amounts of installed electric generation tend to have only small-scale generation facilities; counties with relatively large amounts of installed generation tend to have large-sized facilities.

When the physical size of counties is taken into account, Contra Costa County

has the highest amount of installed electric generation per square mile of any California county.

Generation facilities in some counties play a special role in maintaining electric system reliability in the region. These units operate, upon request by the California Independent System Operator (Cal ISO), to provide voltage support and other grid reliability services.

Specifically, the Cal ISO has designated more than 100 electric generating units as "Reliability Must Run" (RMR) because of their locations within one of seven "local reliability" areas. The map in Appendix II shows where these 100 RMR units are located. Most RMR units are located in northern California (i.e., the PG&E service area), but many are clustered in Los Angeles and San Diego as well. In fact, most electric generating units in San Diego are also RMR-designated facilities. Most RMR facilities are hydroelectric or oil/gas power plants, but RMR facilities can also be waste-to-energy and geothermal power plants.

The following subsections describe the geographic distribution of the eight types of electric generation facilities.

Hydroelectric Facilities

During the first half of the 20th century, California's abundance of water resources served as the main source of electricity for the state. The current system has approximately 386 hydroelectric generating plants with a total generating capacity of 14,116 MW, with gross system production varying substantially depending on the water year.

Nearly all of California's major river systems have hydroelectric facilities on them. The river systems with the largest electric generation capacity include the following:

- Pit and Feather Rivers in the Cascade Mountains
- San Joaquin and Kern Rivers in the Central Sierra Nevada

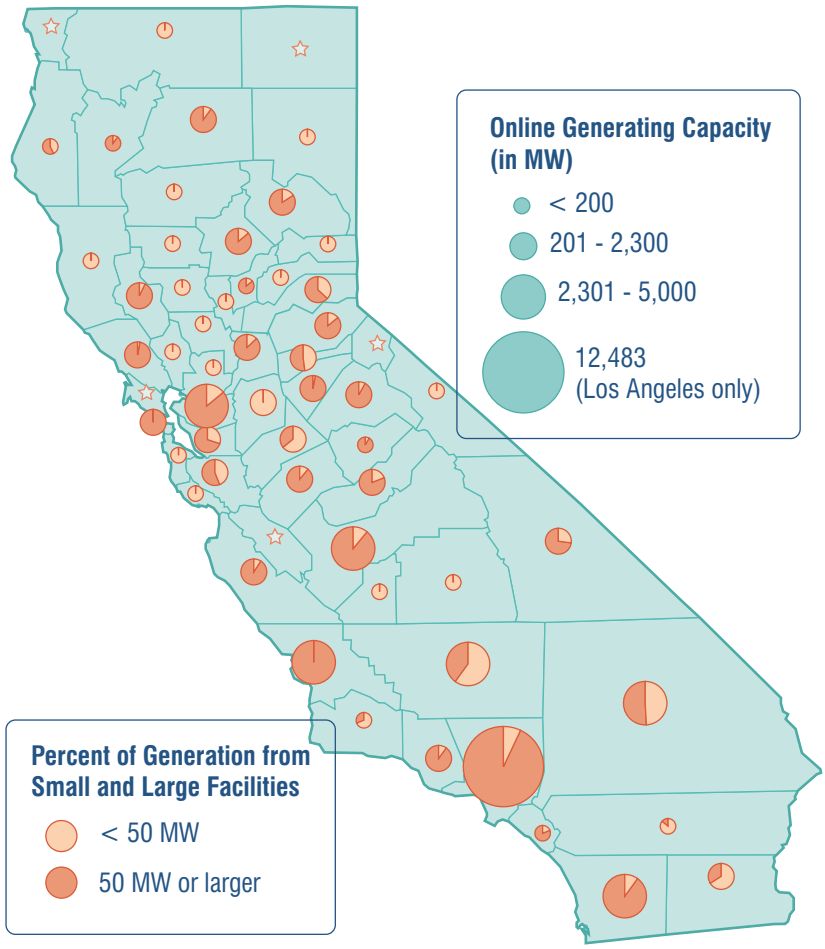
Pacific Gas and Electric's and Southern California Edison's hydroelectric systems represent about 40 percent of the state's hydroelectric capacity and include more than 250 dams in 24 watersheds.

Oil and Gas Facilities

Oil-fired power plant development began in the late 1930s and peaked between 1950 and 1960. The original central station, oil-fired steam boiler power plants were built on coastal and estuary sites in northern, central, and southern California to take advantage of large volumes of cooling water. These plants include the following:

- Pittsburg and Contra Costa power plants on the San Francisco Bay Delta,
- Moss Landing Generating Station on Monterey Bay, and
- Alamitos, Ormond Beach, and Redondo Beach generating stations on the Southern California Coast.

Figure II-6 Electric Generation Capacity by County



As a result of the oil embargo in the mid-1970s and changing air quality regulations, most of these plants were modified to run on natural gas.

The construction of natural gas-fired cogeneration facilities, sited in existing industrial complexes, peaked in the 1980s and continued through the 1990s. The current generation of combined-cycle facilities are being sited throughout the state with many located in inland areas or near major population centers.

Currently, 340 gas- and oil-fired facilities exist throughout California, with 28,290 MW of capacity and a gross system production of approximately 85,000 GWh. Most power plants of this type are located in Los Angeles County, which also has the greatest generating capacity (10,193 MW). Contra Costa County has only 17 plants but is second in generating capacity (3,731 MW).

Nuclear Facilities

Four nuclear power plants were added to California's utility system from the late 1960s through the 1980s. Three of the four were sited in coastal areas because of the need for large quantities of water for cooling.

Although Humboldt Bay and Rancho Seco have been decommissioned, the San Onofre and the Diablo Canyon plants have 2,150 MW and 2,160 MW capacity, respectively, and account for some 40,000 GWh of gross production. Future nuclear development is precluded in California until acceptable methods of radioactive waste disposal are developed.

Coal Facilities

Most of the coal-fired power plants in California were constructed during the 1980s and early 1990s. These plants typically can burn coal and petroleum coke. In-state coal-fired production accounts for only 560 MW.

California now has approximately 15 coal-fired power plants with a combined gross system production of around 36,000 GWh. The largest facility, located

in Trona, is 100 MW while the others range from 17 MW to 50 MW in capacity. San Bernardino County has the largest coal-fired generating capacity (183 MW) followed by Kern County (124 MW), San Joaquin County (94 MW) and Contra Costa County (83 MW). Los Angeles, Kings, and Amador Counties also have some coal-fired capacity as well.

Geothermal Facilities

Geothermal power generation began in the 1970s, peaked in the 1980s, and continued into the early 1990s. Currently installed capacity is 2,626 MW. These facilities account for nearly five percent of the power generated in California or more than 13,000 GWh of gross system production.

California produces about 40 percent of the world's geothermal electricity. Sonoma and Lake Counties have the largest share of geothermal plants with a total capacity of more than 1,500 MW. Imperial and Inyo Counties have 16 developed geothermal resource sites, totalling more than 640 MW.

Waste-to-Energy Facilities

Most waste-to-energy power plants — which burn biomass, municipal solid waste, digester gas, and landfill gas — were constructed in the 1980s and, to a lesser degree, in the 1990s.

Approximately 100 waste-to-energy-fueled power plants are scattered throughout the state, with a combined capacity of 1,071 MW and a gross system electricity production of approximately 5,663 GWh. Los Angeles County has the largest generating capacity from these types of plants (177 MW), followed by Shasta County with a combined capacity of 148 MW, and Humboldt County with a combined capacity of 124 MW.

Wind Facilities

Between 1981 and 1988, nearly 17,000 small to intermediate-sized wind turbines were installed in California in clusters commonly referred to as wind farms.

Currently, California has four major wind farm areas or wind resources areas with 1,818 MW of total capacity and a gross system production of 3,433 GWh. Kern County has the largest number of wind farm sites, 39 (663 MW), followed by Riverside County with 25 (368 MW.)

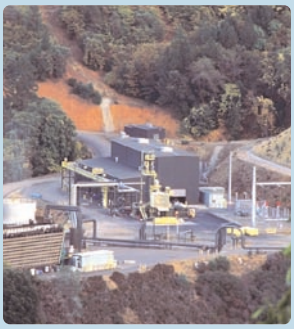
Solar Thermal Facilities

Beginning in the late 1980s, solar thermal power plants were constructed in California but peaked in the early 1990s. (Solar thermal conversion, rather than photovoltaic (PV) conversion, is the predominant form of solar power generation in California.)

California has approximately 409 MW of solar thermal capacity, with a gross system production of 838 GWh. San Bernardino County has 11 solar thermal power plants with a capacity of 369 MW. These facilities use natural gas as a back up fuel.

GEOTHERMAL

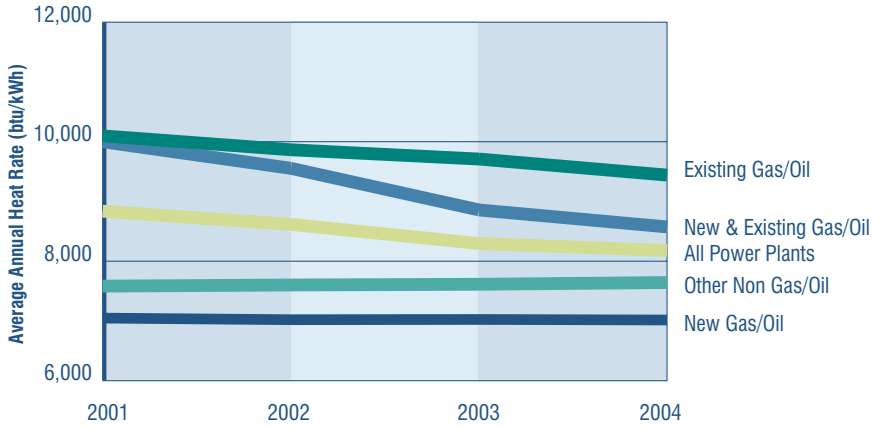
Facilities: 47
MW: 2,626
Ave. size: 57 MW
Avg. age: 16 years



BEAR

Photo: Calpine

Figure II-7 Illustrative Future California Generating Efficiency Trends



Power Plants Licensed in California Since 1996

Since 1996 and as of June 6, 2001, the Energy Commission has issued 27 licenses to build gas-fired power plants, representing 11,217 MW of capacity. Sixteen of these plants are now under construction and nine are in the financing stage. In addition to the approved projects, 18 more have been proposed and are currently under permit review. Furthermore, 28 additional power plant projects have been publicly announced representing approximately 9,000 MW of capacity. See Appendix II for the name, status, capacity, location, and projected on-line date for each project.

Other Sources of Electric Supply

Distributed Generation

Distributed generation (DG) is the generation of electricity from small-scale facilities that are located close to the load. A potential growth sector, particularly in response to current supply concerns, DG comprises the following:

- diesel engines
- fuel cells
- small and "micro" turbines and reciprocating engines
- solar thermal and solar PV and
- small wind turbines.

Energy Efficiency and Demand-Side Management

Energy efficiency and demand-side management (DSM) measures have been implemented to reduce electricity demand; they are the most environmentally efficient portion of California's electricity system. DSM includes a variety of approaches, including energy efficiency and conservation, building and appliance standards, load management, and fuel substitution.

Since 1975, energy efficiency and DSM have displaced roughly the equivalent of eighteen 500 megawatt power plants from peak demand. The annual impact of building and appliance standards has increased steadily, from 600 MW in 1980 to 5,400 MW in 2000, as more new buildings and homes are built under increasingly efficient standards. The savings from energy efficiency programs run by utilities and state agencies have also increased since 1975, from 750 to 3,300 MW.

Generation System Efficiency Has Improved

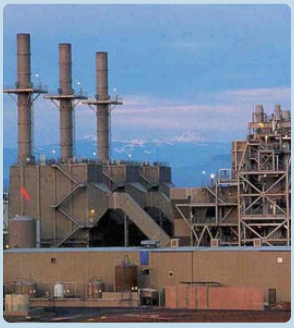
In California, the generation system has become more efficient, with less fuel or energy input needed to produce a unit of electricity.

Figure II-7 shows the estimated relative heat rates of different groupings of power plants in the generation system supplying electricity to California and the West. The lower the heat rate, the higher the thermal efficiency. The overall generation system heat rate of producing an average kilowatt hour of energy in 2001 is about 8,800 Btus per kilowatt hour. This includes all sources of electricity, even those that consume no fuel — solar, wind, geothermal, and hydroelectric.

A number of efficient new natural gas-fired power plants are expected to come on-line over the next three years. These plants use efficient new aero-derivative gas turbines to generate electricity directly and also capture some of the heat energy of the exhaust to power a steam cycle that generates more electricity. As shown in Figure II-7, these combined-cycle power plants (labeled "New Oil/Gas") have average heat rates of about 7,000 Btus per kilowatt hour. Figure II-7 also shows the effect of adding about 10,000 megawatts of new generation, mostly new combined-cycle plants, to the Western System resource mix. These additions of combined-cycle power plants, plus a few hundred megawatts of added wind and geothermal power plants, could reduce the overall average system heat rate to about 8,100 Btus per kilowatt hour by 2004.

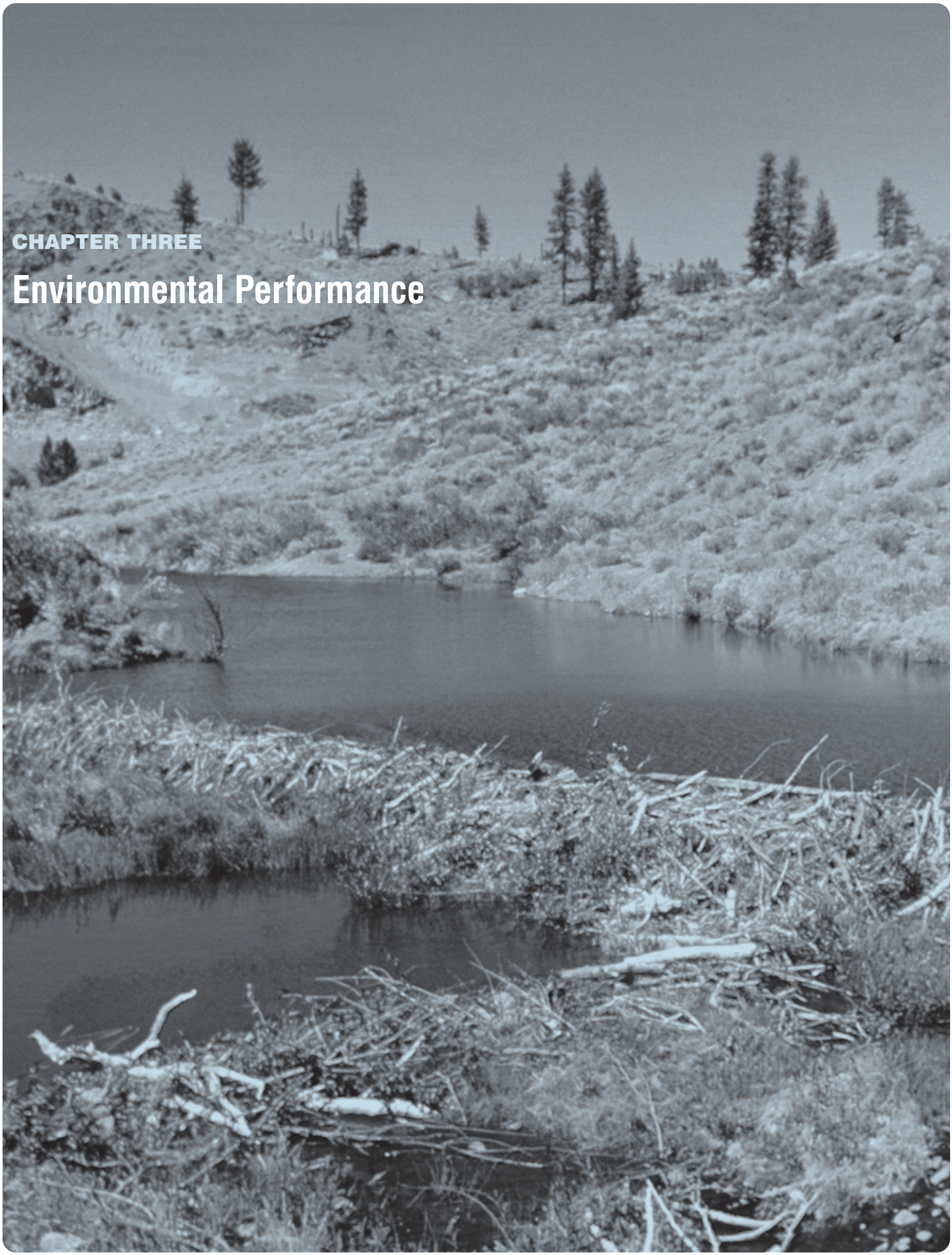
WASTE-TO-ENERGY

Facilities: 103
MW: 1,071
Ave. size: 10 MW
Avg. age: 13 years



WHEELABRATOR

Photo: Wheelabrator



CHAPTER THREE

Environmental Performance

Photo: California Department of Water Resources

III. Environmental Performance

This chapter discusses the environmental performance of California's electricity generation system and its impacts on air, water, and biological resources. Four environmental performance characteristics are used in this chapter:

- Thermal efficiency
- Environmental discharge
- Environmental quality effects
- Environmental efficiency

Environmental efficiency is the key measure used in this chapter to assess the relative environmental performance of a broad range of electricity production technologies. The concept of environmental efficiency allows the analysis of trends over time and across technology sectors.

See the Glossary for a definition of each characteristic.

Various Factors Influence Environmental Impacts

The broad environmental impacts and evolving environmental efficiency of the state's electricity generation infrastructure can be understood by identifying core technological changes, shifts in fuel types, and legislative and regulatory developments.

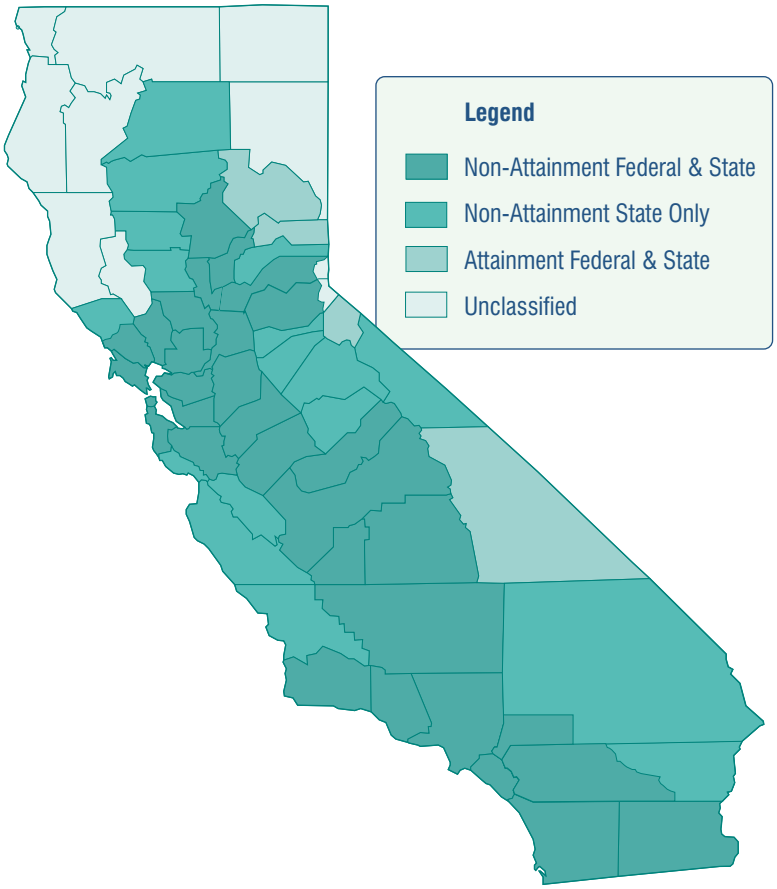
In addition to technology, legislative and regulatory initiatives have played a key role in changing the system's environmental efficiency. As would be expected, the advent of environmental regulations in the 1970s marked a turning point in addressing the environmental impacts from power generation. In addition to the Federal Clean Water Act, Clean Air Act, and Endangered Species Act, the California Environmental Quality Act passed in 1970 required that any environmental impacts from the operation and construction of power plants be mitigated. California's Clean Air Act gave state regulators added authority to address air quality issues. The thrust of these policies was to promote the development of a diverse and environmentally efficient generation system.

In response to the 1970s energy crisis, Congress passed the Public Utility Regulatory Policies Act (PURPA) in 1978, which spawned the renewables and cogeneration sectors of California's electricity supply system. Renewables and cogeneration now account for 24 percent of in-state generation capacity.

Thermal Efficiency of Oil/Gas Electric Generation

In the 1940s to early 1950s, low-pressure steam boilers had thermal efficiencies of about 33 percent[2]. This power generation technology was adapted for civilian use from the U.S. Navy, which has often been at the forefront in advancing power technology. Only five oil/gas facilities, built between 1940 and

Figure III-1 State Ozone Standard Attainment Designation



1949 and totaling 2,332 MW, are still operating.

In the 1950s and 1960s, thermal efficiency of new units improved to about 38 percent by doubling steam pressures and increasing temperatures within steam boilers from 1,000 or 1,500 pounds per square inch (PSI) to 2,500 PSI. Seventeen oil/gas facilities, built in the 1950s and totaling 12,800 MW, are in use today.

Super-critical steam (e.g., 3,600 PSI) further increased thermal efficiency to 44 percent due to advances in metallurgy and mechanical technology in the late 1960s and 1970s.

In the 1990s, gas turbine technology from the U.S. Air Force was adapted for civilian use. Although gas turbines can be operated as simple-cycle electric generators, most applications combine gas turbines with waste-heat recovery steam generators to produce electricity at 53 percent efficiency. The most advanced gas turbine technology — known as the H class — in a combined-cycle application has achieved a slightly higher efficiency of 54.1 percent.[3]

Cogeneration, although an old concept, was widely applied in the late 1970s and 1980s due to PURPA's financial and regulatory incentives. Any technology, which simultaneously produces heat energy and electrical or mechanical power from the same fuel in the same facility, is a cogeneration facility. Common applications pair gas turbines with waste-heat-recovery steam generators. Because low-grade heat is being recovered and used in industrial applications, overall thermal efficiencies increase to 72 percent.

In short, thermal efficiency has been improving steadily since the 1950s. One note of caution, however, is needed. The fuel efficiency of these new power plants may be nearing the thermodynamic limit and future gains may come mainly from distributed generation, renewables, and demand side efficiencies.

[2] All efficiencies are expressed in Higher Heating Value for comparison purposes.

[3] Gas Turbine World 2000-2001 Handbook, Volume 21, page 85.

Air Resources

Summary of Findings

- Power plant technologies have evolved, significantly improving plant thermal efficiency and emissions control efficiency.
- Emissions and emission rates of critical air pollutants from in-state generation have significantly decreased over the last 25 years. In addition, significant additional reductions are expected over the next few years, as new emission control technologies are installed at existing plants.
- Locally, strategies to improve air quality will continue to consider power plant emissions.
- The majority of California's power plants are located in the state's most severely polluted air basins, South Coast and San Joaquin Valley, or most densely populated air basins, San Francisco Bay Area and San Diego County.

OIL/GAS COGENERATION

Facilities: 277
MW: 6,642
Ave. size: 24 MW
Avg. age: 13 years

CAMPBELL SOUP

Photo: SMUD

Air Emissions Have Declined from 1975 to Present

In-state power plants burning fuels (e.g., fossil and biomass) emit air pollutants into local air basins. Additionally, geothermal plants emit air pollutants as a result of electricity production. The air pollutants include nitrogen oxides (NOx)[4], particulate matter less than 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$)[5], sulfur dioxide (SO_2), carbon monoxide (CO), hydrogen sulfide (H_2S), and reactive organic compounds (ROC). Ozone (O_3), while not directly emitted from power plants, is the by-product of NO_2 and ROC reacting with sunlight. Other pollutant emissions from the power generation sector include ammonia (NH_3) and carbon dioxide (CO_2).

These air pollutants, except for CO_2, are regulated by local, state, and federal agencies with the goal of avoiding unhealthy ambient air quality conditions by attaining and maintaining health-based ambient air quality standards.

Air Pollutants

The air pollutants most relevant to California's electricity production are NOx and PM_{10}. [6] NOx emissions from new and existing sources are controlled to improve ambient air quality, particularly relating to the ozone standards, which are exceeded in many parts of California as illustrated in Figure III-1.

Because most California air basins exceed the state PM_{10} air quality standard, PM_{10} emissions from new and existing sources must also be controlled to improve ambient air quality. Because many other air pollutants, such as NOx, SO_2, ROC, and NH_3 are precursors to PM_{10} and $PM_{2.5}$, controlling ambient PM_{10} levels is difficult. The processes by which the precursors react to form PM_{10} are complex and variable from air basin to air basin and from season to season. Additionally, there are many natural sources of PM_{10} that are difficult to control.

According to statewide emissions data from the California Air Resources Board (CARB), between 1975 and 2000, NOx and PM_{10} emissions from power

[4] NOx emissions consist mainly of nitric oxide (NO) and nitrogen dioxide (NO_2). Although the state and federal standards deal with NO_2 (and many parts of California are barely below the NO_2 standards), generally NOx emissions from a source are monitored and controlled as if they were NO_2.

[5] The United States Supreme Court has only recently resolved the issue of the new federal $PM_{2.5}$ emission standard. Air districts are now monitoring $PM_{2.5}$ to determine attainment status and potential control measures.

[6] Trends in CO, ROC, SO_2, and H_2S power plant emissions are not discussed in this chapter, because they are not significant compared to trends in NOx and PM_{10} emission reductions in the generation sector and the state as a whole.

Table III-1 Comparison of Statewide Emissions with Emissions from Power Generation (tons/day)

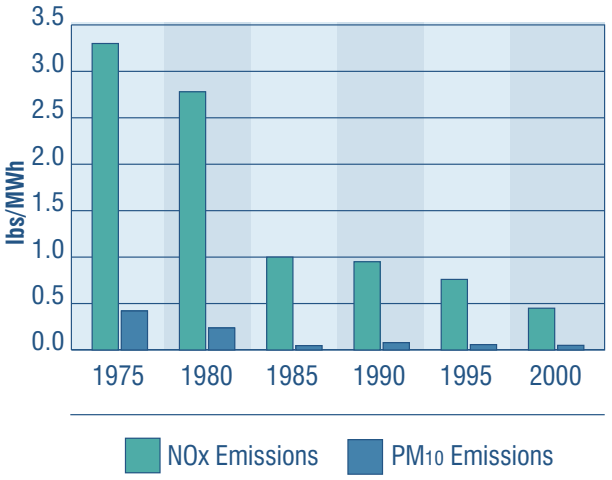
Pollutant	Source of Emissions	1975	1980	1985	1990	1995	2000	2005 (est.)	2010 (est.)
NOx	From All Sources	4,761	4,947	4,950	4,929	4,207	3,570	3,008	2,573
	From Power Generation	385	341	161	141	107	79.0	66.5	65.1
	% Power Generation	8.1%	6.9%	3.3%	2.9%	2.5%	2.2%	2.2%	2.5%
PM_{10}	From All Sources	1,864	2,018	2,004	2,240	2,177	2,313	2,467	2,612
	From Power Generation	49.6	29.1	5.7	11.8	8.1	8.62	9.63	9.8
	% Power Generation	2.7%	1.4%	0.28%	0.53%	0.37%	0.37%	0.39%	0.38%

Source: CARB 2001

generation declined by 75 percent and 70 percent, respectively (CARB 2001). At the same time, the generation sector's contribution to the total state NOx and PM_{10} emission inventory declined by 69 percent and 80 percent, respectively. These data are summarized in Table III-1. Changes in unit emissions on a per megawatt hour, per capita, and per unit of gross state product basis are shown in Figures III-2a, 2b, and 2c, respectively.

The emissions, trends, and relative contributions of air pollutants are shown on an annual statewide basis. While representative of trends in local air basins, emissions generally vary by air basin, time of year, and time of day. Additionally, in-state generation and emissions vary from year to year due to swings in the availability of imported power and hydroelectric power. Hence, air quality planning is done at the air-basin level to ensure consideration of local sources and daily and seasonal variations in emissions. Power plant licensing is also a local issue, which considers existing ambient air quality and potential emissions from proposed projects.

Figure III-2a Historic California Power Plant Emissions Per Unit of Power Generated



Factors Affecting Emissions Trends

Several factors have led to the decrease in air pollutant emissions, in particular NOx and PM_{10}, from in-state electricity production, including, but not limited to:

- Requirements of the federal and California Clean Air Acts
- Shifts to cleaner fuels (e.g., natural gas)
- Improvements in power plant efficiency
- Improvements in emission control technologies
- Retrofit of older plants

Clean Air Act Requirements — The federal Clean Air Act (CAA) requires regions to monitor ambient air quality to determine the regions' status relative to health-based standards. Based on the region's attainment status, control measures are implemented to attain or maintain ambient air quality standards. The California Clean Air Act (CCAA) provides the basis for air quality planning and regulation independent of federal regulations.

Local air districts in violation of the California standards must prepare attainment plans which identify air quality problems, causes, trends, and actions to be taken to attain and maintain California's air quality standards by the earliest practicable date. Since many parts of California violate federal and state ambient air quality standards, air districts have implemented control measures on existing and new sources of air pollutant emissions to reduce ambient levels of air pollutants and improve air quality.

As part of this effort, local air districts established Best Available Retrofit Control Technology (BARCT) requirements to reduce emissions (mostly NOx[7]) from existing power plants. Additionally, most new sources, including power plants, are subject to New Source Review rules, which require that emission reductions be surrendered to offset proposed emission increases, and that Best Available Control Technology (BACT) be applied to minimize emission levels of some pollutants.

Shift to Cleaner Fuels — The 1972 oil embargo encouraged generators to shift away from fuel oils towards other domestic fuel supplies, which included natural gas. The net result was a substantial decline in NOx and PM_{10} emissions, as shown on Figures III-2a, 2b, and 2c.[8] Today, only four California steamboiler plants can still burn fuel oil as a system reliability component, but only in an emergency or during natural gas curtailment. Additionally, many of the peaker combustion

[7] and CO

[8] Additionally, California experienced a significant drop in SO_2 emissions as generation moved away from fuel oils and their inherently high sulfur content.

Figure III-2b Historic California Power Plant Emissions Per Capita

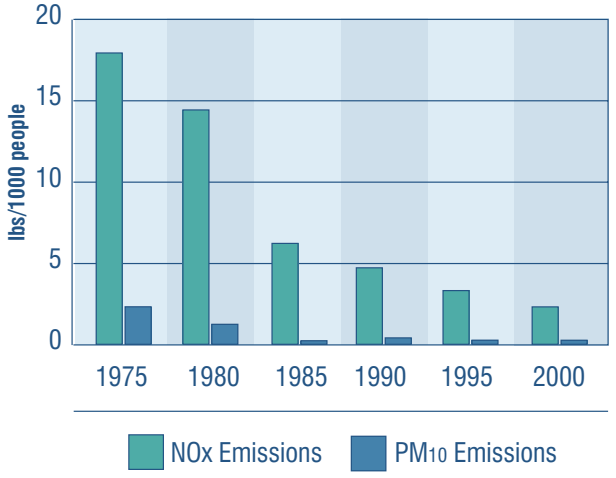
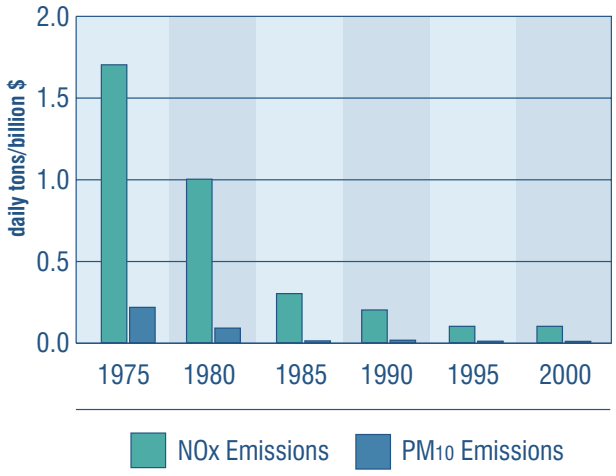


Figure III-2c Historic California Power Plant Emissions Per Dollar of Gross State Product



turbines use distillate fuel oil, albeit, with restricted fuel sulfur, emission rates, and annual operating hours.

Technology Improvements Have Helped Reduce Emissions

Power Plant Efficiency

Since the 1950s, changes in power plant equipment design have improved thermal efficiency and reduced emissions. The efficiency improvements were realized by increasing power plant size and firing temperatures.

The higher firing temperatures promote more complete fuel combustion, generally limiting CO, ROC, and PM_{10} emissions. The higher temperatures, however, significantly increased NOx emissions. The increased generating capacities of these plants also made them the largest sources of air pollution in most of the communities where they are located, raising concerns about their impacts on local air quality conditions.

The sidebar shows an example of how an existing power plant, the Moss Landing Generating Station, has expanded its generating capacity, reduced emissions per MWh, and improved thermal efficiency[9] since it was first built.

Air Pollution Control Technologies in Use

NOx emission control technologies for boilers include flue gas recirculation (FGR), low-NOx burners, and selective catalytic reduction (SCR). Together, these

[9] Thermal efficiency expressed in high heating value.

The Evolution of a Generating Station — Moss Landing

Photo: Energy Commission

Moss Landing Generating Units	Time	NOx Emission Factor	Eff.
Moss Units 1-3: 3 x 110 MW of boilers	1950	5.0 lbs/MWh	20%
Moss Units 4/5: 2 x 120 MW of boilers	1952	3.0 lbs/MWh	28%
Moss Units 6/7: 2 x 750 MW of supercritical boilers	1967	13.56 lbs/MWh	38%
Moss Units 6/7: 2 x 750 MW install FGR	1970's	2.54 lbs/MWh	38%
Moss Units 6/7: 2 x 750 MW install S burners	early '90's	1.02 lbs/MWh	38%
Moss Units 1- 5 retired: 570 MW	1995		
Moss Units 6/7: 2 x 750 MW install SCR	2001/02	0.113 lbs/MWh	38%
Moss Units 1A,1B,2A,2B: 4 x 265 MW comb. cycle	2003	0.062 lbs/MWh	48%

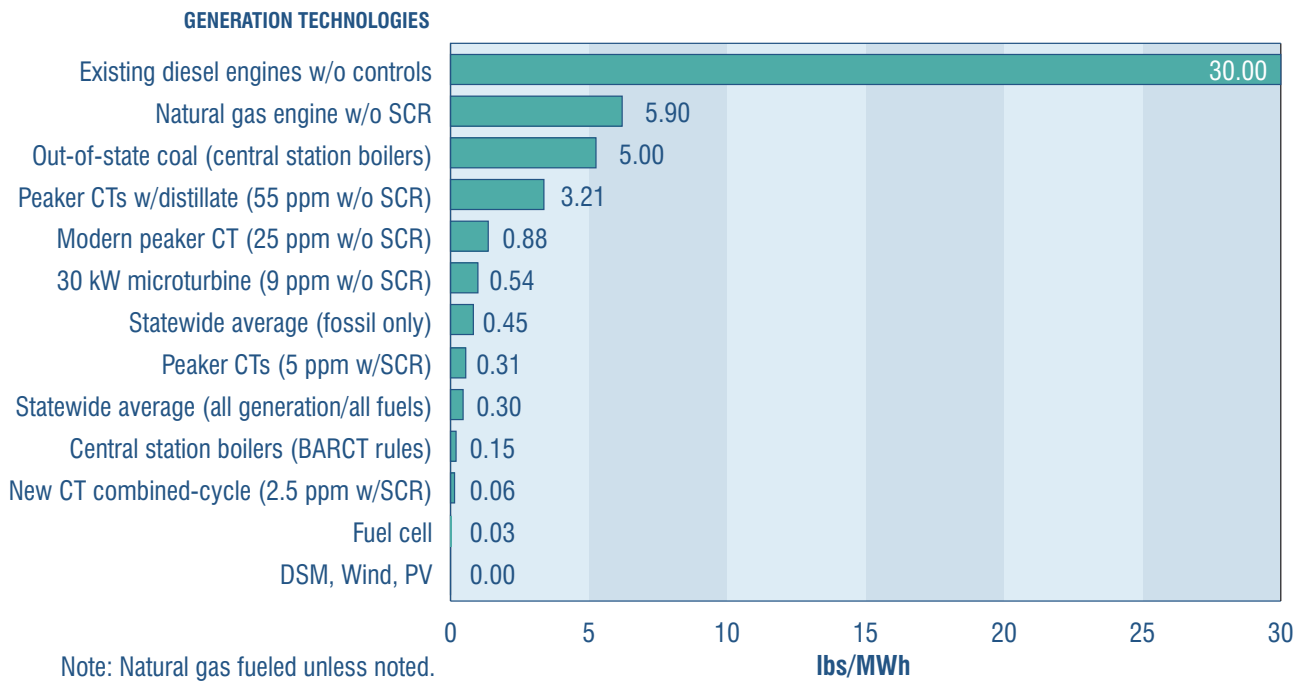
Pacific Gas and Electric built the Moss Landing Generation Station in the early 1950s. The first three units were twin boilers feeding one steam turbine; the unit thermal efficiency was in the low 20s. Units 4 and 5 were single boilers with an improved thermal efficiency approaching 30%. The start-up of the large supercritical Units 6 and 7 in the late 1960s significantly increased unit thermal efficiency but also increased emission rates. Over time, PG&E was required to reduce emission rates at Moss 6 and 7 to today's levels. To date, flue gas recirculation, low-NOx burners, and selective catalytic reduction have been installed. The new combined cycle units effectively replace Units 1 – 5.

technologies can reduce boiler NOx emissions by as much as 99 percent. NOx control measures for combustion turbines include low-NOx combustors, dilution (steam or water injection), and SCR. New technologies under development and small-scale demonstration include adsorption catalyst technology (SCONOx®) and catalytic combustion. These technologies appear to have emission control efficiencies similar to current emissions control technologies, but could represent advances in pollution control technology. NOx emission rates for combustion turbines and boilers, in the range of 0.05 to 0.15 lbs per MWh, can be achieved with cost-effective control technologies (see Figure III-3). In general, PM_{10} emissions have also decreased on a per megawatt hour basis with increasing efficiency. The implementation of new NOx control measures, however, has often increased levels of PM_{10}, CO, and ROC emissions.

Retrofit of Older Plants

During the 1990s, air districts worked with power plant owners to establish BARCT levels and implementation schedules for central station boilers. As a result of these rules, 55 power plants were scheduled to be retrofitted to comply with the BARCT regulations; most retrofits will reduce NOx emission rates to as low as 0.10 lbs per MWh. The net result of these retrofits will be a significant reduction in NOx emission rates for these units, on the order of 90 percent from 1996 emission rates. A comparison of NOx emission rates from a central station boiler

Figure III-3 Comparison of NOx Emissions



Note: Natural gas fueled unless noted.

(with fully implemented BARCT rules) to other California generation options is provided in Figure III-3. The BARCT and new combustion turbine combined-cycle units will be cleaner (for NOx) than the current California system average, and should continue the trend of improving NOx emission rates for in-state generation, once they come on-line.

While the pollution retrofits of most larger units are completed or proceeding, many smaller peaking units are not now required to employ all available pollution control technology. These units are used less than the larger plants, but still have high emission rates per megawatt hour produced. Since they often operate on the hottest, most polluted days, reducing emissions from these units continues to be important.

Emissions are Concentrated in Four Air Basins

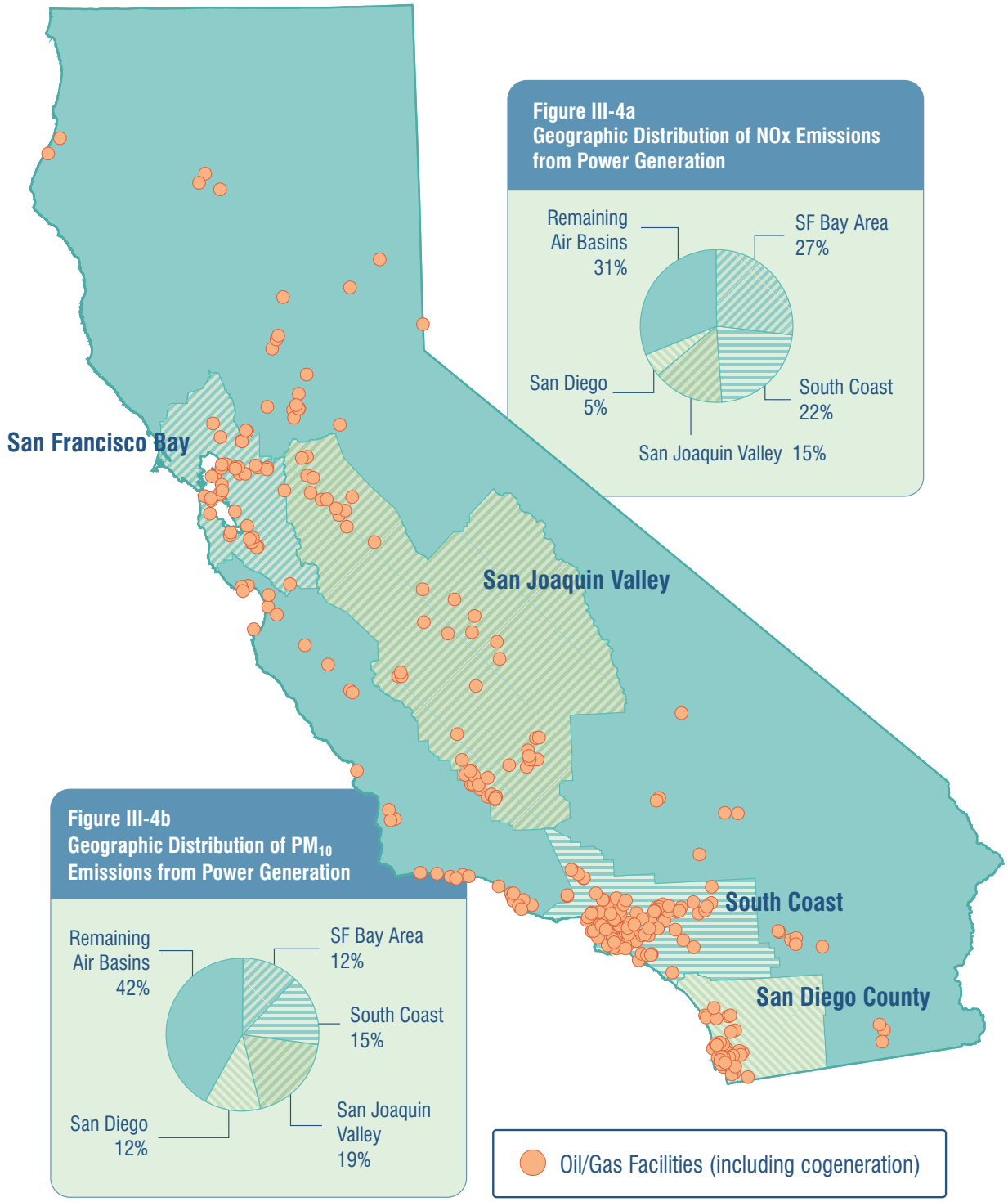
The state's 58 counties are divided into 35 air districts and 15 separate air basins. An air basin is an area that has common meteorological and geographical conditions, but is not necessarily controlled by a single air district. The air districts are often defined by a political boundary like a county line. Figure III-4 shows the locations of the state's oil/gas-fired power plants. An analysis of emissions in each air district shows that emissions from power generation facilities are clustered primarily in four air basins:

- San Francisco Bay Area Air Basin
- South Coast Air Basin
- San Joaquin Valley Air Basin
- San Diego Air Basin

These are also the most densely populated and/or most polluted air basins in California. Depending on the air pollutant, over half of all the emissions associated with power production occur in these air basins. For example, in 2000, 69 percent of the NOx emissions from power generation occurred in these four air basins. Similarly, 58 percent of the PM_{10} emissions occurred in these four air basins. It is also important to note that air pollutant emissions in an air basin can be transported to downwind districts and air basins, adversely affecting air quality (CARB 2001b).

The majority of new facilities will likely be located in one of these air basins, in part, because these locations are near load centers, transmission lines, and natural gas pipelines. The additions of new power plants, specifically fossil-fueled units, would appear to add to the air pollution burden of these air basins. However, these new sources are significantly less polluting and more efficient than existing fossil-fueled power plants. Also, certain air pollutant emissions from new sources are offset. This offset trading results in no net increase, and often a reduction, of critical air pollutants in the air basin. Air district New Source Review programs ensure that new sources are clean (i.e., low emitting) and that the existing sources (e.g., kilns, bakeries, refineries, power plants, diesel engines) that provide the emission reductions become cleaner over time.

Figure III-4 Geographic Distribution of California's Oil and Gas Facilities



Other Emissions

Carbon Dioxide (CO_2)

CO_2 is a "green-house gas" pollutant potentially associated with global climate change. California power generation CO_2 emissions have not followed the trends in emission reduction described earlier. On a percent basis, CO_2 emissions from fuel combustion by utilities have remained at approximately 13 percent of the total CO_2 emissions since 1990. Forecasts by the Energy Commission indicate that CO_2 emissions from power plants are likely to remain constant relative to total CO_2 (Energy Commission 1999), despite potential increases in fuel use, energy production, and CO_2 emissions in the generation sector. Potential increases will be dampened by improvements to the system average thermal efficiency, fuel diversity, the use of demand-side management, and energy efficiency improvements. These improvements will also reduce CO_2 emissions on a per capita and per megawatt hour basis.

Ammonia

SCR control technology, which reduces NOx emissions, requires the use of ammonia. During normal operation, some unreacted ammonia is released out the stack as "ammonia slip." The ammonia is an air pollutant and a precursor to PM_{10}. Most air districts limit ammonia emissions in the power plant's air permit.

Distributed Generation

Additional air pollutant emission concerns have been raised regarding the type and penetration of distributed generation (DG) technologies in a restructured electricity market. Although emissions from natural gas and diesel-fired units are being reduced, they currently emit at much higher rates than new, large power plants. Last year, the CARB released a report on the air pollution implications of the economic penetration of DG technologies (CARB 2000a). The most likely DG technologies in California would be microturbines and reciprocating engines, which currently have higher emission rates (for NOx, see Figure III-3) than the less polluting DG technologies — fuel cells and solar PV. The economics of DG technology applications, however, are very site-specific.

In response to SB 1298, enacted as Chapter 741 of the Statutes of 2000, CARB is developing an emissions standards and certification process for DG technologies that are exempt from local air district permitting, and a guidance document for air districts in permitting DG technologies that are under air district jurisdiction. The certification program and guidance document will be considered for adoption as early as November 2001.

Back Up Generators

A debate has recently arisen regarding back up emergency generator (BUG) use during periods of acute electricity shortages. Most BUGs (about 11,000 units, or 3,500 MW) are diesel-fired, old, and have no pollution controls (CARB 2000b). BUGs are generally sized for a limited emergency load at a facility, so it is

unlikely that owners will choose to disconnect from the grid and operate solely with the BUG. Only about 1,000 MW of BUGs are designed to operate in parallel with the grid. (The facility remains connected to the grid while supplying electricity to the grid from the BUG.) Diesel emissions, however, are very dirty compared to all other types of electric generators on the grid. Uncontrolled diesel or natural gas reciprocating engines emit more NOx per kilowatt hour than an out-of-state coal plant (see Figure III-3). Additionally, diesel particulate matter emissions are a known carcinogen and subject to much scrutiny (CARB 2001a).

Water Resources

Summary of Findings

- Competition for the state's limited fresh water supplies is increasing and demand may exceed supply by 2020.
- While the amount of water used by power plants is less than one percent of total statewide water demand, impacts to local water supplies from individual power plants can be significant.
- Existing coastal or bay side power plants that use once-through cooling are being expanded, repowered, or replaced with more efficient combined-cycle facilities. These new power plants use 50 percent less cooling water per megawatt hour for once-through cooling than the older, steam boiler plants.
- No new power plants using once-through cooling have been proposed at coastal or bay side sites.
- Many new power plants are being located in areas with limited water supplies.
- Increased demand for fresh water supplies has lead to a reduction in fresh water use by power plants, due to increased use of alternative water supplies and dry-cooling technology.
- Water quality impacts from power plants have been reduced due to improvements in wastewater treatment and disposal practices.

Power Plant Water Demand Depends on Technology

As California's population continues to grow, competition for the state's limited fresh water supplies is also escalating. If current trends continue, the state's water demand is expected to exceed supply by 2020 (LAO, September, 1999).

Power plants use water primarily for steam production and for cooling. While power plants use less than one percent of the state's total water supply, impacts from individual facilities can be significant where local water supplies are limited. Discharge of cooling and process wastewater may also degrade the quality of local water supplies.

Combined-cycle or boiler-fired power plants use once-through cooling or cooling towers. The cooling water demand for a 500 MW combined-cycle power plant

using once-through cooling is about 15,000 gallons per MWh. This rate of water use compares to 30,000 to 40,000 gallons per MWh for a central station boiler using once-through cooling. The difference in rate of water use is due to the approximately 60 percent improvement in thermal efficiency of the combined-cycle facility compared to the steam boiler.

Approximately 40 percent of the state's generation capacity uses once-through cooling. Those facilities are located predominantly along the Central and Southern California Coast and the San Francisco Bay and Delta. The repowering or replacement projects at these existing power plant sites, which are more efficient, are increasing generating capacity without increasing net water use.

The two operating nuclear facilities within California, Diablo Canyon and San Onofre, were the last once-through cooling facilities built. Recent repowering and expansion projects at existing facilities, however, perpetuate this practice.

Closed-loop cooling recirculates the water through cooling towers where heat is dissipated to the atmosphere through evaporation. Since water is recirculated, the volume of water used is significantly less than that required for once-through cooling. Closed-loop cooling requires only about 200 to 250 gallons per MWh. However, a substantial portion of the water that circulates through a cooling tower is lost to evaporation, while essentially no water is lost through the use of once-through cooling technology.

Air-cooled (dry) and wet/dry hybrid technologies are now being used in some power plants. There are six existing air-cooled dry cooling facilities in California, totaling approximately 273 MW of installed capacity (Maulbetsch 2001). In addition, a new 500 MW dry cooling combined-cycle facility will begin operations in June 2001, and another 500 MW dry cooling combined-cycle facility has just been licensed. These facilities are tripling the use of dry cooling technology by power plants in the state. Dry cooling can use as little as 25 to 50 gallons per MWh.

Simple-cycle combustion turbine power plants, which do not have steam boilers, use relatively small quantities of water to cool inlet air, control emissions, and for washing equipment. For example, a 51 MW simple-cycle facility requires only 65 to 180 gallons per minute of water (Energy Commission 2001), or about 75 to 200 gallons per MWh.

Impacts on Local Water Supplies by Thermal Plants

As competition for local water supplies intensifies, the effects of water use by power plants are becoming more significant. A power plant's impact on water supplies may vary widely, depending on the source of the water — ocean, river, or groundwater — and how the water is obtained (direct diversion or extraction, municipal supply or imported through a water project). The most significant effects of water use by power plants are on other current and future users of local water supplies.

For example, groundwater pumping by a power plant may reduce water supplies

to agricultural, rural residential, or urban users. Similarly, surface water diversion may impact recreational uses, municipal or domestic supplies, agriculture, both aquatic and terrestrial habitats, water quality or flows of the source water body, or future development opportunities in a community.

Power plants using once-through cooling tend to have the greatest effect on aquatic life because of entrainment and impingement from the significant volumes of water drawn into these plants at high velocities (see the Biological Resources section for more discussion).

NUCLEAR

Facilities: 2
MW: 4,310
Ave. size: 2,105 MW
Avg. age: 25 years

DIABLO CANYON

Photo: Pacific Gas & Electric

Wastewater Discharge May Affect Adjacent Land and Water Bodies

Cooling water is the major source of wastewater generated by most thermal power plants. For steam boiler and combined-cycle facilities using wet cooling technology, from 20 to 40 percent of the water used by the facility becomes wastewater, and the rest is lost through evaporation. A 500 MW facility generates about one million gallons per day of wastewater, about 70 percent of this wastewater is for cooling tower blowdown. The remainder of the wastewater is from the boiler, evaporative cooler and heat recovery steam generator blowdown, equipment washwater, and stormwater runoff. In once-through cooling processes, little if any water is lost, resulting in a wastewater stream that only differs slightly in volume from the source water.

Steam production, evaporative coolers, and several other power plant processes require higher quality water than for cooling towers. Treatment processes to achieve this high quality water create wastewater streams, such as filter backwash or reverse osmosis reject water, that carry concentrated dissolved and suspended constituents.

Impacts of Wastewater Discharge

Thermal power plants in California use a variety of wastewater disposal methodologies, including discharging to surface or groundwater, land, evaporation ponds, or sewer systems. Wastewater from thermal power plants may degrade surface and groundwater supplies, adversely affecting drinking water supplies and other beneficial uses, including those related to wildlife habitat and other biological resources. Pollutants of concern associated with wastewater from thermal power plants include heat, dissolved solids (including metals), and chlorine. To address these concerns and related regulatory requirements, a number of power plants are using zero liquid discharge technologies. Such facilities generally treat the wastewater through concentration and evaporation. Clean water is distilled and recycled, and a salt cake remains as solid waste.

For once-through cooling facilities, wastewater temperatures may be in excess of 30 degrees F above the receiving water temperatures. In comparison to once-through cooling facilities, the temperature of heated wastewater from thermal plants using wet-cooling towers is significantly less because most of the heat is dissipated as the water passes through the cooling towers. Such discharges rarely

exceed 10 degrees F above receiving water temperatures. Wastewater discharges often range from 70 to 110 degrees F under normal conditions, but may peak as high as 110 to 135 degrees F for very short periods. Where coastal power plants discharge the heated wastewater to the open ocean, the buoyancy and rapid mixing of the thermal plume tends to minimize the potential impacts to sea life. In more contained systems such as bays and rivers, however, the elevated temperature of the discharged wastewater can have a more significant effect on water quality and aquatic organisms. The impacts from thermal discharge on aquatic organisms are discussed in the Biological Resources section.

Recent Trends Reduce Fresh/Sea Water Use and Disposal Concerns

Before the 1970s, most of the thermal power plants within the state were large plants using once-through cooling. Only recently has there been an effort to replace or retrofit existing coastal facilities with more efficient, state-of-the-art technologies, but those facilities will continue to use once-through cooling.

The recent trend is to build large, 500 to 1,000 MW combustion turbine combined-cycle facilities that use closed-loop cooling; many are located inland. Although the water use efficiency of these power plants is better than the older plants, the amount of water required can still be from 3.5 to 5 million gallons per day. Therefore, their impacts on local water supplies have become significant issues.

Figures III-5a and 5b show cooling water sources for 32 of the state's existing fossil fuel plants and 13 recently approved plants. Imported water, such as through the State Water Project, reclaimed water and groundwater have increased in importance as cooling water supplies, along with the use of dry cooling. These figures also reflect the recent trend of continuing the use of once-through cooling at existing coastal facilities that are being retrofitted or replaced.

An important trend has been the increasing use of reclaimed water in urbanized areas. Such areas, of course, have more than a sufficient wastewater effluent supply. A survey of the use of reclaimed water by existing power plants indicates use of approximately 1,200 acre-feet (AF) of reclaimed water per year, representing only six percent of the total industrial use of reclaimed water statewide (SWRCB 1999). Another 15,000 AF of reclaimed water is planned for use associated with three recently approved new power plants, Delta Energy and Los Medanos in Contra Costa County, and Mountainview in San Bernardino County. Use of reclaimed water by these new facilities represents a twelve-fold increase in reclaimed water use compared to its use by existing power plants.

The final aspect of this trend is the increase in the use of dry cooling technology. When the 500 MW Sutter Power and 500 MW Otay Mesa Generating projects are completed, the installed generating capacity in California using dry cooling will increase almost four-fold.

Replacing Boiler with Combustion Turbine Technology for Gas-Fired Plants

Improvements in thermal efficiency reduces cooling water demand, since less

waste heat is dissipated in these new power plants. Under average operating conditions, for example, a proposed new facility using once-through cooling will use half the amount of water as would be used by older facilities at the same location. The recent siting of simple-cycle facilities, which have minimum water demand, also illustrates how additional capacity can be added without increasing water demand significantly.

Trends in Wastewater Disposal

Of the most recent proposals to repower coastal facilities, which use once-through cooling, no changes to wastewater treatment or disposal practices have been proposed. Factors that affect wastewater disposal from inland facilities are: the location of the facilities, volumes of discharge, and quality of discharge. Projects in more urban areas tend to dispose of their wastewater streams to municipal systems. Unlike older projects, fewer remote facilities today propose to dispose of plant wastewater in evaporation ponds or surface impoundments. More often they will use zero liquid waste disposal systems.

In general, the volume of wastewater generated by newer combined-cycle facilities is noticeably less than that of older facilities. This reduction in wastewater discharge is due to the greater efficiencies of the newer combined-cycle plants, which require less cooling water, and to more efficient use of water within the plants. This trend includes an increase in the number of cycles of concentration for cooling water and recycling of other wastewater streams. More and more power plants are also using zero discharge facilities because this technology has become more cost effective. Furthermore, a number of existing and proposed plants will use dry or wet/dry cooling technology, which eliminates or substantially reduces the amount of cooling water blowdown.

Figure III-5a Cooling Water Sources for Largest Existing Power Plants (percent of plants)

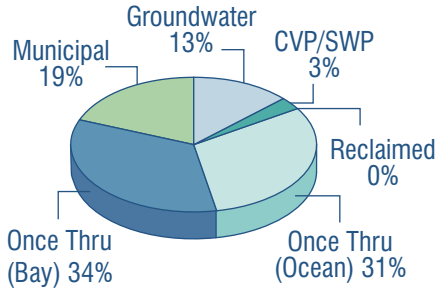
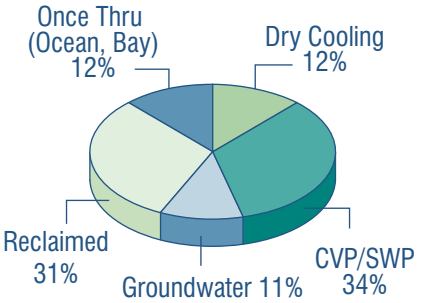


Figure III-5b Cooling Sources for 13 Recently Approved Projects (percent of future capacity)

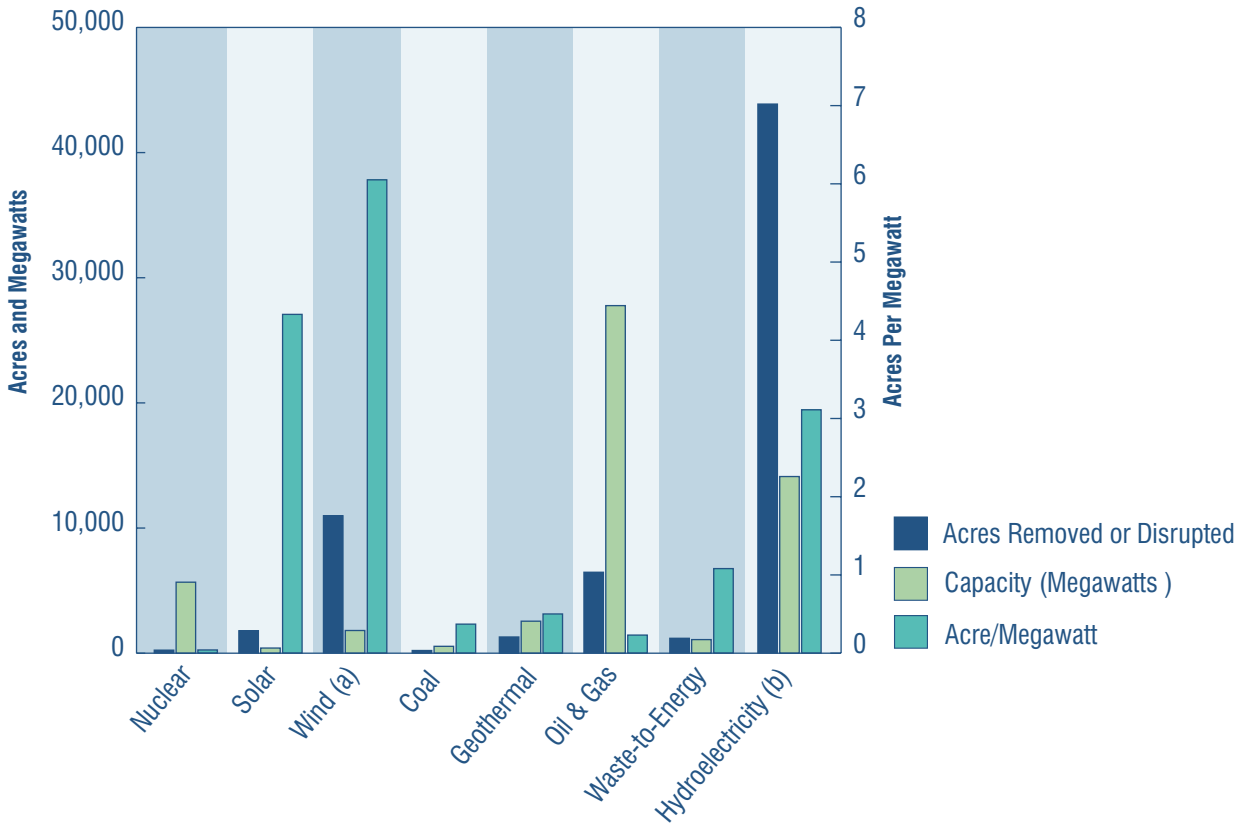


Evolving Regulatory Trends to Improve Water Quality and Environmental Protection

Currently, developing regulations and policies may lead to cleaner wastewater discharges from power plants built in the future, including the following:

- More costly infrastructure modifications may be required under Federal Clean Water Act Section 303(d) — Impaired Waters List, as administered by the State Water Resources Control Board. Even older power plants may be required to upgrade their infrastructure by applying best practicable control technology to meet site-specific water quality improvement objectives.
- Wellhead Protection Act — Currently, the Department of Health Services administers the wellhead protection program, which is a federal program to protect groundwater sources of drinking water supplies from sources of contamination. Presently the State's efforts have focused on developing an

Figure III-6 Acres of Habitat Removed or Disrupted



(a) Wind farms disrupt, but do not eliminate, most wildlife habitat values. Wind turbines harm birds in areas like Altamont Pass.

(b) The 43,862 acres shown is the land area flooded by PG&E reservoirs only. It is a representative figure used to illustrate land and aquatic habitats eliminated by hydroelectric facilities. The total number is substantially higher. The MW capacity figure is for all California hydro production. The addition of all hydroelectric facilities acreage would increase the number of acres needed per megawatt. The efficiency number for PG&E's hydroelectric system is 11.2 acres/MW.

inventory of groundwater supplies and potential contamination sources. In the future, however, the State may institute additional requirements for the disposal of wastes and the handling of potential contamination sources.

- California Toxic Rule — This rule specifies priority pollutants with applicable criteria and objectives to determine if water quality-based effluent limitations may be required on a given project.
- Total Maximum Daily Loading (TMDL) Restrictions — A method to address both point and non-point sources of pollution, a TMDL is a quantitative assessment of pollution sources and allocations to reduce pollution levels.

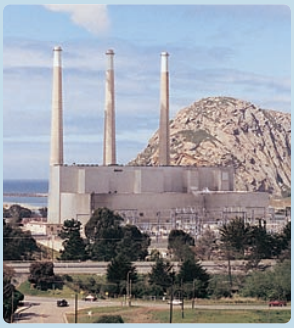
Biological Resources

Summary of Findings

- The primary biological impacts from electrical generation development in California have been loss of terrestrial habitats and loss and alteration of aquatic habitats.
- Large portions of the state's thermal and hydroelectric generation infrastructure, which were constructed in sensitive ecosystems before modern environmental statutes were enacted in the 1970s, caused substantial, unmitigated environmental damage.
- The damage to aquatic biological resources continues at coastal power plant sites using once-through cooling and at many hydroelectric facilities due to altered river flows.
- Repowering or expanding power plant capacity at six existing coastal and bay side sites will perpetuate significant impacts on aquatic ecosystems through the continued use of once-through cooling water systems.
- The new combined-cycle power plants now being constructed have markedly fewer impacts on wildlife habitat on a per megawatt and per acre basis than the older steam boiler generation plants.
- Existing and proposed power plants in the southwestern oil fields of San Joaquin Valley have caused and will continue to cause significant cumulative impacts to biological resources, mitigated in part, by off-site habitat preservation programs.
- With the exception of hydroelectric generation, power plant impacts to biological resources are much less significant than impacts from urban, suburban, transportation, and agricultural development.

OIL/GAS

Facilities: 63
MW: 22,365
Ave. size: 355 MW
Avg. age: 32 years



MORRO BAY

Photo: Laura Frank

Power Generation Directly Eliminates Habitat

Power generation facilities impact biological resources by directly eliminating habitat for the footprint of power plants and associated facilities. Power generation causes numerous other direct and indirect impacts to biological resources as well.

The acreage of habitat removed or degraded from development of electricity generation systems serves as an indicator of the relative biological impacts of each technology sector. About 65,960 acres have been displaced or degraded in California from power generation development. Figure III-6 shows the distribution of this acreage by power sector, illustrates the relative MW capacity for each sector, and shows the estimated acres of land impacted per MW of capacity.

Hydroelectric Impacts are Significant

Hydroelectric development has significantly altered river systems throughout California by changing the natural flows of rivers, altering aquatic habitats, dewatering sections of streams, blocking the migration of fish, changing water

temperatures, and flooding land and riparian areas. Hydroelectric projects are installed on all but one of the Sierra Nevada's major river systems. According to the Sierra Nevada Ecosystem Project report, aquatic and riparian systems are the most altered habitats in the Sierra Nevada mountain range, with dams cited as a major degradation factor (UC Davis 1996).

Hydroelectric projects can divert from 30 to 90 percent of a river's total annual flow for electricity production. (Water not diverted for power production is called an "instream flow.") Such severe alterations in the river's natural hydrograph (or river flows) can cause severe impacts on the wildlife and ecosystems that evolved with these flows. Changes in water temperatures can transform native cold water habitats for salmon, trout, and other species into warm water habitats, or vice-versa, disrupting native species. A review of PG&E's extensive hydropower system, which has 26 projects and 99 reservoirs across 16 major California river systems, found that nine projects have instream flow problems and ten have water quality problems (CPUC 2000).

Operating hydroelectric dams for peaking power can result in severe downstream river fluctuations. Fluctuating water levels can strand spawning salmon and their egg masses. Spawning chinook salmon are often stranded on the banks of the Yuba River below Engelbright Dam because of water level fluctuations from peaking power production (DFG 2001).

Two-thirds of California's fresh water fish species have been impacted by hydroelectric development (CPUC 2000), and 67 percent of California's native fish are considered to be extinct, endangered, or in decline (Mount 1995). Reservoirs provide excellent habitat for predators that feed on migrating fish slowed by dams. Amphibious species such as frogs and salamanders are also adversely impacted by reservoirs and altered river flows. Dams block the migration of anadromous fish, resident fish, and other organisms. Barriers can be partially mitigated with fish ladders, but many power dams have ineffective ladders, or no fish passage structures. On many Central Valley river systems, however, fish passage is blocked by State and federal water project dams.

Reservoirs displace land and riparian habitats. Reservoirs for PG&E's hydroelectric system have flooded 43,862 acres, with Lake Almanor at the head of the Feather River accounting for more than 27,000 of the flooded acres (CDF 2001). Dam construction eliminated 95 percent of the original 6,000 miles of salmon and steelhead habitat in the Central Valley (USFWS 1998). Dams have contributed to 89 percent of California's riparian habitat losses (Ketibah, 1994).

Trends in Hydroelectric Environmental Quality Impacts

More than 8,000 MW, or about 60 percent of the current hydroelectric system infrastructure, was built between 1920 and the early 1970s throughout the Sierra Nevada and Southern Cascade Mountains before modern federal and state environmental laws were in place. Nonfederal hydroelectric projects, which make

up about 80 percent of California's hydroelectric capacity, typically operate under 30 to 50-year licenses issued by the Federal Energy Regulatory Commission (FERC). FERC's authority pre-empts nearly all state environmental regulatory authorities. Because of when these dams were built and the fact that FERC's original mandate under the Federal Power Act (FPA) was to promote hydroelectricity as an energy resource, original project licenses generally did not include protections for fish, wildlife, or water quality.

The passage of the major federal environmental statutes in the 1970s (National Environmental Policy Act, Clean Water Act, Endangered Species Act, and amendments to the FPA) created new standards and conditions for evaluating hydroelectric-related environmental quality impacts. As a result of these legislative changes, FERC now requires a high level of environmental study and analysis — which takes a minimum of five years — before relicensing a hydropower project. The five-year study period is needed to assemble baseline scientific information over a series of water years. These data will be used to determine measures for protection, mitigation, and enhancement of impacted natural resources.

California is entering a period when licenses for many of the large, high-impact hydroelectric projects will expire and seek license renewal from FERC. Twenty-nine of the 119 FERC-licensed projects are scheduled for relicensing between 1998 and 2009. (See Appendix III for the number of relicensing cases expected per year.) Relicensing presents an important opportunity to improve environmental quality in rivers affected by hydroelectric production.

California's deregulation of electricity markets may also affect hydroelectric systems. For example, after failing to win legislative approval to transfer its entire 3,896 MW hydroelectric system to a non-regulated affiliate, PG&E sought to auction the system. The CPUC's extensive environmental review of the proposed auction found that 49 significant environmental impacts could occur throughout the Sierra Nevada, Southern Cascade, and Coast Range watersheds if the system were acquired by independent power producers and operated to maximize electricity production (CPUC 2000).

Although the era of large hydroelectric development has passed, small hydroelectric projects continue to be developed throughout California. Small hydroelectric facilities, defined as producing less than 30 MW of power, can have a disproportionately large environmental impact per unit of energy produced. For example, PG&E's Potter Valley Project on the south fork of the Eel River generates nine MW of electricity by diverting most of the upper river's summer flow into the Russian River drainage. The diversion almost completely dewaters what was historically one of the state's largest salmon runs.

HYDROELECTRIC

Facilities: 386
MW: 14,116
Ave. size: 37 MW
Avg. age: 36 years

BIG CREEK

Photo: Southern California Edison

Impacts from Oil and Natural Gas Power Plants Vary

The footprints of power generation facilities directly remove wildlife and wildlife habitat. As shown in Figure III-6, existing and proposed oil- and gas-fired power

plants will have directly impacted 6,455 acres of habitat, or 9.7 percent of the total 65,960 acres estimated to have been displaced by electrical generation development. Oil- and natural gas-fired power plants can also significantly impact aquatic environments through use of once-through cooling water systems. At least 16 of the boiler plants and six of the new combined-cycle plants use once-through cooling from ocean or estuarine sources. Off-site impacts such as electrical transmission lines, natural gas pipelines, and maintenance roads can also negatively affect wildlife and wildlife habitat.

The Original Steam Boiler Plants

California currently has 21,187 MW of natural gas-fired capacity. The available data show that at least 6,300 acres were used for the original power plants (see Appendix III), which is 97 percent of the total 6,455 acres impacted by all existing and proposed natural gas-fired power plants. Sixteen of these facilities were built on coastal, estuarine, or riparian sites and displaced wetland, riparian, and coastal dune habitats. Many of the original power plant complexes had oil storage tanks, which required additional acreage. These power plants ranged from 33 to over 2,000 acres in size, and averaged about 370 acres.

For example, the Pittsburg plant in Contra Costa County was built in 1954 on the south bank of the New York Slough opposite Browns Island, in the Sacramento River Delta, an area rich in wetlands, undeveloped upland wildlife habitat, and important aquatic habitat for a variety of State and/or federally listed species of plants and animals. The Moss Landing plant in Monterey County was built in 1950 adjacent to Elkhorn Slough, a biologically rich wetland system that provides habitat for over 400 species of invertebrates, 80 species of fish, and 260 species of birds.

These steam generation plants required large amounts of cooling and process water, and 16 were located on coastal or estuarine sites to take advantage of low cost once-through cooling water supplies. These plants were concentrated in coastal Los Angeles County and the San Francisco Bay Delta Estuary. Once-through cooling systems entrain and impinge juvenile and adult fish, and some animals. For example, the once-through cooling system at the Contra Costa power plant, which was built in 1951, impacts five federally listed endangered and threatened species, including the Delta smelt, Sacramento splittail, and numerous life stages of migrating chinook salmon and steelhead trout.

Although a rough approximation, California built the first 18,500 MW of its thermal electrical generation system with unmitigated impacts to over 6,300 acres of habitat, and unmitigated impacts to bays, estuaries, and marine environments from once-through cooling water entrainment, impingement, and thermal discharges. In terms of environmental efficiency, the steam boiler plants used an average of 0.34 acres of land with biological resources per MW of capacity.

Cogeneration

Just over 6,500 MW of natural gas-fired, combustion turbine cogeneration facilities were constructed between the late 1970s and 2000 as a result of PURPA. Nearly all of these power plants were added into existing industrial complexes and generally used cooling water from the host industrial site, without causing entrainment or thermal discharge impacts.

California expanded its natural gas-fired generation capacity by 35 percent by adding cogeneration facilities with far fewer impacts on terrestrial and aquatic ecosystems than the original steam boiler power plants. A total of 25,086 MW is now available with the same basic land footprint of 6,300 acres used for the steam boiler plants. Although a rough approximation, the environmental efficiency of this technology sector increased by about one-third to 0.25 acres per MW for the metric of habitat impact.

California's 550 MW of in-state coal-fired plants are cogeneration facilities that have little biological impact on terrestrial or aquatic systems because they are sited within existing industrial or energy production complexes. However, California utilities own interests in out-of-state coal-fired plants, such as the Four Corners Plant, that were built to supply California electricity markets. At the national scale, coal-derived electricity imposes severe impacts to biological resources compared to other conventional energy technologies.

Modern Combined-Cycle Combustion Turbine Power Plants

Twenty-seven high-efficiency combustion turbine power plants have been licensed, since the passage of AB 1890 in 1996 and 18 more of these facilities are currently under permit review. A sample of 27 of these plants (Appendix III) is used to compare their biological resource impacts and contrast them with the impacts from the 20 initial steam boiler plants constructed before the 1970s.

The 27 new plants have just over 15,000 MW of capacity. The estimated amount of total land needed for these plants is 793 acres. Average plant size is 29.4 acres, although one plant would use 239 acres. The average amount of land needed per MW of capacity is 0.05 acres, as compared to the 0.34 acres per MW required for the initial steam boiler plants.

Eighteen of the new plants are brownfield sites, which means that the land used is a former power plant site, industrial site, or other highly disturbed area with little or no biological resources. These brownfield sites account for 587.5 of the total 793.5 acres used (74 percent), and represent 66 percent of the total 15,098 MW capacity.

The nine greenfield — or previously undeveloped — sites total 206 acres and support just over 5,000 MW, or 33 percent, of capacity. The environmental review and mitigation process for the greenfield plants is stringent. All project-related impacts to endangered species and sensitive biological habitats have been minimized or mitigated to levels considered "non-significant" as defined by the

COMBINED CYCLE

SUTTER

Sutter is the first combined-cycle power plant being built in California since deregulation.

Photo: Calpine

California Environmental Quality Act, the Warren-Alquist Act, and the Federal Endangered Species Act. In contrast, the approximately 6,300 acres of land used for the first 20 steam boiler plants was not generally environmentally reviewed or mitigated.

From a biological resource perspective, direct habitat loss from the footprint of a power plant complex is only part of the concern. Wildlife and wildlife habitat are also directly and indirectly impacted from the networks of transmission grids, roads, pipelines, and ancillary facilities needed to support power plants. For example, the new Sutter Power plant, located in Sutter County on a 16-acre green-field site, will also require four miles of 230 kV (kilovolt) transmission lines and approximately 14.5 miles of natural gas pipelines. The transmission line traverses a highly used waterfowl area. Similarly, the Western Midway Sunset plant in Kern County will require an additional 19 miles of 230 kV transmission line, some of which runs through a sensitive natural area, while the Mountainview plant in San Bernardino County will require a new 17-mile long 30-inch natural gas pipeline.

The geographic distribution of the new combined-cycle plants is markedly different than for the 20 original large steam boiler plants. While 75 percent of the steam plants were built on coastal or estuarine sites to take advantage of once-through cooling, only six of the 27 new plants (22 percent) are sited on coastal or estuarine sites, all of which are repower, restart, or expansion projects. The other new plants are located in other parts of the state as follows:

- The San Joaquin Valley has a cluster of seven new plants with 3,467 MW capacity, or 23 percent of the new capacity.
- San Francisco Bay Area counties have eight new plants with 3,751 MW capacity, or 25 percent of the new capacity.
- The Los Angeles and San Diego regions have eight new plants with 4,661 MW capacity, or 31 percent of the new capacity.

Resurgence of Once-Through Cooling Systems

A negative biological resource trend with some of the new combustion-turbine power plants is the resurgence of once-through cooling. Tons of aquatic biota are killed annually through entrainment and impingement in once-through cooling systems. In addition, aquatic habitats are damaged from the thermal discharges. Once-through cooling impacts had been diminishing as 13 of the older coastal steam boiler units were decommissioned. Six of the 27 new projects are repower or expansion projects at existing power plant sites that will take advantage of infrastructure and original permits allowing for once-through cooling, although some cooling water intake structures may be upgraded to reduce impacts. The six new projects are as follows:

- Contra Costa and Potrero projects on the San Francisco Bay Delta Estuary,
- El Segundo and Huntington Beach on the South Coast, and
- Moss Landing and Morro Bay on the Central Coast.

Case Study — Moss Landing Once Through Cooling

Elkhorn Slough, on the edge of Monterey Bay, is a biologically rich wetland system providing habitat for over 400 species of invertebrates, 80 species of fish, and 260 species of birds. The cooling system for Moss Landing Power Plant is designed to withdraw water from the Moss Landing Harbor near the mouth of the Elkhorn Slough and to discharge this water after it has been used for cooling into the Pacific Ocean. Historically, cooling water from Units 1 through 5 were discharged into Elkhorn Slough, but those units have been off-line since 1995.

The Moss Landing Power Plant is currently being repowered with modern combined-cycle units. These units will replace Units 1 through 5, and will be capable of generating about 1,060 MW. About 250,000 gallons per minute (GPM) of ocean water will be used for once-through cooling. By comparison, existing Units 6 and 7 will require about 600,000 GPM of ocean water to generate 1,500 MW.

During the modernization project, intake structures will be modified to reduce impacts to marine organisms. The cooling water volumes, pumped through the Unit 1 through 5 intake structure, will be reduced from 381,000 GPM to 250,000 GPM for the new combined-cycle units. New fish screens will be installed to reduce the amount of biological organisms pulled into the plant's cooling system.

Despite these changes, the new facilities will still cause a significant loss in biological resources. The power plant owner was required to mitigate these significant impacts by funding wetlands and other habitat restoration projects in the Elkhorn Slough and to monitor thermal impacts.

Photo: Energy Commission

Cumulative Impacts in the San Joaquin Valley

Cumulative habitat loss in the San Joaquin Valley is an ongoing concern to State and federal resource agencies. Only 2.9 percent of the 2,950 square miles of Southern San Joaquin Valley floor remains in "good" or "better" natural condition (Energy Commission 1991).

In addition to the current 11 natural gas-fired cogeneration plants in the area, five new combined-cycle power plants will be built in the southern end of the San Joaquin Valley within the next five years — Pastoria, La Paloma, Sunrise, Western Midway-Sunset, and Elk Hills. This area contains habitat for numerous threatened and endangered species. As part of the permit review process, habitat compensation is required when habitat losses are anticipated in an area with listed species. All five power plants will provide habitat compensation funds to the same land management firm for land purchases in the Lokern Natural Area, which includes the Lokern Preserve.

The Lokern Natural Area currently encompasses 3,500 acres, and will be expanded by at least 1,350 acres after all funds are collected (a 38 percent increase). The solution developed here has become a model for long-term regional solutions for cumulative habitat losses.

Impacts from Renewable Generation Vary

Renewable generation includes solar, wind, geothermal, waste-to-energy, and small hydroelectric technologies. (Small hydroelectric facilities were discussed above, in the Hydroelectric Impacts section of this chapter.)

Solar thermal power plants, such as the facilities located in the Kramer Junction and Harper Lake areas of San Bernardino County, require approximately five acres of land for each megawatt of capacity. Of the estimated 67,098 acres of habitat removed by power plants throughout the state, the impact of solar power plants is third, after hydroelectric and wind, affecting 1,782 acres. For example, Harper Lake Solar Units 8 and 9 each generate about 80 MW of electricity and together occupy approximately 800 acres.

Solar thermal power plants often grade all of the land they occupy, disrupting remote and fragile ecosystems, such as desert lands. This land grading makes them effectively more land-intensive than wind or hydroelectric development. Solar thermal facilities that use conventional gas-fired steam boilers to generate supplemental electricity require cooling water, which can place a significant strain on limited water resources in arid areas.

Wind farms occupy about 11,000 acres of habitat, which represents 17 percent of the total habitat impacts from power plants in the state. Wind turbines, by themselves, generally occupy less than ten percent of the total land area, leaving other areas within the wind farms in their natural state to be used by wildlife, or for livestock grazing. However, grading for creating and maintaining access roads and associated erosion problems can adversely impact plant communities and disrupt wildlife habitat.

The primary biological concern related to wind farms is the potential for bird collisions with wind turbines. Bird kills vary, depending on the number and layout of turbines, as well as the bird species present, bird population density, use of the area, time of day, time of year, weather conditions, and visibility. The Altamont Pass Wind Resource Area has the highest concentration of bird kills, where 100 to 300 raptors, including 40 golden eagles, are estimated to die annually (Orloff and Flannery 1992).

Geothermal power plants have directly impacted only 1,283 acres of habitat, statewide, but they are located in remote areas, which can have significant wilderness, scenic, and biological value. Furthermore, the siting of a geothermal plant may cause significant off-site impacts, due to steam-well field development and construction of transmission lines, steam pipelines, and access roads for the power plant and steam wells. Such geothermal development can impact endemic

ecosystems. These ecosystems contain special-status species, which have evolved with unique attributes to take advantage of serpentine soils, naturally occurring sulfuric gases, and higher than average soil temperatures. Because of the development of multiple well fields and power plants within the productive geothermal areas, the cumulative impacts on biological resources have been significant.

Waste-to-energy facilities, in general, have few unique impacts on biological resources because they are usually located at existing industrial sites, dairies, or landfills. Burning municipal solid wastes produces toxic air emissions and ash residues that may include metals such as lead, cadmium, and mercury, and organics such as dioxins and furans. These wastes may impact wildlife through inhalation or distribution through the food chain. Wastewater from biogas facilities can impact local aquatic habitats if not properly treated. Because about 60 percent of the biomass used to generate electricity in California is forest waste, concerns have been raised about the potential impacts of forest waste removal on threatened species such as the California spotted owl and Pacific fisher.

WIND FARMS

Facilities: 105
MW: 1,818
Ave. size: 18 MW
Avg. age: 14 years

ALTAMONT PASS

Trends in Inter-Agency Consultations will Further Reduce Impacts

Several regulatory and policy changes have recently helped to reduce the environmental impacts of power plant development:

- The U.S. Environmental Protection Agency (U.S. EPA) has proposed changes to the National Pollutant Discharge Elimination System (NPDES) permit requirements regarding cooling water intake structures for new facilities (Federal Register, August 10, 2000). The regulatory change is intended to reduce cumulative losses to aquatic species. The Energy Commission is requiring applicants to implement changes to intake and outflow structures to lessen biological impacts in anticipation of more stringent standards.
- The U.S. Fish and Wildlife Service (U.S. FWS) and Energy Commission are scrutinizing the nitrogen deposition rates from fossil fuel-burning facilities and their possible indirect impacts on plant communities. The primary concern is with serpentine soils and the unique assemblage of sensitive species they support, such as at the Metcalf project in Santa Clara County. There is also concern about desert communities where soils can be nutrient limited, such as at the Mountainview project in San Bernardino County. Extensive modeling of nitrogen deposition has been required in some cases before an assessment of indirect impacts could be completed and appropriate mitigation measures assigned.
- Power plant projects that impact endangered species may need to develop a Habitat Conservation Plan (HCP). While some projects prepare individual HCPs, such as the Pastoria project in Kern County, others meet permit obligations by participating in regional or countywide HCP plans, such as the Otay Mesa project in San Diego County. These large-scale HCPs allow project proponents to pool funds and develop regional solutions. Regional and

county-scale HCPs are becoming more common, and will continue to influence the conditions of certification imposed on licensees.

Biodiversity and Protected Species Impacts are Relatively Low

California is one of the most biologically diverse areas in the world. Within its 160,000 square miles, California has more unique animals than any other state — 30,000 species of insects, 63 species of fresh water fishes, 46 species of amphibians, 96 species of reptiles, 563 species of birds, and 190 species of mammals.

Currently, 288 of California's plant and animal species are listed as threatened or endangered, which is 23 percent of the national total. Many of these species now occupy only a fraction of their former ranges in California. Dramatic changes in population growth within the state have resulted in the reduction, degradation, and elimination of habitat, which has curtailed the range, distribution, and populations of many of these species.

While electricity generation facilities constitute an important component of the mix of impacts to biological resources in California, in the context of statewide population growth, urban and suburban housing development, and agricultural and industrial development, power resource development represents only a fraction of the cumulative total impacts to biological resources. The other forms of land development have contributed to the majority of losses of California's most productive biological systems. For example, California has lost 80 percent of its coastal wetlands, 94 percent of its interior wetlands, and 89 percent of the Central Valley's riparian woodlands (TNC 1987). Between 90 percent and 95 percent of the vernal pools are gone, and only one percent of native Central Valley grasslands remain (CNPS 1994).

Conclusions

California's in-state electric generation facilities have impacted air, water, and biological resources in different ways, depending on the type, size, and location of the facility. Below are the conclusions drawn from the air, water, and biological resource analyses contained in this chapter.

Air Resources

Power plant technologies used in California have changed significantly over the last 25 years, markedly improving plant thermal efficiency and emissions control efficiency. Consequently, air pollutant emissions and emission rates from in-state generation have significantly decreased. Statewide emissions trends demonstrate the improvements on a real, per megawatt hour generated, per capita, and per dollar of gross state product basis. This reduction in power plant emissions has contributed significantly to California's efforts to improve its ambient air quality. However, air emissions and air quality are not uniform across the state. For example, many small peaking units and some large generators with high emissions could lower their emissions by installing available emission-control technology. Therefore, generation sector emissions and emission rates will continue to be monitored, controlled, and in many cases reduced.

Water Resources

Although water used by power plants represents only a small fraction of overall state water demand, water use by power plants may result in significant impacts on local water supplies. Most new power plant development is occurring in the inland areas of the state where water supplies are limited. (Coastal development is restricted to retrofit and replacement of existing plants.) Most of the recent power plant development has proposed the use of closed-loop wet cooling systems (90-95 percent of a plant's demand) that require 3,000 to 7,000 AF of water annually. This use can put a tremendous demand on local water supplies. Once-through cooling practices are limited to coastal areas because of the vast quantities of water required and result in significant aquatic resource impacts. In addition, wastewater discharged by these facilities can degrade surface and groundwater supplies, adversely affecting drinking water supplies and other beneficial uses. Recent technology developments have resulted in less water being used per unit of electricity generated, and improved disposal methods that have reduced the risks of adverse impacts associated with wastewater disposal. California's shrinking water supply options and energy market conditions will have a significant effect on power plant development in the state and the types of technologies used for both cooling and wastewater disposal in the future.

Biological Resources

Power plants and their linear facilities were constructed in sensitive ecological areas before modern environmental standards and legislation were enacted; the damage was substantial and unmitigated. The primary impacts from the electrical generation system have been to terrestrial habitats and aquatic habitats. Although impacts to terrestrial habitats are small in comparison to losses caused by other forms of land development, impacts to rivers and watersheds from hydroelectric dams, and marine and estuarine environments from once-through cooling, are significant.

Using the amount of land needed for power plants as a proxy for biological resource impacts, the new combined-cycle power plants are significantly more efficient than the first generation of steam boiler plants. While the first steam boiler plants averaged about 370 acres, the new plants are averaging less than 30 acres. Biological impacts from the new plants are reduced to less than significant levels through the modern environmental assessment and mitigation process.

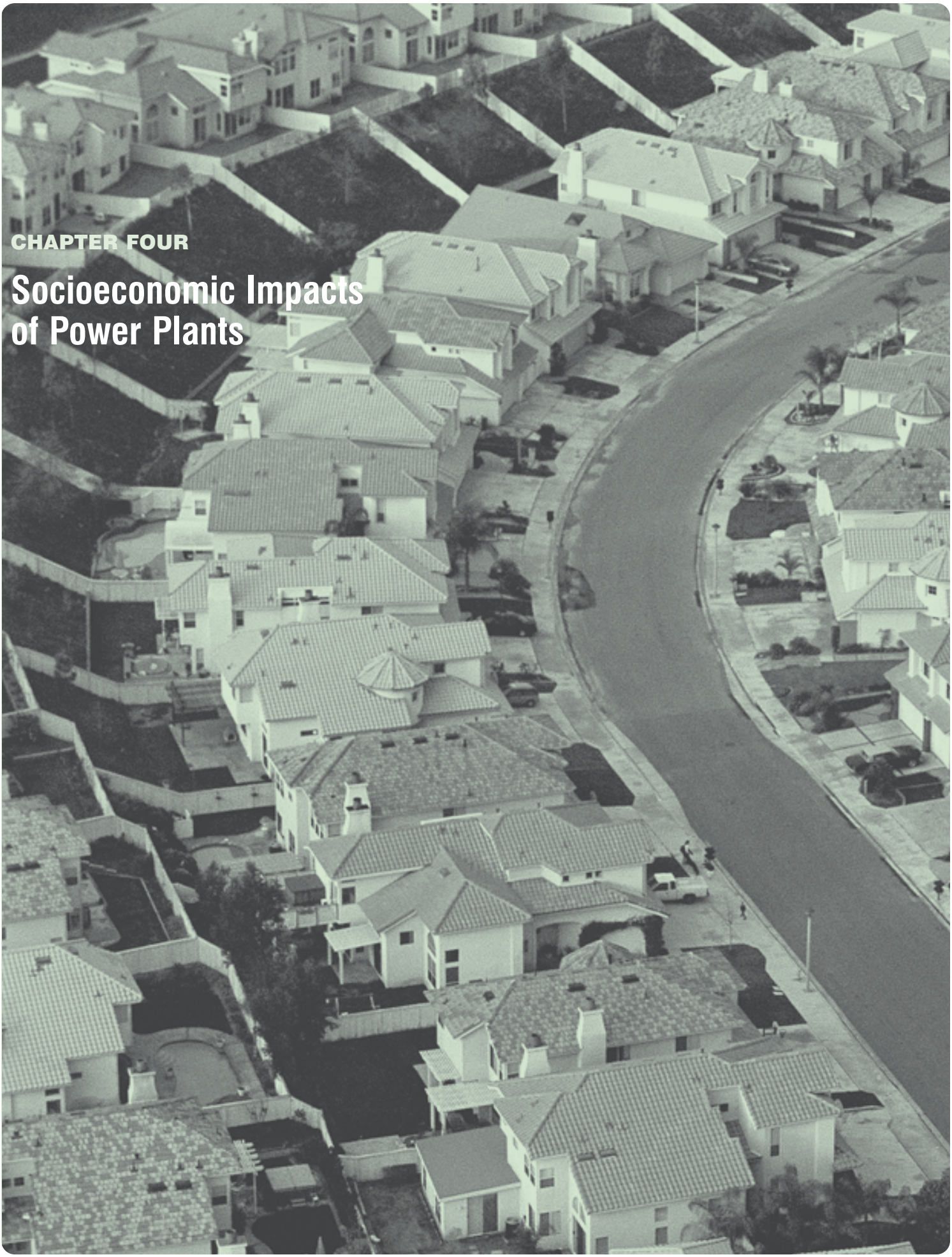
The continued use of once-through cooling water systems at six coastal and estuarine plant sites that are being repowered will perpetuate impacts to marine and estuary ecosystems.

SOLAR

Facilities: 14
MW: 413
Ave. size: 29 MW
Avg. age: 12 years

SMUD

Photo: Energy Commission



CHAPTER FOUR

Socioeconomic Impacts of Power Plants

IV. Socioeconomic Impacts of Power Plants

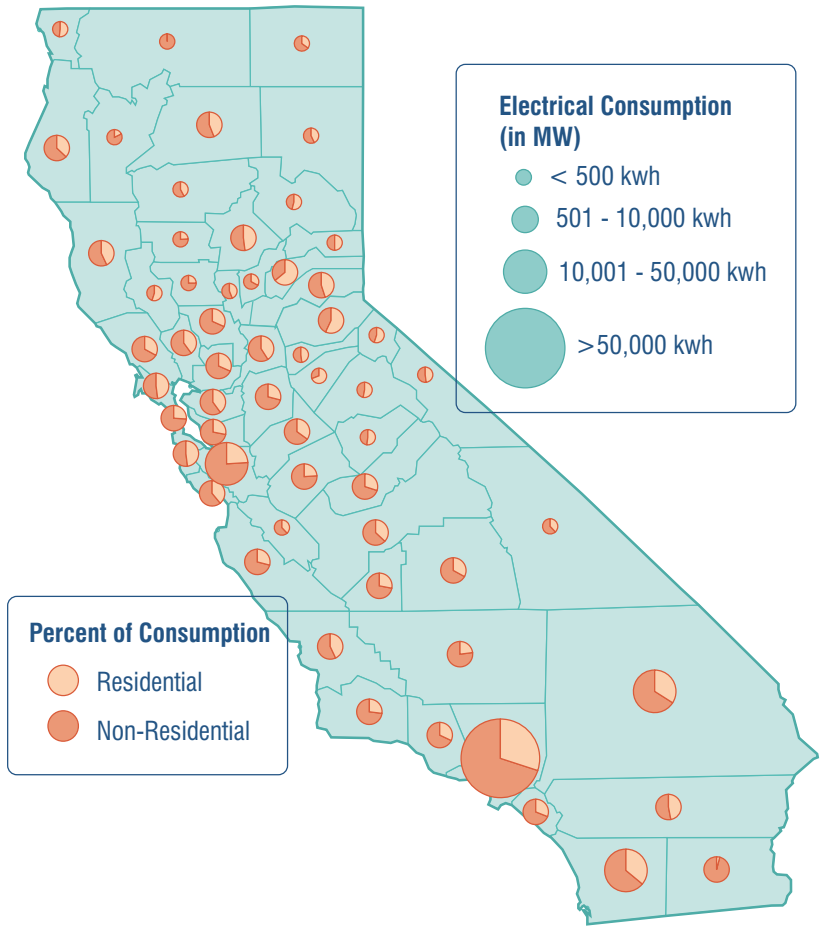
As required by Public Resources Code 25309.3(c)(2), this chapter describes the geographic distribution of statewide socioeconomic effects of existing generating facilities. Socioeconomic benefits accrue from the general societal benefits of electric power, the public revenue generated from electric generating facilities, and the employment associated with power plant construction and operation. The socioeconomic drawbacks of electric generating facilities tend to be concentrated at the local level, affecting local populations and communities.

Summary of Findings

Commonly identified benefits of electric generating facilities include the following:

- A reliable and affordable electricity supply supports economic development and helps maintain the state's high standard of living.
- Electric generating facilities supply electricity for a variety of uses, including lighting, heating, ventilation, and air conditioning, and power for industrial and agricultural motors. It is also essential for transportation, communications, public safety, and public health, as well as public comfort and convenience.
- In-state electric generation enhances statewide electricity supplies and system reliability, and reduces the need for importing electricity over congested transmission lines.
- Urban counties in Southern California and the San Francisco Bay Area are the largest producers and consumers of electricity.
- Small, rural counties consume the least amounts of electricity. However, they are the largest electricity users on a per capita basis.
- Property tax revenues from merchant plants are paid only to the municipal jurisdictions in which they are located. Property tax revenues from utility-owned generation are distributed to multiple municipal jurisdictions within a county.
- In Fiscal Year 2000-2001, the new owners of divested utility power plants paid approximately $34 million in property taxes to the local jurisdictions in which they are located.
- There are approximately 9,000 permanent jobs in power plant operations, and that number is projected to increase by 1,400 between 1998 and 2008.
- Power plant construction projects create approximately 10 times more jobs than power plant operations, but these jobs are temporary.
- Increased demands on public facilities and services (e.g., schools, transportation, utilities and emergency services) may adversely affect local communities.
- The Energy Commission has identified no significant disproportionate environmental justice impacts in any of the power plant projects it has approved since 1998.

Figure IV-1 Electricity Consumption by County



Potential Socioeconomic Benefits are Significant

This section reviews financial information from a sample of California's oldest and largest oil/gas-fired electric facilities, many of which were divested recently by California investor-owned utilities. In addition, the table entitled "Socioeconomic Benefits of New Facilities" in Appendix IV provides estimates of socioeconomic benefits from new natural gas-fired central station power plants, which are or soon will be under construction in California.

Reliable and Affordable Electricity Supply

The biggest socioeconomic benefit of electric generation facilities comes from the electrical power they provide. California has the largest economy of any state in the country and one of the largest economies in the world. Because electricity powers the economy and helps maintain the state's high standard of living, the availability of a reliable and affordable electricity supply is essential to the well being of the state and its citizens. Electric generating facilities supply electricity to California residences and businesses for a variety of uses, including lighting, heating, ventilation, and air conditioning, and power for industrial and agricultural motors. It is also essential to transportation, communications, public safety, and public health, as well as public comfort and convenience. In-state electric generation in particular enhances statewide electric supplies and system reliability by reducing the need for electricity imports over congested transmission lines.

In 1996, statewide electric consumption totaled more than 218,178 million kWh, including imports. The geographic distribution of electricity consumption is illustrated in Figure V-1. Table IV-1 shows electrical consumption by county and the proportion of electrical use by each county's residential and non-residential consumers. Highly populated, urban counties in Southern California and the San Francisco Bay Area are the largest producers and consumers of electricity.

Table IV-1: Top Ten Counties in Electricity Consumption and Generation

Top 10 Electricity Consumers	Top 10 Electricity Consumers Per Square Mile	Top 10 Electricity Consumers Per Capita (Residential Only)	Top 10 Electricity Producers	Top 10 Electricity Producers Per Square Mile
Los Angeles	San Francisco	Mono	Los Angeles	Contra Costa
Orange	Orange	Modoc	San Diego	Los Angeles
San Diego	Los Angeles	Alpine	Contra Costa	San Francisco
Santa Clara	Alameda	Calaveras	San Luis Obispo	Ventura
San Bernardino	Santa Clara	Lake	San Bernardino	San Diego
Riverside	Sacramento	Del Norte	Fresno	San Luis Obispo
Alameda	Contra Costa	El Dorado	Kern	Orange
Sacramento	San Mateo	Placer	Shasta	Butte
Kern	San Diego	Nevada	Ventura	Alameda
Contra Costa	San Joaquin	Shasta	Monterey	Sacramento

Taking the physical size of counties into account, the City and County of San Francisco has the highest electrical use per square mile of any California county.

California businesses and institutions, such as industrial, commercial, agricultural, governmental, and other institutional entities, consume approximately twice as much electricity as the state's residential users.

Small, rural counties consume the least amounts of electricity. They are, however, the largest electricity users on a per capita basis. There are three main reasons for the high per capita electric consumption of rural counties:

- These counties experience extreme climate conditions: cold winters and hot summers.
- Many rural residents do not have natural gas service[10], leading to increased use of electricity for space heating, water heating, and cooking.
- Rural residents pay for services in their individual electricity bills that urban consumers pay for in other bills, such as water pumping and street lighting.

Table IV-1 summarizes which counties are large electric consumers or producers. Note that Los Angeles, San Diego, and Contra Costa counties appear on four of these lists, but their rank order changes when county size is considered.

Some of the "top ten" electricity-producing counties are on the list because of only one or two very large thermal power plants. For example, San Luis Obispo

[10] The 12 counties without gas service are Alpine, Del Norte, Inyo, Lake, Lassen, Modoc, Mariposa, Mono, Plumas, Sierra, Siskiyou, and Tuolumne.

Solar thermal facilities in San Bernardino County paid $517,000 in property taxes in 2000. Only the fossil-fuel portion of these facilities was taxable, because state law excludes solar facilities from property tax assessment. [13]

Photo: Energy Commission

County has both Diablo Canyon and Morro Bay power plants. Similarly, Ventura County has Ormond Beach and Monterey County has Moss Landing. Butte County, although small in size, is a top electricity producer per square mile, because of its many hydroelectric facilities.

The following urban and suburban counties are large electric consumers, but they do not have commensurate installed electric generation: Humboldt, Marin, Napa, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Solano, Tulare, and Yolo.

State and Local Tax Revenues

State and local government agencies impose a variety of taxes on electric generating facilities. These tax revenues enable the State and local jurisdictions to provide public services and infrastructure. The types of taxes paid by facility owners may include income taxes, property taxes, sales taxes, and social security and other payroll taxes.

Some types of taxes are paid only by private owners of electric generating facilities. Governmental entities, such as municipal utilities, municipal utility districts, irrigation districts, and State and federal entities, which own approximately one-third of California's electric facilities, pay no property taxes, income taxes, or franchise fees.

State Income Tax Revenues. Because California permits deductions, exemptions, exclusions, and tax credits to reduce state tax liability, only about 60 percent of corporations actually pay state income taxes.[11] Specific information on income tax revenues collected from California's electric generators was not available for this report.

Many merchant power plant owners have also reduced their income tax liabilities by establishing themselves as limited liability companies (LLCs). LLCs are not corporations and, therefore, are not subject to state franchise (income) taxes. Instead, LLCs pay fees, based on total annual income, of up to $10,177. Corporate owners of the LLC, however, will pay a corporate franchise tax on income earned in California.

Property Tax Revenues. Property taxes apply to real property (e.g., land, buildings, and fixtures) and to business-owned personal property such as equipment and machinery. The State Board of Equalization (SBE) assesses the taxable value of electric generating facilities owned by CPUC-regulated utilities.[12] County governments assess most other real and personal property, including electric generating facilities owned by private entities.

The SBE establishes the property values for utility-owned electric generators each year. Uniquely, SBE allows the assessed values to decline because of equipment depreciation.

The State of California distributes property tax revenues from utility-owned electric generation facilities differently from how it distributes property tax revenues from merchant power plants. Property tax revenues from utility-owned

[11] "California's Tax System: A Primer," by Elizabeth G. Hill, Legislative Analyst, January 2001, Page 35.

[12] Regulated electric utilities include: Anza Electric Cooperative, Inc., PacifiCorp, Pacific Gas and Electric Company, Sierra Pacific Power Company, Southern California Edison Company, Valley Electric Association, Inc., Surprise Valley Electrification Corporation, Plumas-Sierra Rural Electric Cooperative, Arizona Electric Power Cooperative, Inc.

[13] Chapter 855 of the Statutes of 1998. This property tax exclusion expires on January 1, 2006.

Table IV-2: Property Taxes Levied for Selected Power Plants

Facility Name Size County/Location	Purchaser Current Facility Owner	Book Value Sales Price	Property Taxes for FY 2000/01
Alamitos 2,088 MW Los Angeles	AES Corporation AES Alamitos, LLC	$136,100,000 $436,000,000	$4,806,238
Contra Costa 680 MW Contra Costa	Mirant Southern Energy Delta, LLC	$96,200,000 See Note 1	$2,060,000
El Segundo 1,020 MW Los Angeles	NRG/Destec El Segundo Power Company LLC	$70,800,000 $87,800,000	$9,229,111
Encina 965 MW San Diego	NRG/Dynegy	$90,400,000 See Note 2	$2,990,102
Etiwanda 911 MW San Bernardino	Reliant Mountain Vista Power Generation LLC	$29,800,000 $9,500,000	$385,000
Morro Bay 1,002 MW San Luis Obispo	Duke Energy Corp. Duke Energy Morro Bay LLC	$170,100,000 See Note 3	$2,030,512
Moss Landing 1,090 MW Monterey	Duke Energy Corp. Duke Energy Moss Landing LLC	$206,800,000 See Note 3	$4,014,840
Ormand Beach 1,500 MW Ventura	Reliant Ormand Beach Power Generation LLC	$125,000,000 $40,000,000	$441,448
Pittsburg 2,022 MW Contra Costa	Mirant Southern Energy Pittsburg LLC	$182,600,000 See Note 1	$4,180,000
Redondo Beach 1,310 MW Los Angeles	AES Corporation AES Redondo Beach LLC	$92,500,000 $249,000,000	$2,802,330
South Bay 693 MW San Diego	Port Authority of San Diego	$64,400,000 $110,000,000	$980,353*

Note 1: Mirant purchased Contra Costa, Pittsburg and Potrero for $801 million.

Note 2: NRG/Dynegy purchased Encina, Kearny and a number of combustion turbines for $365 million.

Note 3: Duke Energy Co. purchased Morro Bay, Moss Landing and Oakland for $501 million.

*Property leased to Duke Energy, which pays a possessory interest tax (levied on government property used by a private entity) based on limited rights in the property.

Sources: *Some Financial Data on Divested Power Plants* California Energy Commission and information collected from individual county assessors in February and March, 2001.

facilities go to all municipal jurisdictions in the county, whereas property tax revenues from merchant generating facilities are assessed by the county and only distributed to the one city in which the facility is located. Electric generation facilities can be significant sources of local property taxes.

Table IV-2 lists the divested power plants, their book value at the time of sale, the sales price (if known for the individual facility), and the Fiscal Year 2000-2001 tax liability, based on the county-assessed value.

Franchise Fees and Utility Users Taxes

City or county governments may receive additional revenues from electric facility operations through business license fees, franchise fees or surcharges, and utility user taxes.

Electric and gas utilities pay franchise fees to city and county governments for the right to place electric lines or gas pipelines along public roads. Franchise fees are typically one to two percent of the utility's gross annual receipts from that franchise. The City of Pittsburg, for example, is projecting it will receive $878,000 in franchise fees from PG&E in Fiscal Year 2000-2002. Electric and gas utilities, which transport electricity or natural gas to their competitors' customers, collect surcharges and forward them to the local jurisdiction. For example, the City of Pittsburg's Finance Director reported receiving $540,000 in "unexpected revenue" from the natural gas franchisee, PG&E, for providing service to Southern Energy, the new owner of PG&E's Pittsburg power plant.

Some cities and counties may charge a utility user tax on all utility services, including telephone, cable, natural gas, and electricity, usually between two to seven percent of the total utility bill. The City of El Segundo, for example, imposes a three percent utility user tax on its commercial and industrial customers. In Fiscal Year 1999-2000, NRG Energy, Inc., the owners of the El Segundo power plant, paid approximately $3 million in natural-gas utility user taxes. Like the franchise fee surcharge, this tax could provide significant revenues to local jurisdictions with natural gas-fired electric generation, because the price of natural gas increased significantly in 2001.

Employment

California electric power generators employ between 7,000[14] and 9,000[15] workers as power generation plant operators. The two utility-owned nuclear facilities are the largest employers in electric power generation: Southern California Edison's San Onofre nuclear power plant in San Diego County employs more than 1,900 people; and Pacific Gas and Electric Company's Diablo Canyon in San Luis Obispo employs more than 1,200 people.

Jobs in power plant construction, however, far outnumber jobs in power plant operations. Each combined-cycle power plant now under construction is projected to employ approximately 250 workers at the peak of its two-year

construction schedule. The projected number of permanent operator jobs at each of these plants is projected to be 25. (See the table entitled, "Estimated Socioeconomic Benefits and Impact Mitigation Fees for Recently Approved and Proposed Power Plants" in Appendix IV for projections of employment and payroll.)

Table IV-3 provides employment information for large oil/gas power plants, which were divested by electric utilities.

Table IV-3: Number of Jobs at Selected California Power Plants

Plant Operator	Plant Name and Size	Operating Staff
AES	AES Alamitos (2,120.5 MW)	84
	Redondo Beach (1,312.3 MW)	67
	Huntington Beach (573.3 MW)	34
Duke Energy North America	Morro Bay (1,056.2 MW)	80
	Moss Landing (1,404 MW)	80
	South Bay (732.5 MW)	77
City of Glendale Public Service	Grayson (283.4 MW)	52
Los Angeles Dept. of Water and Power	Haynes (1,606 MW)	162
	Scattergood (823.2 MW)	112
Mirant	Pittsburg (2,022 MW)	215
NRG Energy Inc.	El Segundo (996.6 MW)	63
Reliant	Coolwater (658 MW)	58
	Etiwanda (1,046 MW)	57
	Ormand Beach (1,612.8 MW)	59
	Mandalay (577 MW) and Ellwood (100 MW) – share operating staff	47

Source: Utility Data Institute, *Who's Who at Electric Power Plants*, 2001

As steam turbine power plants, such as those listed, are modernized, the number of employees at each site will likely decline, because new electric generating facilities are easier to maintain and because operations use more automated controls. In addition, new owners may choose to contract with outside firms to operate and maintain their facilities, rather than hire permanent staff, or to use the same permanent workforce to maintain multiple facilities.

The number of workers employed at operating power generation facilities, however, is projected to increase by 1,400 between 1998 and 2008[16].

Potential Socioeconomic Drawbacks May Include Impacts to Public Services, Property Values, and Environmental Justice Concerns

Public Services and Infrastructure

The construction of new power plants can increase demands on public services and infrastructure. Examples of these services and infrastructure include schools, utilities, emergency response, streets, wastewater treatment, and other services. Local governments, school districts, and other special districts typically recover increased costs from power plant construction by collecting impact fees from the developer. Examples of the types and amount of impact fees imposed on power plant developers are provided in Appendix IV.

[14] Includes Employment Development Department 1998 estimate of 3,000 power generation plant operators plus 3,100 workers employed at operating nuclear power plants.

[15] Estimate based on employee-per-MW factors obtained from UDI *Who's Who* at Electric Power Plants, which have been applied to each size and type of electric generation facility in the Energy Commission's power plant database.

[16] California Projections of Employment, Employment Development Department.

Housing Property Values

Homeowners are often concerned that their property values will decrease if a proposed power plant or its transmission lines would be visible from their homes, create noise, or expose them to air pollution or other public health risks. Three possible effects to the market value of residential properties have been claimed: diminished price, properties take longer to sell, or decreased sales volume, because potential buyers decide not to buy in the impact area. Based on the community's concerns about property values, the Energy Commission staff analyzes potential property value impacts in its socioeconomic impact assessments of proposed power plants.

Property value impact analyses typically indicate the following findings about property value impacts of proposed power plants:

- The fear of health hazards by current residents must be distinguished from the market behavior of actual or likely homebuyers and sellers in the same area.
- The more informed a potential buyer is about the potential risks and the (low) probability of those risks occurring, the less likely that a buyer will be deterred from purchasing residential property near the claimed health hazard.
- Observed negative price, marketing time, and sales volume effects tend to be statistically insignificant; the observed results could easily have occurred randomly or by chance.
- Landscaping to screen views of a power plant or transmission lines can diminish or eliminate the negative price effect.
- Observed negative values diminish over time (within four to ten years).

If a power plant has been proposed recently, only its short-term impact on property values can be studied. Analysts have also evaluated the long-term impacts on property values of operating power plants and other types of very large industrial facilities. In the Analysis of Property Value Impacts of the Crockett Cogeneration Project, for example, several studies were cited that examined the property value impacts of nuclear power plants, industrial waste incinerators, and landfills, and which determined the following:

> …Thus, even for very large facilities that are extreme in terms of their potential health, safety, and aesthetic impacts, there is no clear association with diminished economic impacts…Economic impacts are not clearly and reliably observed even for nuclear power generation facilities near residential properties.[17]

Environmental Justice

Environmental justice developed in the mid-1980s in response to a growing concern that minority[18] and low-income[19] populations bear a disproportionate share of society's environmental risks in the siting, construction, and operation of toxic facilities and other locally unwanted facilities.

[17] Analysis of Property Value Impacts of the Crockett Cogeneration Project, Appendix X, Crockett Cogeneration Project, 1992.

[18] Minorities are defined as individuals who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black not of Hispanic origin; or Hispanic.

[19] Low-income populations are identified with the annual statistical poverty thresholds from the Bureau of the Census's Current Population Reports, Series P-60 on Income and Poverty.

The U.S. EPA Guidelines offer the following definition of environmental justice:

> The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, State, local, and tribal programs or policies.

In 1994, the Energy Commission began assessing new power plants in terms of environmental justice; these assessments are now a standard part of the Energy Commission's evaluations of proposed power plants. To date, the staff has applied criteria for determining whether a proposed project raises an environmental justice issue in 23 siting cases.

Of the power plants the Energy Commission has approved since 1998, potential environmental justice issues have been identified in five projects. The projects were deemed as having potential environmental justice issues because the size of the minority populations within a six-mile radius of the proposed project was greater than 50 percent. (The six-mile radius represents the area to be potentially affected by various project emissions.)

Of these five projects, two have been the subject of complaints with the U.S. EPA. In 1999, interveners in the Los Medanos (98-AFC-1, certified on August 17, 1999) and Delta (98-AFC-3, certified on February 9, 2000) power plants certification proceedings filed a complaint with U.S. EPA Office of Civil Rights for violations of Title VI. Title VI of the Civil Rights Act of 1964 is the legal basis for groups to file lawsuits against an agency when that agency has failed to consider environmental justice impacts in its environmental review of a project. The complainants stated that both projects, approved in the City of Pittsburg, would further inflict disparate impacts on low-income and minority populations in Contra Costa County from criteria pollutants. At this time, the U.S. EPA has not ruled on the complaints.

Of the projects identified as having greater than 50 percent minority populations within the six-mile radius, the staff has identified no significant unmitigated or disproportionate adverse impacts.

Environmental Justice Case Study

In 1994, the Bayview Hunter's Point Community was the first group to oppose a power plant based on environmental justice. Although the Commission approved this San Francisco Energy Company's (SFEC) Cogeneration project, local opposition prevented the developer from securing a lease for the project site from the City and County of San Francisco. Without the lease, SFEC was unable to develop a power plant in the Bayview Hunters Point area of San Francisco. Since then, Energy Commission staff began conducting environmental justice analyses as part of the socioeconomic impact assessment on all siting cases.

Socioeconomic and Demographic Factors were Analyzed for a Subset of Plants

Findings

The Energy Commission evaluated the potential impacts of 13 of California's oldest and largest electric generating facilities on the socioeconomic characteristics of the surrounding communities. These power plants represent 25 percent of the state's installed generating capacity. The analysis concluded the following:

- The construction of power plants has not lead to significant increases in minority or low-income populations near the power plants over time.
- The presence of a power plant has not restrained growth of the median family income in the city where the power plant is located in comparison to the income of surrounding cities.
- The proportion of renters to homeowners in cities with large power plants is consistent with the proportion of renters to homeowners in surrounding communities.
- These power plants, built in the 1950s and 1960s, were generally constructed in industrial areas separated from urban uses, but as population grew, the power plants were encroached on by expanding residential and commercial development.

Approach

The purpose of this analysis was to evaluate whether the presence of power plants in selected communities has affected socioeconomic and demographic conditions in those communities over time. Data were gathered for 11 cities and 13 power plants, both before and after power plant construction, in order to evaluate whether population growth, racial characteristics, income, home ownership, or general development patterns seemed to be affected by the presence of the power plants. Although 13 power plants were considered in this analysis, to keep the report at a reasonable length, the City of El Segundo was selected to represent the socioeconomic impacts of power plants over time.

Public Resources Code 25309.3 (c)(2) required a

Table IV-4: Selected Sites for Demographic and Socioeconomic Assessment

Facility Name, Owner	Location	Generating Capacity (MW)	On-Line Year
Contra Costa, Mirant	Antioch, Contra Costa Co.	680	1951
Pittsburg, Mirant	Pittsburg, Contra Costa Co.	2,022	1954
Morro Bay, Duke Energy	Morro Bay, San Luis Obispo Co.	1,002	1955
Ormond Beach, Reliant Energy	Oxnard, Ventura Co.	1,500	1971
Grayson, City of Glendale	Glendale, Los Angeles Co.	272.5	1941
Redondo Beach Generating Station AES Corporation	Redondo Beach, Los Angeles Co.	1,310	1948
El Segundo, NRG/DESTEC	El Segundo, Los Angeles Co.	1,020	1955
Alamitos, AES Corporation	Long Beach, Los Angeles Co.	2,088	1956
Scattergood, Los Angeles Department of Water & Power	Los Angeles, Los Angeles Co.	803	1958
Haynes, Los Angeles Department of Water and Power	Long Beach, Los Angeles Co.	1,570	1962
Huntington Beach, AES	Huntington Beach, Orange Co.	563	1958
Encina Power Plant Dynegy Power and NRG	Carlsbad, San Diego Co.	965	1954
South Bay, Port of San Diego (leased to Duke Energy)	Chula Vista, San Diego Co.	693	1960

Source: California Power Plant Data Information Statewide, Operational Only 100 KW and Greater, California Energy Commission

socioeconomic and demographic analysis but did not specify which factors or which electric generating facilities to assess. Rather than attempt to assess the potential effects of the more than 1,000 operating electric generating facilities, the Energy Commission staff chose a sample of 13 old and large oil/gas-fired facilities. Methodology for selection is provided in Appendix IV. These selected facilities started their operations between 1941 and 1971 and range in capacity from 272 MW to 2,088 MW. The rationale for using this sample is as follows:

- Older electric generating facilities would provide a better opportunity to observe changes in demographic and socioeconomic factors over time than newer facilities.
- Electric generating facilities built in the 1980s and 1990s were primarily small-scale renewable energy and cogeneration facilities, which have more siting constraints than oil/gas-fired facilities. Renewable energy facilities must be built near adequate supplies of the renewable energy resource and cogeneration facilities need adjacent industrial or commercial customers to use their process steam or hot water.
- Large electric generating facilities would have more potential to create socioeconomic impacts than small facilities. Although the sample includes only 13 power plants, these plants represent one-fourth of all installed electric generation capacity in the state (14,500 MW out of 53,200 MW). All have been important contributors to California's post-war economic growth.
- Lastly, only facilities built in or immediately adjacent to incorporated cities were used, because incorporated cities are the smallest geographic unit for which historical demographic and socioeconomic data could be obtained. Historical census tract data are inappropriate to use because census tract boundaries are not constant decade-to-decade. County data are inappropriate to use because it describes too large of a geographical area.

El Segundo

The El Segundo Power Plant was built in 1955; the Scattergood Power Plant was built 0.3 miles to the northwest in 1958. Both are located near the shore of the Pacific Ocean and just south of Los Angeles International Airport.

El Segundo, Units 1 & 2 and Units 3 & 4

Photo: NRG/Destec

The demographic factors selected for this assessment were population and racial composition. The socioeconomic factors used were family income and housing ownership. The City of El Segundo was selected as the representative city for this analysis because El Segundo is located on the coast in Southern California, where a majority of these large electric generating facilities are located. In addition,

Table IV-5 Poverty and People of Color in Areas Surrounding the El Segundo and Scattergood Power Plants: 1990

	Number of Tracts in 1-mile radius				Number of Tracts in 6-mile radius			
	Percent of People in Census Tracts							
Plant Name	**0-24.9 %**	**25-49.9 %**	**50-74.9%**	**57-100%**	**0-24.9 %**	**25-49.9 %**	**50-74.9%**	**57-100%**
El Segundo								
Percent poverty	2	0	0	0	112	7	0	0
Percent people of color	2	0	0	0	49	26	21	23
Scattergood								
Percent poverty	2	0	0	0	111	8	0	0
Percent people of color	2	0	0	0	53	23	22	21

Source: California Energy Commission Statewide Power Plant Maps 2001, 1990 U.S. Census

the City of El Segundo would be affected by two power plants, El Segundo and Scattergood, instead of one power plant.

Table IV-4 presents the 13 power plants in 11 cities that were analyzed for this demographic and socioeconomic assessment. In this report, only the data for the City of El Segundo are presented. Please refer to Appendix IV for supporting tables, graphs, and data used in this assessment.

Analysis: City of El Segundo

The El Segundo Power Plant was built in 1955; the Scattergood Power Plant was built 0.3 miles to the northwest in 1958. Both are located near the shore of the Pacific Ocean and just south of Los Angeles International Airport.

The Scattergood Power Plant is not within the city limits of El Segundo, but it influences the City of El Segundo due to its proximity. Scattergood is in the City of Los Angeles, but is isolated from Los Angeles residential areas by the Los Angeles International Airport and surrounding non-residential uses. The beach, a regional sewage treatment plant, a Chevron refinery, and the City of El Segundo bound the Scattergood Power Plant. The Scattergood Power Plant would be more likely to affect the socioeconomic and demographic conditions of the City of El Segundo than the City of Los Angeles.

The neighboring cities of Torrance and Hawthorne were used as comparison cities because all three cities are in Los Angeles County and are similar in size and composition. Hawthorne is located 3.5 miles east of the City of El Segundo and 4.5 miles inland from the coast. Torrance is located 9 miles southeast of the City of El Segundo and 3 miles inland from the coast. However, the cities of Torrance and Hawthorne do not have large power plants. Therefore, the socioeconomic and demographic data for City of El Segundo can be compared to Torrance and

Hawthorne to determine whether the power plants have affected the population, racial composition, income, and housing tenure in El Segundo.

By 1964, the City of El Segundo (which was incorporated in 1917) was already well established. Between 1964 and 1981, there was minimal development immediately adjacent to both power plants and the surrounding area remained industrial. Between 1981 and 1998, a nearby residential area was extended westward toward the industrial area, but overall there was a minimum of new residential development near the power plants after 1964.

Demographic Status

To determine El Segundo's current demographic status, 1990 census tract data[20] were used to generate maps showing the distributions of people of color and low-income populations. Table IV-5 presents the percentages of persons at or below poverty level and persons of color within both a six- and one-mile radius of the power plant. Figures IV-2 and Figures IV-3 are maps that illustrate census tracts and their relative percentage of persons in poverty and persons of color.

In 1990, the total population of the City of El Segundo was 15,223. In the three census tracts within a one-mile radius of both the Scattergood and the El Segundo Power Plants, less than 25 percent of the population consisted of people of color or people in poverty.

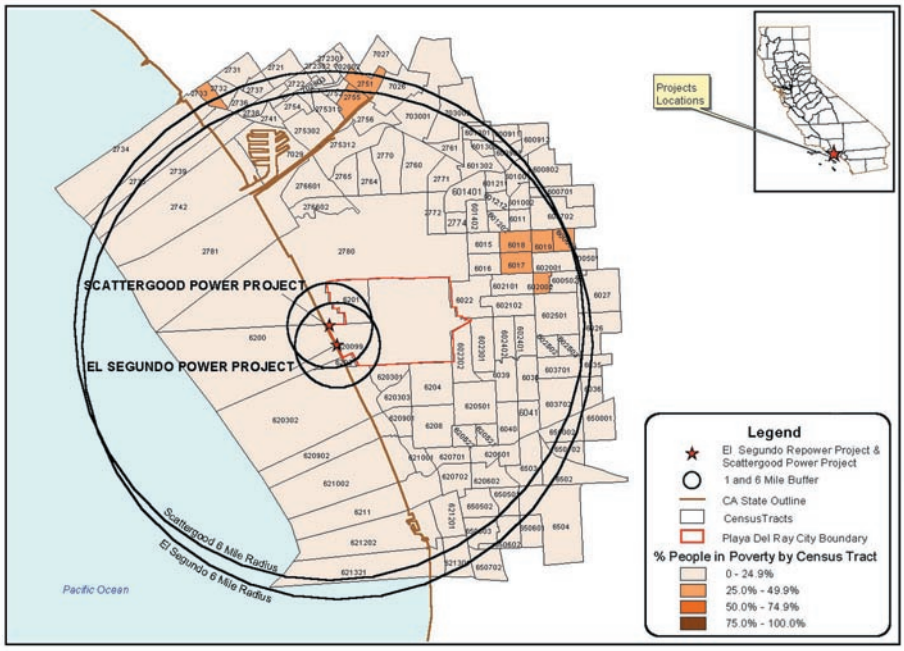
As illustrated in Figure IV-3, the tracts furthest from the power plant are more heavily populated with persons of color. The census tracts with higher percentages of the population in poverty are approximately four miles east of the El Segundo and Scattergood Power Plants.

Population Growth and Racial Characteristics

Figure IV-4 presents the percent of non-white residents in El Segundo. As shown in Table IV-4, the El Segundo Power Plant went on-line in 1955, and the Scattergood Power Plant went on-line in 1958. The population of the City of El Segundo grew 78 percent between 1950 and 1960, when the power plants were built. Between 1960

[20] Housing data from the 2000 Census were not available at the time of this analysis, so for consistency, all Census data are from the 1990 census.

Figure IV-2 Percent Persons in Poverty by Census Tracts in Areas Surrounding the El Segundo and Scattergood Power Plants: 1990



Source: California Energy Commission Statewide Power Plant Maps 2001, 1990 U.S. Census

and 1970, the population grew 10 percent. Between 1970 and 1980, the population dropped 12 percent, but rose again 11 percent between 1980 and 1990. In comparison, Los Angeles County grew 16 percent between 1960 and 1970, six percent between 1970 and 1980, and 19 percent between 1980 and 1990.

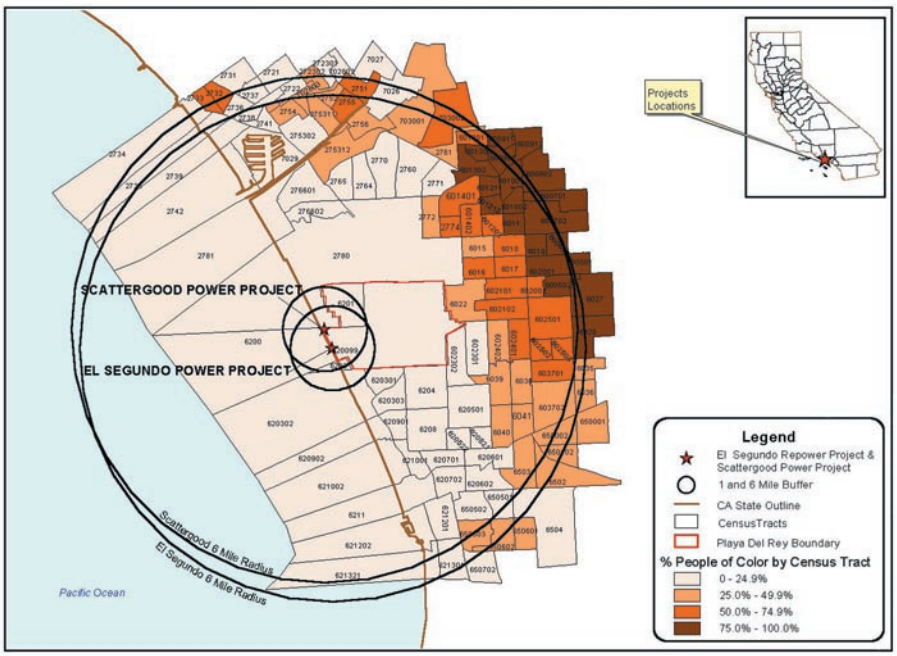
The non-white population in the City of El Segundo has always been small, but grew steadily between 1950 and 1990. El Segundo's non-white population grew from nearly zero in 1950 to nine percent in 1990. During the same time period, the City of Hawthorne's non-white population grew from one to 58 percent and the City of Torrance's non-white population grew from three to 27 percent. As a reference, Los Angeles County's non-white population grew from seven to 43 percent between 1950 and 1990.

Income

Within one mile of the El Segundo and Scattergood Power Plants all census tracts have fewer than 25 percent of the population in poverty (refer to Table IV-5 and Figure IV-2). Median family income data were collected for 1950, 1960, 1970, 1980, and 1990. In all of these years, the City of El Segundo had a median family income that was higher than that for Los Angeles County.

The cities of El Segundo, Hawthorne, Los Angeles, and Torrance and Los Angeles County as a whole were compared to determine whether the power plants near and in the City of El Segundo might have an effect on the income in El Segundo. Figure IV-5 shows the median family income for the comparison cities and Los Angeles County from 1950 to 1990. In 1950, El Segundo's median income was three percent higher than that of Los Angeles County. In 1990, El Segundo's median income rose to 27 percent above the County. In comparison, income for the cities of Torrance and Hawthorne were 0.5 percent and five percent above county levels in 1950. In 1990, income in the City of Torrance was 30 percent higher and the income in the City of Hawthorne was ten percent lower than Los Angeles County.

Figure IV-3 Percent Persons of Color by Census Tracts in Areas Surrounding the El Segundo and Scattergood Power Plants: 1990



Source: California Energy Commission Statewide Power Plant Maps 2001, 1990 U.S. Census

Home Ownership

Higher rates of homeownership are indicators of higher income communities. Therefore, the number of owner-occupied dwelling units in comparison to the number of renter-occupied units can provide an insight into the socioeconomic well being of a community.

The total number of dwelling units in the City of El Segundo nearly doubled between 1950 and 1990, and during those years, the number of renter-occupied units increased steadily. The cities of Hawthorne and Torrance have a similar trend: the number of renter-occupied dwelling units has steadily increased.

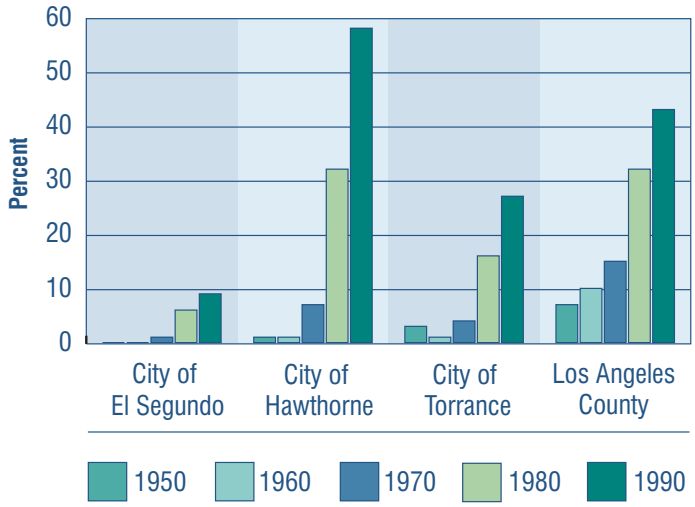
Figure IV-6 illustrates the percentages of renter-occupied dwellings. In 1950 and 1960, there were fewer renter-occupied units than owner-occupied units in all studied jurisdictions. After 1960, there were more renter-occupied units in each area except for the City of Torrance where there were more owner-occupied units. These data illustrate that the housing tenure trends for the City of El Segundo follow the trends for comparative cities and the county as a whole.

El Segundo Conclusions

A variety of factors have contributed to the socioeconomic and demographic development of the City of El Segundo, including the construction of the two large power plants. However, there is no apparent evidence that the construction and operation of the El Segundo and Scattergood Power Plants have significantly influenced the socioeconomic and demographic characteristics of the City of El Segundo.

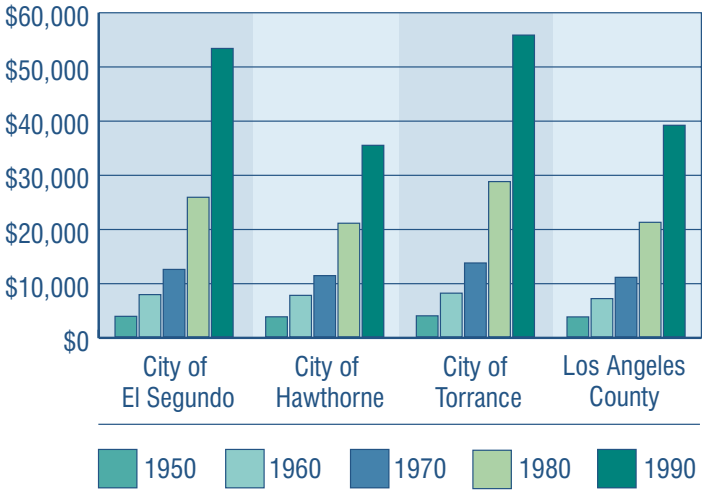
Since 1950, the City of El Segundo has maintained a median income level higher than that of Los Angeles County. The racial composition of El Segundo has not changed as dramatically as that of nearby cities in the region or Los Angeles County as a whole. The increase in the number of renter-

Figure IV-4 Percent of Persons that are Non-White



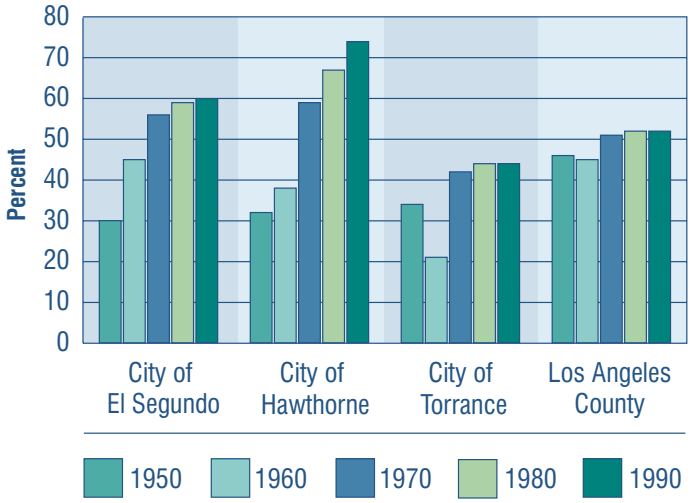
Source: US Census 1950, 1960, 1970, 1980, and 1990, *California Cities, Towns & Counties*, 2000, Information Publications
Note: The figure indicates white and non-white components of the total population.

Figure IV-5 Median Family Income in the Cities of El Segundo, Hawthorne and Torrance, and Los Angeles County



Source: US Census 1950, 1960, 1970, 1980, 1990
California Cities, Towns & Counties, 2000, Information Publications

Figure IV-6 Percent of Renter-Occupied Dwelling Units



Source: US Census 1950, 1960, 1970, 1980, and 1990
California Cities, Towns & Counties, 2000, Information Publications

occupied dwelling units that has occurred in El Segundo has also occurred in the region as a whole. This information does not provide any clear evidence that the power plants have had a significant effect on the socioeconomic and demographic development of the city.

Conclusions for Other Cities

This section addresses conclusions drawn from the data collected and analyzed for the 11 power plants in ten cities that were evaluated in addition to the two power plants in the City of El Segundo. (These data are presented in Appendix IV.)

Similar to El Segundo, no definitive conclusions can be drawn as to the impact that specific power plants may have had on local socioeconomic or demographic conditions in the years after the plants were built. However, some observations relating to socioeconomic and demographic conditions in the vicinity of power plants are presented below.

Population Encroachment. Topographic maps were used to evaluate the development patterns around power plants as a means of evaluating population encroachment trends. In later development (generally past the mid-1970s) mobile home parks were built within a one-mile proximity of five out of the 13 power plants. The mobile home parks appear to 'fill in' vacant industrial and residential areas. They were likely built in these locations because land costs were low or the land was otherwise undesirable for other land uses. While areas near power plants are generally less desirable for residences due to their industrial setting, the general desirability of coastal property does not seem affected by the presence of the power plants.

Ten out of the 13 power plants were built in industrial areas, often separated from residential areas by distances of approximately one-half to one mile. There is no clear trend showing that residential development does not occur near power plants. When the plants were constructed, generally in times of very rapid growth in the state, the land areas surrounding the power plants were also in the process of being developed. In the cases where power plants were built in developed urban areas, these areas were industrial sections of a city, on the border of the city, next to highways, military bases, or otherwise on the coastline.

Racial Composition. The Cities of Long Beach and Pittsburg showed the largest change in racial composition between 1950 and 1990 (refer to Appendix IV for the data used in this analysis). There are few similarities between these locations. The City of Long Beach was well established before the power plant was

constructed, whereas Pittsburg was a rural area with little development. Although Long Beach and Pittsburg are both situated on the waterfront, Long Beach is in Southern California and sits on the Pacific Ocean, while Pittsburg is located in Northern California in the East San Francisco Bay Area on the San Joaquin River.

Based on the sample of power plants selected for this analysis, there is no evidence that the racial composition was affected by the construction of the power plants, regardless of whether the power plant was built before the city was established, or the power plant was built in an undeveloped area. In the cities of Long Beach and Pittsburg, the percentage of non-white persons in the population rose between 1960 and 1990, from four percent to 42 percent, and 16 percent to 41 percent, respectively.

Income. Based on the sample of power plants considered in this analysis, the census tract data show that areas within a one-mile radius of a power plant are not necessarily low-income neighborhoods. In the decade after the power plants were built, median family income generally continued to grow consistently with the wider surrounding area. In some specific cases, there is a clear pattern of higher incomes closer to the plant than somewhat farther away. This, however, may result from the plant's proximity to the Pacific Ocean, a clear amenity that affects property values and thus housing incomes.

Home Ownership. Trends in home ownership do not appear to be linked to the presence of a power plant in the area. Infill development and construction of small apartments that replaced the single-family home affected the number of homeowners in California. For example, in the case of the Haynes and Alamitos Power Plants in the City of Long Beach, the total number of dwelling units has increased. Between 1950 and 1960, the number of owner-occupied units increased by 51 percent and the number of renter-occupied dwelling units increased 26 percent. Between 1960 and 1970, the number of owner-occupied units increased by one percent and the number of renter-occupied dwelling units increased 27 percent. However, the Haynes and Alamitos Power Plants were not the only development factors affecting homeownership rates in the area. The California State University at Long Beach was built in 1949 directly northwest of the Alamitos Power Plant, the Los Alamitos Naval Station is located three miles northwest of the power plants, and the U.S. Naval Weapon Station is located approximately two miles east of the power plants.

General Conclusions

Most of California is served by grid-connected electric generation facilities. Electric consumption is greatest in Southern California, but San Francisco is a particularly intensive electricity-consuming region. California's rural counties — such as Mono, Modoc and Alpine counties — have the highest per capita electricity consumption.

For-profit electric generation facilities are taxed by state and local governments in a variety of ways, including property taxes, franchise fees or surcharges, and utility users taxes. It is important to note, however, that about one-third of California's

electric generation facilities are owned by public entities, which are tax-exempt.

Counties, cities, and school districts with taxable electric generation facilities within their jurisdictions receive these tax revenues. Counties with large thermal power plants — including Los Angeles, Contra Costa, Monterey, and San Luis Obispo — report that plant owners are some of their largest property tax contributors. Some cities and counties generate utility-users-tax revenues for electricity and natural gas consumption. This tax is currently a particularly significant source of revenue for local jurisdictions with large, natural gas-fired electric generation facilities because the tax is a percentage of the total natural gas bill and, therefore, varies with the price of natural gas.

Employment at power plants can be significant at some large thermal facilities, such as California's two nuclear power plants, but jobs at new combined-cycle power plants will be relatively few. The temporary construction workforce for these new facilities, however, will provide hundreds of millions of dollars in construction payroll, employee benefits, and employment taxes.

Socioeconomic drawbacks of electric generation facilities include increased costs to local governments for providing services and infrastructure to these facilities, such as water and sewer service, and police and fire protection. New power plants compensate local governments for these costs through the payment of impact fees and taxes.

Negative impacts to the people and property near a power plant are difficult to quantify because other variables could also be contributing to the effects. For this report, socioeconomic and demographic characteristics of areas near selected power plants today were compared with the same characteristics when the plant was first built. The analysis of 13 power plants did not reveal any negative trends or significant differences with nearby communities without power plants.

Public perceptions about power plants can be negative or positive, depending on the communities' values and interests. In minority and low-income communities, environmental justice concerns are raised and addressed through the Energy Commission's power plant licensing process.

On balance, the socioeconomic benefits of electric generating facilities substantially outweigh their socioeconomic drawbacks, especially when considered from a regional and statewide perspective. Because of the revenues generated by power plants, benefits at the local level can also be substantial. However, these benefits have to be considered along with local concerns, such as potential effects on property values and the potential for disproportionate impacts on low-income and minority populations. These local concerns emphasize the need for careful attention to local issues during the power plant siting process.

CHAPTER FIVE

Displacement of Existing Power Plants

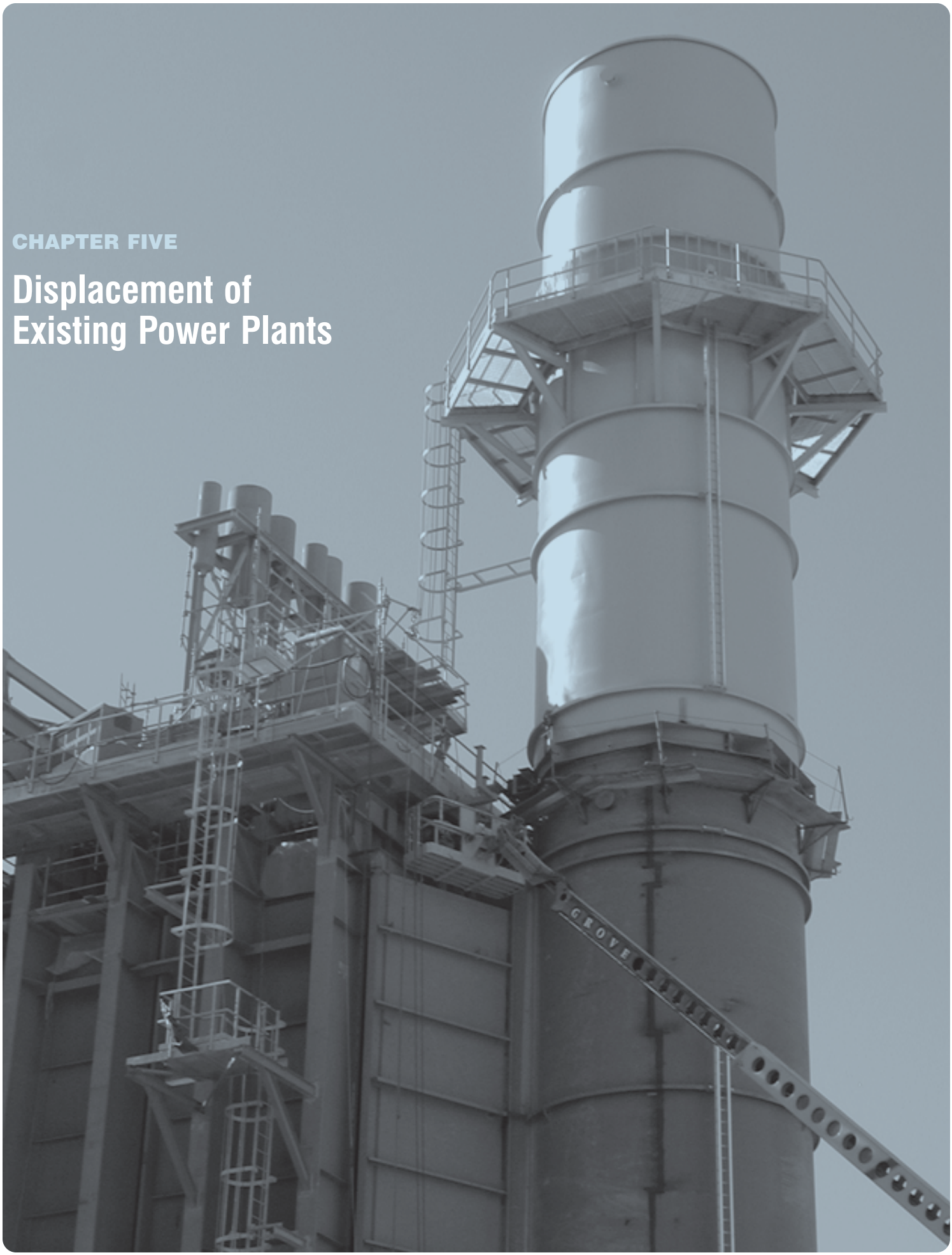


Photo: Laura Frank

V. Displacement of Existing Power Plants

This chapter discusses the displacement of existing power plants by newer, more efficient power plants.

Economic Displacement Affects Dispatch and New Capacity Decisions

Economic displacement is another name for competition in the energy commodity markets. Economic displacement affects both short-term decisions about how to dispatch available resources to meet the daily changes in demand, as well as longer-term decisions about if, when, and what kind of new capacity to add to or remove from the system.

New power plants are typically added to the generation system not only to maintain reliability in the face of increasing loads and retiring power plants but also to lower the cost of producing electricity. As the growth in demand over time approaches the capacity of the system's existing generating resources, new capacity is added to ensure that power can be delivered reliably during all hours of the year, especially during the hours when the annual peak demand occurs. This capacity is baseload, intermediate, or peaking.

As the existing resources are used and strained to meet the higher demands that load growth places on every hour of the year, less efficient and more expensive existing generation must be dispatched to meet that increasing demand.

However, if new generating capacity has been added and is significantly more efficient than the existing capacity, there will be many hours of the year where, even though the existing capacity may be sufficient to meet the hourly demand, generation from new capacity would be cheaper to dispatch than generation from existing capacity. Energy from the new, more efficient capacity would economically displace energy from the relatively less efficient and more expensive existing capacity.

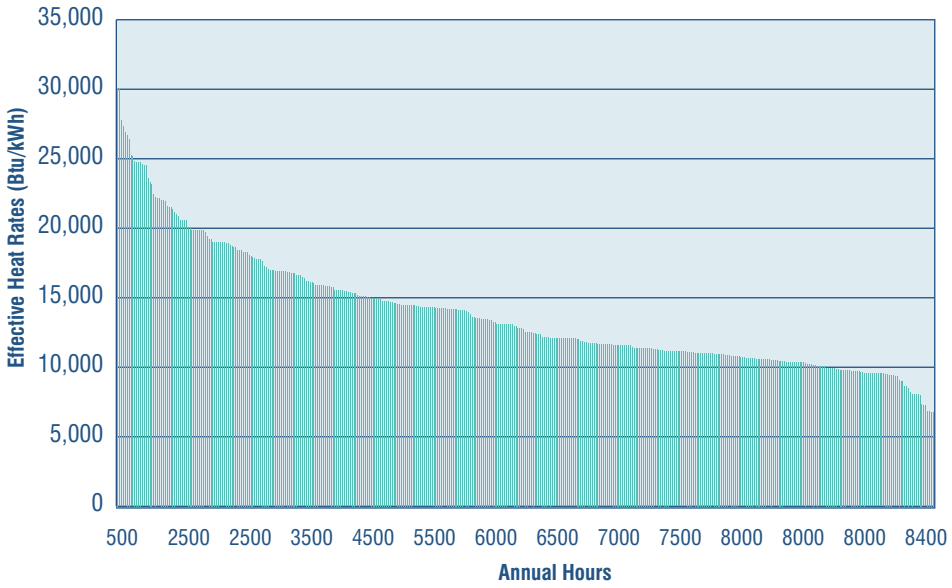
Numerous power plants in California have been temporarily shutdown due to their inability to operate economically. These 108 plants are deemed temporarily "inactive," but not permanently displaced. Some of these power plants could still return to operation under the right economic or system-reliability conditions — unless their owners have given up the air permits and decommissioned them physically. (See Appendix V for more detail.)

Merit Order in Dispatching Older Electricity Resources

On the West Coast, when power plants are dispatched to meet the growing demand for electricity, they are dispatched on a "merit order," from most efficient to least efficient. (See Appendix V for supporting data.)

Merit order is the order in which a series of power plants would be dispatched to meet growing electricity demand of the system. The merit order reflects relative heat rates. Higher heat rates are generally associated with higher position

Figure V-1 Generation Duration Curve Illustrative of Merit Order Dispatch



on the merit order and less frequent use.

Figure V-1 shows the marginal heat rate (heat rate of the last unit needed to be dispatched to serve load that hour) for each hour of a typical year. The most inefficient units are used for relatively few hours of the year — as shown at the left end of the graph — corresponding to summer afternoon hours. For most of the hours of the year, the system marginal heat rate fluctuates within a fairly narrow range — as shown by the relatively flat slope of the curve — and many power plants of fairly similar heat rates are dispatched to meet fairly moderate demand levels.

But other economic variables are also factored into the merit order such as relative transmission losses and fuel costs. A power plant that uses a cheaper fuel or has less transmission losses associated with the delivery of its generation will be lower on the merit order than another plant with the same heat rate. It could also be lower on the merit order than a power plant with a slightly lower heat rate.

The actual merit order of power plants available to generate power will change daily. Power plants that are shut down for refueling, scheduled maintenance, or for forced outages cannot be dispatched to serve load that hour. So, the next most expensive resource would have to be dispatched instead. This may make little difference to overall system efficiency, because these substitutions occur between plants with very similar efficiencies. However, such substitutions can make marked differences in environmental effects that are necessarily geographic.

The merit order of power plants, illustrated in Appendix V, varies widely in geographic location among power plants that are very close to each other in the merit order. This feature has considerable significance to the ability of electricity system operators to make useful predictions of power plant emissions or water use.

Displacement of Specific Plants Cannot be Predicted

Public Resources Code 25309.3(c)(2) directs the Energy Commission to assess the extent to which generation from new power plants might displace generation

from existing power plants and the environmental consequences of that displacement; however, for several reasons, this analysis is not possible.

First, the environmental consequences of displacement are necessarily geographic and temporal in nature. Thus, section 25309.3 implies that a geographically specific prediction of economic displacement can be done. But identifying combinations of individual existing power plants that would be displaced during a certain hour, presuming the presence of a new power plant, is not a trivial task.

To accurately identify displacement that has occurred would require all of the information on which plant owners' and control area operators' base their system dispatch decisions. Predicting displacement in advance is made even more difficult because one cannot know in advance other key information that can significantly affect future dispatch decisions (such as the weather's effect on demand, precipitation's effect on hydroelectric supplies, time's effect on plant breakdowns, etc.).

To assess or predict the environmental effects of such projected displacement is an order of magnitude more difficult because the environmental effect of a change in power plant pollutant emissions or water usage is the result of complex interactions with environmental effects from other sources and ambient conditions, which would also have to be predicted.

Simulation Models Identity Underlying Forces

Computer simulation models of the electric generation system have been used to attempt to understand the dynamics of economic displacement and the uncertainties inherent to its prediction.

By controlling the inputs to the model, the modeler can note the difference in dispatch between the two simulations, which can be thought of as the theoretical displacement effect of the new power plant. The results of the modeling help identify underlying forces at work, but these results should not be considered predictions of what will happen.

As many as one hundred different power plants reduce their generation to some generally small degree during certain hours when they may have been dispatched at or near the margin. These displaced plants may range in location anywhere from Mexico to Canada.

The possibility that existing power plants may be displaced by newer power plants, everything being equal, has often lead to the expectation that new plants will be used more frequently, and older, dirtier plants will be ultimately retired.

But such an outcome has not been observed in model simulations or in real life. The dispatch of intermediate power plants from one year to the next can vary tremendously, individually, and in aggregate, for all of the reasons discussed in the previous chapters on the development of the Western system and relative power plant efficiencies.

Even with the addition of many new power plants, say, in 2002, and even if those new power plants are dispatched up to their maximum availability, the amount of generation from existing intermediate power plants could drastically increase in 2002 compared to 2001 for any number of reasons. In addition to population growth increasing the underlying demand trends, the summer weather could be hotter or winter weather colder — leading to higher electricity demand. Forced outages of power plants could increase. Less precipitation could lead to lower hydroelectric energy generation. All of these changes could act to increase generation from existing intermediate power plants.

The previous example illustrates the importance of not relying on theoretical estimates of economic displacement to forecast specific future levels of generation or environmental performance (*e.g.*, a certain amount of air pollutant emissions) at individual power plants. Modeling techniques and input assumptions could be changed or improved to allow better estimates of short-term system operations. But probabilistic methods would need to be employed to account for uncertain key variables such as temperature and precipitation effects or plant breakdowns. The probabilistic results of such studies would need to be completely understood by their intended audience to be of much assistance in decision-making. In addition, estimates of the potential economic displacement of energy from old power plants by energy from new power plants should be treated with even more caution if based on simulation studies that do not expressly take into account the real incentives and constraints in the still-emerging restructured energy market.

New Capacity Additions Include Gas-Fired Facilities and Renewables

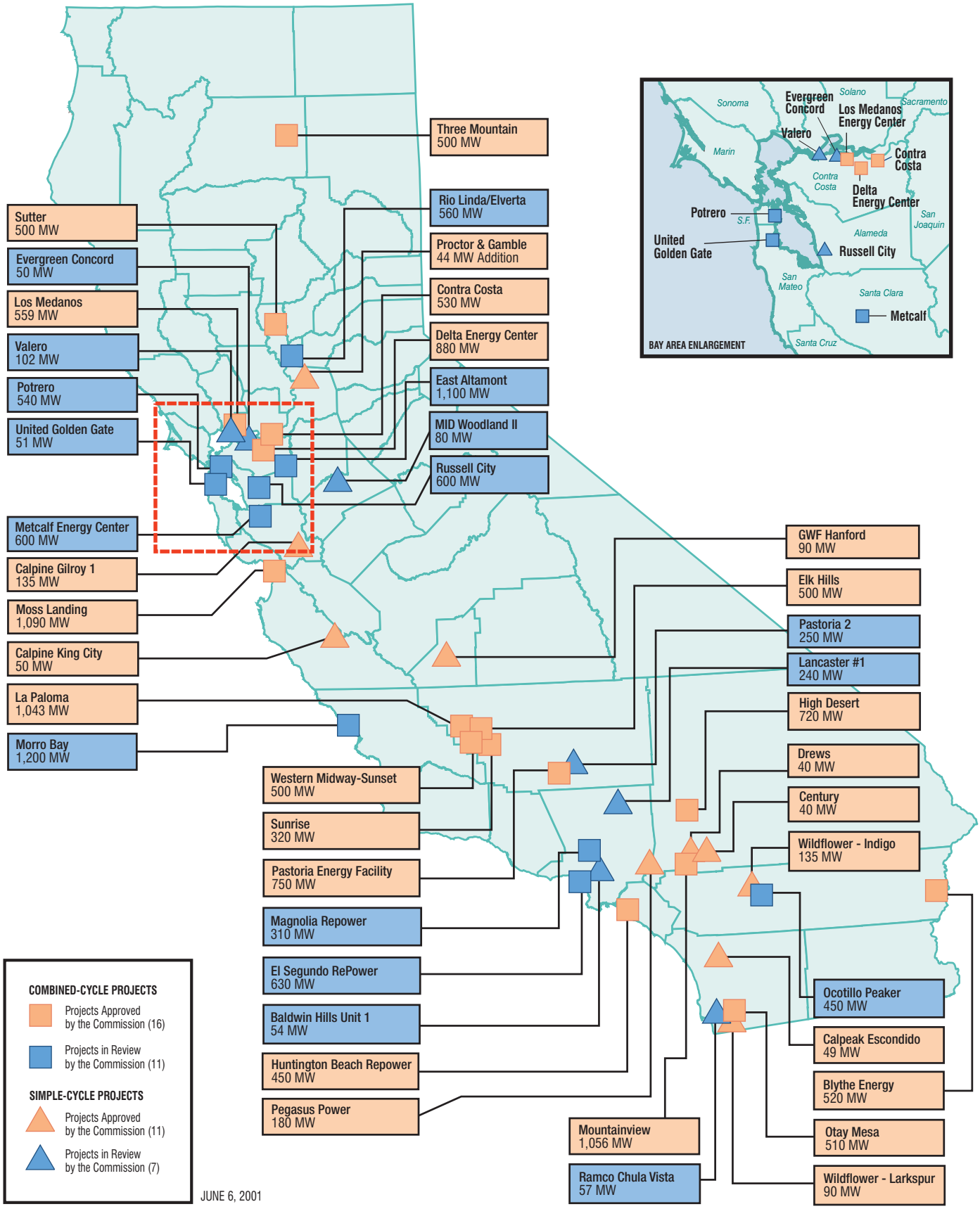
California's electric generation system will expand rapidly over the next few years. The Energy Commission has received many applications to build new natural gas-fired combined-cycle and simple-cycle power plants since 1997. In addition, State and federal purchase and tax incentives and consumer awareness of high electricity prices are stimulating the market for renewable energy facilities.

Figure V-2 and Appendix V provide information and the locations of each of the newly approved or proposed natural gas facilities. Appendix V also includes information on each power plant's thermal efficiency, projected air emissions, water supply source and consumption, and biological resource impacts and mitigation measures.

In addition to gas-fired electric generation, the State of California is fostering the construction of many small-scale electric generating facilities through its Renewables Program. To date, more than 1,000 MW of biomass, digester gas, geothermal, landfill gas, small hydroelectric, and wind energy facilities have received State electricity production incentives.

Consumer interest in solar PV systems is particularly strong at this time. Administrators of PV programs within the Energy Commission, Sacramento

Figure V-2 Current and Recently Approved Power Plant Licensing Cases



Municipal Utility District and Los Angeles Department of Water and Power all report exponential growth in applications for purchase-price subsidies.

For example, the Sacramento Municipal Utility District's PV program for residential customers now has a 1,000-person waiting list and receives up to 50 calls a day. The Energy Commission's program is receiving more than 750 applications per month. To date, the Energy Commission's "Emerging Account" program for individual users of PV, fuel cells, and small wind turbines has resulted in 592 installations, totaling more than 2.8 MW of renewable energy generating capacity.

Installing solar PV systems is an environmentally beneficial response to the electricity crisis. PV systems have no air pollution emissions, use no seawater or fresh water for cooling, and are installed on existing residential and commercial roofs, so their installation does not subtract from natural wildlife habitat. Furthermore, these systems generate electricity during the day when electricity demand is highest and shave peak electric demand in the late afternoons when residential and commercial electric use overlaps.

If enough PV systems were installed in California, they might even contribute to electric system reliability, so that operation of diesel-fired emergency generators is avoided.

Electric facility sites offer unique opportunities to add electric generation quickly because the transmission, gas, and water supply infrastructures already exist there to support the new equipment. Appendix V provides information on recently approved or proposed expansions at existing electric facility sites, including a description of whether old equipment will be permanently removed and replaced with new, more efficient generating plants. The Energy Commission expects more of these "repowering" projects in the future. These projects are tangible examples of the displacement of older electric generation facilities.

CHAPTER SIX

Conclusions and Recommendations

Photo: Stone / Simeone Huber

VI. Conclusions and Recommendations

Impacts Vary Across Generation Sectors

California's in-state electricity generation facilities affect the environment in different ways. Impacts from hydroelectric facilities include loss of habitat from the construction of storage reservoirs, impacts to downstream aquatic and riparian habitats, species losses, impaired fish migration (especially threatened and endangered species) from dams, and degraded water quality from changes in stream flows and temperatures.

The primary impacts from the oil and gas facilities, built in the 1940s and 1950s in coastal areas, include air pollutant emissions from fuel combustion, aquatic species losses from once-through cooling, and habitat losses (wetlands and sensitive coastal areas) from the plant footprints. The state's two operational nuclear plants also contribute to aquatic losses from cooling water systems.

The impacts from new simple-cycle and combined-cycle facilities are generally limited by footprint size, location, and technology although regional air quality and water supply problems may occur.

Geothermal impacts related to the actual footprint of the facility are limited, but they can become significant in combination with the related development of steam wells, steam pipelines, and access roads.

Waste-to-energy facilities create air emissions, utilize water for cooling, and can eliminate habitat from the construction of the facilities, although on a much smaller scale than oil and gas-fired facilities.

Although wind farms do not release air emissions or require water for cooling, they do require substantial amounts of land, and the turbines can harm birds.

Most solar thermal facilities also create air pollution emissions, because they burn natural gas during periods of low solar insolation.

Power Plant Impacts Have Declined Over Time

The collective impacts of power plant facilities, particularly those built after the 1970s, have declined over time due to improvements in thermal efficiency, fuel switching from oil to natural gas, emission control technology advances, the development of renewable generation resources, and the adoption of environmental laws and regulations.

Air pollutant emissions and emission rates from in-state generation have significantly decreased. This decrease has contributed to California's efforts to improve its ambient air quality. However, air emissions and air quality are not uniform across California. The majority of California's power plants are located in the state's most severely polluted or highly populated air basins (i.e., the South Coast and San Joaquin Valley; and the San Francisco Bay Area and San Diego County,

respectively). New, large thermal power plants and the expanded use of distributed generation and back up generators may contribute to local effects. Therefore, generation sector emissions and emission rates will continue to be monitored, controlled, and — in many cases — reduced.

Water usage by power plants is small compared to overall water demand and has generally declined as fewer plants rely on once-through cooling from ocean and bay waters. The inland siting of new plants in areas with limited fresh water supplies has led to improvements in water efficiency and wastewater discharge. The use of reclaimed water and dry cooling technologies to cool power plants is increasing.

Many hydroelectric and thermal power plants, built before environmental laws were adopted, have caused significant damage to land and aquatic habitats. The impacts from new facilities are generally mitigated. However, the damage to aquatic wildlife continues at repowered and expanded coastal plants that use once-through cooling. Similarly, hydroelectric facilities continue to impact the environment, particularly endangered and threatened species such as salmon and steelhead. The cumulative effects of numerous existing and new power plants in the southern San Joaquin Valley are significant and are being addressed through off-site habitat preservation programs.

Socioeconomic Benefits Outweigh Impacts

Electric generation facilities are valued for the electrical services they supply and contributions to local tax revenues. Employment at operating facilities is not a significant benefit. Southern California and the San Francisco Bay Area counties generate and consume the most electricity. An analysis of 13 older and larger facilities did not reveal any long-term socioeconomic impacts or significant differences in housing, population, and income levels when these facilities were assessed against nearby communities without power plants.

Displacement of Specific Plants Cannot Be Predicted

To the extent that new combined-cycle facilities are actually built, the use of older less efficient generation is in a general decline, all other factors being equal. However, the specific location of this potential displacement, and its potential specific environmental consequences, cannot be predicted with much confidence. From year to year, this trend may be slowed, or even reversed, by the effects of extreme temperatures, rainfall, forced outages of plants, reduced availability of imported power, and local transmission and reliability constraints.

Recommendations for Next Environmental Performance Report

Based on the analyses conducted for this report, a number of suggestions for the next Environmental Performance Report are presented below.

With respect to air quality impacts, regulators should collect data on power plant

facility operations and emissions to analyze and report on the evolving environmental performance of the generation sector during the current energy emergency and in a future functional deregulated electricity market. Better and more current air emissions data and performance will allow the evaluation of potential system improvements (e.g., permanent displacement of less efficient and/or higher emitting units), and the effects of electricity imports and exports on in-state power plant air emissions.

While NOx emissions and emission rate trends are discussed in detail in this report, PM_{10} and the emerging potential issue of $PM_{2.5}$ should be analyzed in more detail in subsequent reports. The potential for the use of alternative fuels, distributed generation, and back up generators, even when limited to acute electricity shortages, could increase PM emissions.

The current electricity situation has accelerated the permitting and development of new power plant facilities. The effects of this new development on water supply and water quality, particularly at the local level, should be reviewed in the future. An updated review of water usage and discharge from existing facilities will allow a thorough analysis of whether new facilities are stressing limited resources to existing facilities, other users of the same water supply, or limited by the availability of water, themselves. A more in-depth evaluation of the various alternatives to fresh water — reclaimed water, contaminated groundwater, dry cooling technologies, etc, — could facilitate siting of future facilities. Finally, it may be instructive to evaluate the trade-offs between some cooling alternatives and thermal efficiency.

More detailed scientific information is needed about the environmental effects of California's hydroelectric system, particularly on a watershed basis versus the project-by-project analysis currently used in FERC licensing. This information is needed to help evaluate the 29 hydroelectric projects that will be relicensed by FERC this decade. The issues and trends that emerge from the first of these relicensings will be examined in greater detail in the next report.

The potential cumulative biological effects of small hydroelectric systems and thermal plants using once-through cooling should also be evaluated. Additionally, cumulative effects of the fast growing wind generation sector should be addressed.

The socioeconomic impact assessment in this initial report focused on the older fossil-fueled facilities. The next report should also assess the impacts from hydroelectric facilities, particularly those in rural counties. The relative contributions of power plants to local and state tax revenues were difficult to discern and better data are needed to identify whether fees and revenues from power plants are sufficient to meet their service needs. Finally, the use of market mechanisms such as the purchase of air quality emission reduction credits and water trading to facilitate power plant development should be evaluated to identify any potential impacts to regional economic development trends.

References, Glossary, and Acronyms

References

CARB 2001a. California Air Resources Board. The 2001 California Almanac of Emissions and Air Quality.

CARB 2001b. California Air Resources Board. Rulemaking on the Amendments to the Assessment of the Impacts of Transported Pollutants on Ozone Concentrations, March 2001.

CARB 2000a. California Air Resources Board. Air Pollution Emission Impacts Associated with Economic Market Potential of Distributed Generation in California. Contract 97-326, Amendment 2. June 2000.

CARB 2000b. California Air Resources Board. Diesel Risk Reduction Plan (Diesel RRP). September 2000.

California Department of Forestry and Fire (CDF). March 9, 2001."Comment Letter to the California Public Utilities Commission on the Draft Environmental Impact Report on Pacific Gas and Electric Company's Application for Authorization to Divest Its Hydroelectric Generating Facilities and Assets." Application 99-09-053. November 2000.

California Department of Fish and Game (DFG). "Testimony of Julie Brown before the State Water Resources Control Board at the Lower Yuba River Hearings." February, 2001

California Energy Commission. Investing in Renewable Electricity Generation in California. Report to the Governor and Legislature. Publication No. P500-00-022, 2000

___. 1999. California Energy Commission. 1997 Global Climate Change Report Greenhouse Gas Emissions Reduction Strategies for California. Publication No. P500-98-001, January 1998.

___. 1999. California electrical generation, 1990-1999. http://www.energy.ca.gov/electricity/electricity_gen_1990-1999.html.

___.1996. 1994 Electricity Report. Publication No. P300-95-02, November 1995. http://www.energy.ca.gov/reports/ER94.html.

___. 1992. Energy technology status report. Publication No. P500-92-007.

___.1991. Southern San Joaquin Valley Ecosystems. Natural Lands Inventory and Maps. Publication No. P700-91-004.

California Native Plant Society (CNPS). 1994. Inventory of Rare and Endangered Vascular Plants of California. Mark Skinner and Bruce Pavlik, Editors.

California Public Utilities Commission (CPUC). 2000. Draft Environmental Impact Report on Pacific Gas and Electric Company's Application for Authorization to Divest Its Hydroelectric Generating Facilities and Assets. Application 99-09-053. November 2000.

Information Publications. 2000. *California Cities, Towns, and Counties*, Louise Horner, editor.

Legislative Analyst's Office. September 8, 1999. The Role of Water Transfers in Meeting California's Water Needs.

Maulbetsch, John S. 2001. Dry and Wet/Dry Cooling for Power Generation in California. February. Manuscript.

Mount, J. F. 1995. California Rivers and Streams: the conflict between fluvial process and land use. University of California Press. 329 pp.

Ketibah, X. 1994. A Brief History of Riparian Forest in the Central Valley of California," in California Riparian Systems, Ecology, Conservation and Productive Management edited by R. E. Warner and K. M. Hendrix. University of California Press. 1035 pp.

Orloff, S. and A. Flannery. 1992. Wind turbine effects on avian activity, habitat use, and mortality in Altamont Pass and Solano County WRAs. Prepared by Biosystems mortality on Unit 2 at the Buffalo Ridge Analysis, Inc., Tiburon, California, for the California Energy Commission, Sacramento Calif. 163pp + appendices.

State Water Resources Control Board. 2000. California Municipal Wastewater Reclamation Survey.
http://www.swrcb.ca.gov/recycling/recyfund/intro_survey_update_May00.pdf

The Nature Conservancy (TNC). 1987. Sliding Towards Extinction: The State of California's Natural Heritage. A Report to the California Senate Committee on Natural Resources and Wildlife.

U.S. Fish and Wildlife Service (USFWS). 1998. Central Valley Project Improvement Act Tributary Production Enhancement Report. Draft Report to Congress Pursuant to the Central Valley Project Improvement Act.

University of California, Davis (UC Davis). 1996. Status of the Sierra Nevada: Summary of the Sierra Nevada Ecosystem Project Report. Centers for Water and Wildland Resources, University of California. 22 pp.

Utility Data Institute, *Who's Who at Electric Power Plants*. 11th Edition. 2001. Brown, Kathy L. (Editor)

Glossary

Anadromous — Ocean-going; aquatic organisms normally living in saltwater (sea water) that ascend rivers in search of freshwater for spawning.

Biomass — Energy resources derived from organic matter. These resources include wood, agricultural waste, and other living-cell material that produce heat energy through direct combustion, gasification or fermentation processes. They also include algae, sewage, and other organic substances that may be used to make energy through chemical processes.

Boiler — A closed vessel in which water is converted to pressurized steam.

Bottoming cycle — A means to increase the thermal efficiency of a steam electric generating system by converting some waste heat from the condenser into electricity rather than discharging all of it into the environment.

British Thermal Unit (Btu) — The standard measure of heat energy. It takes one Btu to raise the temperature of one pound of water by one degree Fahrenheit at sea level.

California Endangered Species Act — The State law, originally enacted in 1970, expresses the State's concern over California's threatened wildlife, defined rare and endangered wildlife and gave authority to the Department of Fish and Game to "identify, conserve, protect, restore, and enhance any endangered species or any threatened species and its habitat in California…" The statute is under the State Fish and Game Code as Chapter 1.5.

California Environmental Quality Act (CEQA) — Enacted in 1970 and amended through 1983, CEQA established state policy to maintain a high-quality environment in California and set up regulations to inhibit degradation of the environment.

Capacity — The maximum amount of electricity that a generating unit, power plant or generating facility can produce under specified conditions. Capacity is measured in megawatts and is also referred to as the Nameplate Rating.

Carbon Dioxide (CO_2) — A colorless, odorless, non-poisonous gas that is a normal part of the air. CO_2 is exhaled by humans and animals and is absorbed by green growing things and by the sea.

Coal — Black or brown rock, formed under pressure from organic fossils in prehistoric times, that is mined and burned to produce heat energy.

Cogeneration — Simultaneous production of heat energy and electrical or mechanical power from the same fuel in the same facility. A typical cogeneration facility produces electricity and steam or heat for industrial process use.

Combined-cycle plant — An electric generating station that uses waste heat from its gas turbines to produce steam for conventional steam turbines.

Combustion — Burning. Rapid oxidation, with the release of energy in the form of heat and light.

Cubic foot — The most common unit of measurement of natural gas volume. One cubic foot of natural gas has an energy content of approximately 1,000 Btu.

Electric generator — A device that converts heat, chemical, or mechanical energy into electricity.

Electricity — A property of the basic particles of matter. A form of energy having magnetic, radiant, and chemical effects. A current of electricity is created by a flow of charged particles.

Emissions standard — The maximum amount of a pollutant legally permitted to be discharged from a single source.

Energy consumption — The amount of energy consumed in the form in which it is acquired by the user. The term excludes electrical generation and distribution losses.

Entrainment — The flow of aquatic organisms in the cooling water that is pulled into and through the cooling system for a thermal power plant. For a hydro facility, it refers to the passage of aquatic organisms through the turbine.

Environmental discharge — The pollution outputs or impacts, such as tons of air emissions, acre feet of water used, or acres of displaced habitat, described cumulatively and by generation technology sector.

Environmental efficiency — Discharges or outputs per unit of energy capacity or production, such as tons of air pollutant per megawatt hour, acre feet of water per megawatt hour, acres of habitat loss per megawatt of capacity. Environmental efficiencies can also be expressed on a per capita or a gross domestic product basis.

Environmental quality effects — The relative effect of energy-related environmental performance on the environmental quality of regions, air basins, and watersheds. For example, adding new power plants to a region may or may not have an effect on attainment of air quality standards. Similarly, land used as a footprint for a power plant may or may not have a significant wildlife habitat impact locally.

Fossil fuel — Oil, coal, or natural gas.

Fuel cell — A device that converts the chemical energy of fuel directly into electricity.

Generating station — A power plant.

Geothermal energy — Natural heat from within the earth, captured for production of electric power, space heating or industrial steam.

Gigawatt (GW) — One thousand megawatts or one million kilowatts.

Grid — The electric utility companies' transmission and distribution system that links power plants to customers.

Heat rate — A number that tells how efficient a fuel-burning power plant is. The heat rate equals the Btu content of the fuel input divided by the kilowatt hours of power output.

Hydroelectric power — Electricity produced by falling water that turns a turbine generator. Also referred to as hydro.

Impingement — The capture of aquatic organisms on the screens of a thermal or hydro facility.

Internal combustion engine — An engine in which fuel is burned inside the engine. It differs from engines having an external furnace, such as a steam engine.

Kilowatt (kW) — One thousand watts. A unit of measure of the amount of electricity needed to operate given equipment.

Kilowatt hour (kWh) — The most commonly used unit of measure telling the amount of electricity consumed over time. It means one kilowatt of electricity supplied for one hour.

Landfill gas — Gas generated by the natural degrading and decomposition of municipal solid waste by anaerobic microorganisms in sanitary landfills.

Load — The amount of electric power supplied to meet one or more end user's needs.

Megawatt (MW) — One thousand kilowatts.

Megawatt hour (MWh) — One thousand kilowatt hours.

Municipal electric utility — A power utility system owned and operated by a local jurisdiction.

Natural gas — Hydrocarbon gas found in the earth, composed of methane, ethane, butane, propane, and other gases.

NOx — Oxides of nitrogen that are a chief component of air pollution produced by the burning of fossil fuels.

Nuclear energy — Power obtained by splitting heavy atoms (fission) or joining light atoms (fusion). A nuclear energy plant uses a controlled atomic chain reaction to produce heat. The heat is used to make steam to run conventional turbine generators.

Ozone (O_3) — A kind of oxygen that has three atoms per molecule instead of the usual two. Ozone is a poisonous gas and an irritant at Earth's surface, capable of damaging lungs and eyes. But the ozone layer in the stratosphere shields life on earth from deadly ultraviolet radiation from space.

Particulate matter — Solid particles, such as ash, that are released from combustion processes in exhaust gases at fossil-fuel plants and from mobile sources.

Peak load – The highest electrical demand within a particular period of time.

Peak load power plant or peaking unit — A power generating station used to produce extra electricity during peak load times.

Photovoltaic cell — A semiconductor that converts light directly into electricity.

Power plant — An electric generating facility.

Pumped hydroelectric storage — Commercial method used for large-scale storage of power. During off-peak times, excess power is used to pump water to a reservoir. During peak times, the reservoir releases water to operate hydroelectric generators.

PURPA — The Public Utility Regulatory Policies Act of 1978 is implemented by the Federal Energy Regulatory Commission and the California Public Utilities Commission. Under PURPA, each electric utility is required to offer to purchase available electric energy from cogeneration and small power production facilities.

Qualifying facility — A cogeneration or small power producer, which, under federal law, has the right to sell its excess power output to the electric utility.

Renewable energy — Resources that constantly renew themselves or that are regarded as practically inexhaustible. These resources include solar, wind, geothermal, hydroelectric and waste-to-energy.

Repower — To modernize an existing electric generation facility.

Retrofit — Adding equipment to a facility or building after construction has been completed.

Solar thermal — The process of concentrating sunlight on a relatively small area to create the high temperatures needed to vaporize water to drive a turbine for electric power generation. Solar thermal systems may also be hybrid solar energy and natural gas-fired electric generating systems.

Steam electric plant — A power station in which steam is used to turn the turbines that generate electricity. The heat used to make the steam may come from burning fossil fuel, using a controlled nuclear reaction, concentrating the sun's energy, tapping the earth's natural heat, or capturing industrial waste heat.

Thermal efficiency — The amount of fuel used to generate a unit of electricity in combustion technologies. Also described as the "heat rate" or fuel input-to-power-output ratio.

Turbine generator — A device that uses steam, heated gases, water flow, or wind to cause spinning motion that activates electromagnetic forces and generates electricity.

Volt — A unit of electromotive force. It is the amount of force required to drive a steady current of one ampere through a resistance of one ohm.

Watt — A unit of measure of electric power at a point in time, as capacity or demand.

Watt hour — One watt of power expended for one hour.

Acronyms

AB 1890 — Assembly Bill 1890
AF — Acre-feet
AFC — Application for Certification
AZ/NM/SNV — Arizona-New Mexico-Southern Nevada Power Area
BACT — Best available control technology
BARCT — Best available retrofit control technology
Btu — British Thermal Unit
BUG — Back up emergency generator
CA/MX — California – Mexico Power Area
CAA — Clean Air Act
CARB — California Air Resources Board
Cal/EPA — California Environmental Protection Agency
CCCT — Combined-cycle combustion turbine
CDF — California Department of Forestry
CDFG — California Department of Fish and Game
CDWR — California Department of Water Resources
CNPS — California Native Plant Society
CO — Carbon monoxide
CO_2 — Carbon dioxide
CPUC — California Public Utilities Commission
CT — Combustion turbine
CVP — Central Valley Project
DG — Distributed generation
DSM — Demand side management
ECPA — Electric Consumers Protection Act
F — Fahrenheit
FERC — Federal Energy Regulatory Commission
FGR — Flue gas recirculation
FPA — Federal Power Act
GPM — Gallons per minute
GSP — Gross state product
GWh — Gigawatt hour
H_2S — Hydrogen sulfide
HCP — Habitat Conservation Plan
HRSG — Heat recovery steam generator
IBEW — International Brotherhood of Electrical Workers
ISO — Independent System Operator
kWh — Kilowatt hour
LADWP — Los Angeles Department of Water and Power
LLC — Limited liability company
MGD — Million gallons per day
MW — Megawatt
MWh — Megawatt hour
NH_3 — Ammonia
NO_2 — Nitrogen dioxide
NOx — Nitrogen oxides
NPDES — National Pollutant Discharge Elimination System
NWPP — Northwest Power Pool Area
O_3 — Ozone
PG&E — Pacific Gas and Electric
$PM_{2.5}$ — Particulate matter less than 2.5 microns
PM_{10} — Particulate matter less than 10 microns
PSI — Pounds per square inch
PURPA — Public Utility Regulatory Policies Act
PV — Photovoltaic
RMPA — Rocky Mountain Power Pool Area
RMR — Reliability Must Run
ROC — Reactive organic compounds
SB 110 — Senate Bill 110
SBE — State Board of Equalization
SCE — Southern California Edison
SCR — Selective catalytic reduction
SDG&E — San Diego Gas and Electric
SFEC — San Francisco Energy Company
SMUD — Sacramento Municipal Utility District
SO_2 — Sulfur Dioxide
SWP — State Water Project
SWRCB — State Water Resources Control Board
TMDL— Total maximum daily loading
TNC — The Nature Conservancy
U.S.EPA — U.S. Environmental Protection Agency
U.S.FWS — U.S. Fish and Wildlife Service
WSCC — Western Systems Coordinating Council

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CALIFORNIA
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Appendix I

Environmental Performance Report

July 2001
P700-01-001

Gray Davis, *Governor*

Verbatim excerpt from (former) SB110

Commencing July 1, 2001, and every two years thereafter, the [Energy] Commission shall submit a report to the Governor and Legislature, developed in consultation with the State Air Resources Board and other appropriate agencies. The report shall contain all of the following:

(1) An assessment of the current status and historic trends in the environmental performance of the electric generation facilities of the state, to include all of the following:

(A) Generation facility efficiency

(B) Air emission control technologies in use in operating plants

(C) The extent to which expected or recent resource additions are likely to displace or reduce the operation of existing facilities, including the environmental consequences of these changes.

(2) An assessment of the geographic distribution of statewide environmental, efficiency, and socioeconomic benefits and drawbacks of existing generation facilities, including, but not limited to the impacts on natural resources including wildlife habitat, air quality, and water resources, and the relationship to demographic factors. The assessment shall describe the socioeconomic and demographic factors that existed when the facilities were constructed and the current status of these factors. In addition, the report shall include how expected or recent resource additions could change the assessment through displacement or reduced operation of existing facilities.

Commencing with the report due on or before July 1, 2003, the [Energy] Commission shall include an assessment of the extent to which the displacement or reduced operation of existing facilities has occurred.

CALIFORNIA
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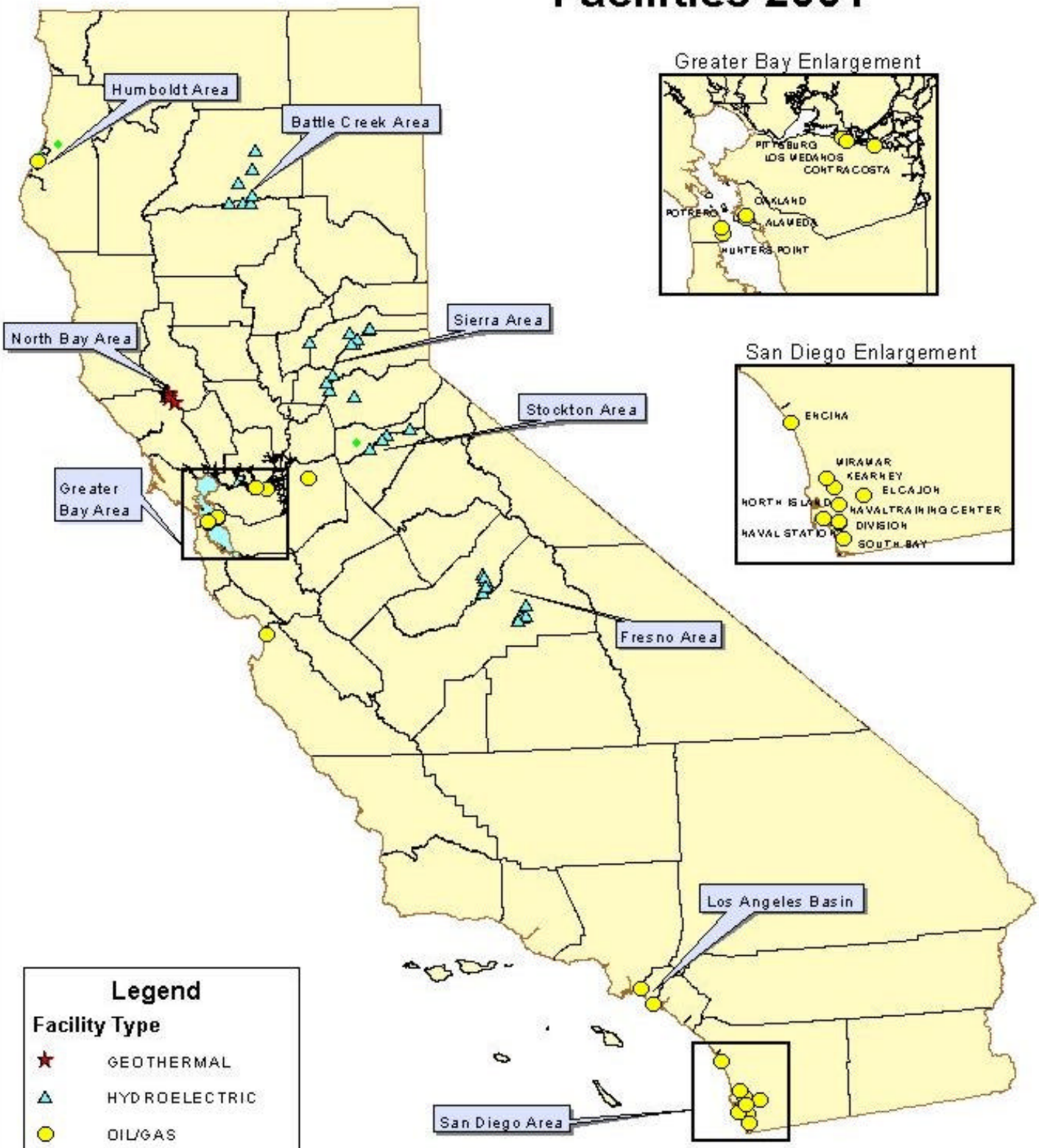
Appendix II

Environmental Performance Report

July 2001
P700-01-001

Gray Davis, *Governor*

Reliability Must Run
Facilities 2001



T:\Projects\CEC\Reliability Must Run\RMR.apr

PLANTNAME (ALIAS)	ID #	FACILITY	GENERAL SOURCE	TECHNOLOGY	ONLINE (MW)	GROSS (MW)	DATE ONLINE	YEAR ONLINE	SERVICE AREA	COUNTY	PLANT ADDRESS
GEOTHERMAL 2 #1-#2	T0040	GEOTHERMAL	GEOTHERMAL - DRY STEAM		120.00	110.00	10/01/1985	1985	PG&E	LAKE	11785 SOCRATES MINE ROAD MIDDLETOWN 95461
CALPINE GEOTHERMAL UNIT 5/6	T0055	GEOTHERMAL	GEOTHERMAL - DRY STEAM	STEAM TURBINE,	106.00	78.00	12/15/1971	1971	PG&E	SONOMA	CLOVERDALE 95425
GEYSERS #7-#8	T0056	GEOTHERMAL	GEOTHERMAL - DRY STEAM	STEAM TURBINE,	106.00	118.80	8/18/1972	1972	PG&E	SONOMA	CLOVERDALE 95425
CALPINE GEOTHERMAL UNIT 11	T0058	GEOTHERMAL	GEOTHERMAL - DRY STEAM	STEAM TURBINE,	106.00	65.00	5/31/1975	1975	PG&E	SONOMA	CLOVERDALE 95425
CALPINE GEOTHERMAL UNIT 12	T0059	GEOTHERMAL	GEOTHERMAL - DRY STEAM	STEAM TURBINE,	106.00	40.00	3/01/1979	1979	PG&E	SONOMA	CLOVERDALE 95425
CALPINE GEOTHERMAL UNIT 14	T0061	GEOTHERMAL	GEOTHERMAL - DRY STEAM	STEAM TURBINE,	109.00	60.00	9/12/1980	1980	PG&E	SONOMA	CLOVERDALE 95425
CALPINE GEOTHERMAL UNIT 17	T0028	GEOTHERMAL	GEOTHERMAL - DRY STEAM	STEAM TURBINE,	113.00	45.00	12/18/1982	1982	PG&E	SONOMA	CLOVERDALE 95425
SALT SPRINGS #1-#2	H0431	HYDROELECTRIC	HYDRO	HYDRO,WATER	44.00	42.00	6/01/1931	1931	PG&E	AMADOR	JACKSON 95642
TIGER CREEK #1-#2	H0516	HYDROELECTRIC	HYDRO	HYDRO,WATER	58.00	52.30	8/01/1931	1931	PG&E	AMADOR	JACKSON 95642
WEST POINT	H0558	HYDROELECTRIC	HYDRO	HYDRO,WATER	14.50	13.60	11/01/1948	1948	PG&E	AMADOR	JACKSON 95642
ELECTRA #1-#7	H0171	HYDROELECTRIC	HYDRO	HYDRO, WATER	92.00	102.50	6/01/1948	1948	PG&E	AMADOR	JACKSON 95642
CHILI BAR	H0096	HYDROELECTRIC	HYDRO	HYDRO, WATER	7.00	7.00	3/01/1965	1965	PG&E	EL DORADO	PLACERVILLE

PLANTNAME (ALIAS)	ID #	FACILITY	GENERAL SOURCE	TECHNOLOGY	ONLINE (MW)	GROSS (MW)	DATE ONLINE	YEAR ONLINE	SERVICE AREA	COUNTY	PLANT ADDRESS
KERCKHOFF 1 #1-#3	H0265	HYDROELECTRIC	HYDRO	HYDRO, WATER	38.00	34.20	8/01/1920	1920	PG&E	FRESNO	AUBERRY 93602
BALCH 1 #1-#7	H0019	HYDROELECTRIC	HYDRO	HYDRO, WATER	34.00	31.00	2/01/1927	1927	PG&E	FRESNO	FRESNO 93725
BALCH 2 #1-#7	H0020	HYDROELECTRIC	HYDRO	HYDRO, WATER	105.00	97.20	11/01/1958	1958	PG&E	FRESNO	FRESNO 93725
HAAS #1-#7	H0215	HYDROELECTRIC	HYDRO	HYDRO, WATER	144.00	135.00	12/01/1958	1958	PG&E	FRESNO	FRESNO 93725
KINGS RIVER	H0272	HYDROELECTRIC	HYDRO	HYDRO WATER	52.00	48.60	3/01/1962	1962	PG&E	FRESNO	FRESNO 93725
KERCKHOFF 2	H0266	HYDROELECTRIC	HYDRO	HYDRO, WATER	155.00	139.50	5/01/1983	1983	PG&E	FRESNO	AUBERRY 93602
HELMS PUMPED STORAGE #1-#7	H0229	HYDROELECTRIC	HYDRO - PUMPED STORAGE	PUMPED STORAGE, WATER	1212.00	1053.00	6/01/1984	1984	PG&E	FRESNO	57800 MCKINLEY GROVE RD SHAVER LAKE 93664
A.G. WISHON #1-#4	H0570	HYDROELECTRIC	HYDRO	HYDRO, WATER	20.00	12.80	9/01/1910	1910	PG&E	MADERA	NORTH FORK 93643
SAN JOAQUIN 2	H0449	HYDROELECTRIC	HYDRO	HYDRO,WATER	3.20	2.90	9/01/1917	1917	PG&E	MADERA	NORTH FORK 93643
SAN JOAQUIN 1A	H0448	HYDROELECTRIC	HYDRO	HYDRO,WATER	0.40	0.40	3/01/1919	1919	PG&E	MADERA	NORTH FORK 93643
CRANE VALLEY	H0120	HYDROELECTRIC	HYDRO	HYDRO, WATER	0.90	1.00	7/01/1919	1919	PG&E	MADERA	WISHON 93669
SAN JOAQUIN 3	H0450	HYDROELECTRIC	HYDRO	HYDRO,WATER	4.20	4.00	7/01/1923	1923	PG&E	MADERA	NORTH FORK 93643
DEER CREEK	H0133	HYDROELECTRIC	HYDRO	HYDRO, WATER	5.70	5.50	5/01/1908	1908	PG&E	NEVADA	NEVADA CITY 95959
SPAULDING 1	H0490	HYDROELECTRIC	HYDRO	HYDRO,WATER	7.00	7.00	5/01/1928	1928	PG&E	NEVADA	EMIGRANT GAP 95715
SPAULDING 2	H0491	HYDROELECTRIC	HYDRO	HYDRO,WATER	4.40	3.70	7/01/1928	1928	PG&E	NEVADA	EMIGRANT GAP 95715

PLANTNAME (ALIAS)	ID #	FACILITY	GENERAL SOURCE	TECHNOLOGY	ONLINE (MW)	GROSS (MW)	DATE ONLINE	YEAR ONLINE	SERVICE AREA	COUNTY	PLANT ADDRESS
SPAULDING 3	H0492	HYDROELECTRIC	HYDRO	HYDRO,WATER	5.80	6.60	1/01/1929	1929	PG&E	NEVADA	EMIGRANT GAP 95715
NARROWS	H0348	HYDROELECTRIC	HYDRO	HYDRO, WATER	12.00	10.20	12/01/1943	1943	PG&E	NEVADA	OFF MOONE FLAT ROAD SMARTVILLE 95977
ALTA #1-#2	H0005	HYDROELECTRIC	HYDRO	HYDRO, WATER	2.00	2.00	11/01/1902	1902	PG&E	PLACER	ALTA 95701
DRUM 1 #1-#4	H0154	HYDROELECTRIC	HYDRO	HYDRO, WATER	54.00	49.20	11/01/1913	1913	PG&E	PLACER	ALTA 95701
HALSEY #1-#7	H0217	HYDROELECTRIC	HYDRO	HYDRO, WATER	11.00	13.60	12/01/1916	1916	PG&E	PLACER	AUBURN 95603
WISE #1-#2	H0569	HYDROELECTRIC	HYDRO	HYDRO,WATER	17.10	16.50	3/01/1917	1917	PG&E	PLACER	AUBURN 95603
DUTCH FLAT 1	H0156	HYDROELECTRIC	HYDRO		22.00	22.00	3/01/1943	1943	PG&E	PLACER	DUTCH FLAT 95714
DRUM 2 #5	H0155	HYDROELECTRIC	HYDRO	HYDRO, WATER	49.50	53.10	12/01/1966	1966	PG&E	PLACER	ALTA 95701
NEWCASTLE	H0357	HYDROELECTRIC	HYDRO	HYDRO, WATER	11.50	12.70	10/01/1986	1986	PG&E	PLACER	AUBURN 95603
KILARC #1-#2	H0271	HYDROELECTRIC	HYDRO	HYDRO WATER	3.20	3.00	10/01/1903	1903	PG&E	SHASTA	WHITMORE 96096
COW CREEK #1-#2	H0118	HYDROELECTRIC	HYDRO	HYDRO, WATER	1.80	1.40	8/01/1907	1907	PG&E	SHASTA	MILLVILLE 96062
VOLTA 1	H0545	HYDROELECTRIC	HYDRO	HYDRO,WATER	9.00	8.60	4/01/1980	1980	PG&E	SHASTA	MANTONWISHOR ROAD MANTON 96059
VOLTA 2	H0546	HYDROELECTRIC	HYDRO	HYDRO,WATER	0.90	1.00	10/01/1981	1981	PG&E	SHASTA	MANTONWISHOR ROAD MANTON 96059

PLANTNAME (ALIAS)	ID #	FACILITY	GENERAL SOURCE	TECHNOLOGY	ONLINE (MW)	GROSS (MW)	DATE ONLINE	YEAR ONLINE	SERVICE AREA	COUNTY	PLANT ADDRESS
EL DORADO HYDRO (MONTGOMERY CREEK	H0168	HYDROELECTRIC	HYDRO		2.60	3.40	2/28/1987	1987	PG&E	SHASTA	ROUTE 299 NORTH MONTGOMERY CREEK
INSKIP	H0244	HYDROELECTRIC	HYDRO	HYDRO, WATER	8.00	7.70	10/01/1979	1979	PG&E	TEHAMA	PAYNES CREEK 96075
SOUTH	H0486	HYDROELECTRIC	HYDRO	HYDRO,WATER	7.00	6.80	12/01/1979	1979	PG&E	TEHAMA	MANTON 96059
COLEMAN	H0106	HYDROELECTRIC	HYDRO	HYDRO, WATER	13.00	12.20	6/01/1979	1979	PG&E	TEHAMA	COTTONWOOD 96022
OAKLAND POWER PLANT #1-#3	G0406	OIL/GAS	OIL/GAS - DISTILLATE OIL	GAS COMBUSTION TURBINE	165.00	201.30	11/01/1978	1978	PG&E	ALAMEDA	50 GROVE STREET OAKLAND 94604
ALAMEDA #1-#2	G0379	OIL/GAS	OIL/GAS - NATURAL GAS	COMBUSTION TURBINE	51.65	50.40	5/01/1986	1986	PG&E	ALAMEDA	2900 MAIN STREET ALAMEDA 94501
CONTRA COSTA #6-#7 (#1-#5 RETIRED)	G0147	OIL/GAS	OIL/GAS - NATURAL GAS	STEAM TURBINE	680.00	718.00	6/01/1951	1951	PG&E	CONTRA COSTA	3201 WILBUR AVENUE ANTIOCH 94509
PITTSBURG #1-#7 (#1-#4 NON-OPERATIONAL)	G0450	OIL/GAS	OIL/GAS - NATURAL GAS	STEAM TURBINE	2022.00	2028.70	7/01/1954	1954	PG&E	CONTRA COSTA	696 W 10TH STREET PITTSBURG 94565
HUMBOLDT BAY ST1-ST2, MOBILE 2-3	G0268	OIL/GAS	OIL/GAS - NATURAL, DISTILLATE	COMBUSTION TURBINE, STEAM TURBINE	105.00	102.40	12/01/1956	1956	PG&E	HUMBOLDT	BUHNE POINT, 1000 KING SALMON AVE. EUREKA 95503
ALAMITOS GENERATING STAT #1-#7	G0011	OIL/GAS	OIL/GAS - NATURAL, DISTILLATE	STEAM TURBINE, GAS TURBINE	2088.00	2120.53	9/01/1956	1956	SCE	LOS ANGELES	690 NORTH STUDEBAKER ROAD LONG BEACH 90803

PLANTNAME (ALIAS)	ID #	FACILITY	GENERAL SOURCE	TECHNOLOGY	ONLINE (MW)	GROSS (MW)	DATE ONLINE	YEAR ONLINE	SERVICE AREA	COUNTY	PLANT ADDRESS
MOSS LANDING #6-#7 (#1-#5 RETIRED)	G0372	OIL/GAS	OIL/GAS - NATURAL GAS	STEAM TURBINE COMBINED CYCLE	1090.00	1506.00	4/01/1950	1950	PG&E	MONTEREY	HWY 1 & DOLAN ROAD MOSS LANDING 95039-0027
HUNTINGTON BEACH #1-#5	G0274	OIL/GAS	OIL/GAS - NATURAL, DISTILLATE	STEAM TURBINE, COMBUSTION TURBINE	563.00	1008.53	6/01/1958	1958	SCE	ORANGE	21730 NEWLAND STREET HUNTINGTON BEACH 92646
ENCINA POWER PLANT ST1-ST5, GT1	G0196	OIL/GAS	OIL/GAS - NATURAL GAS	STEAM TURBINES & GAS TURBINE	965.00	1000.50	11/01/1954	1954	SDG&E	SAN DIEGO	4600 CARSBAD BLVD CARLSBAD 92008
SOUTH BAY ST1-ST4, GT1	G0571	OIL/GAS	OIL/GAS - NATURAL GAS	STEAM TURBINE, NATURAL GAS	693.00	732.50	7/01/1960	1960	SDG&E	SAN DIEGO	990 BAY BLVD. CHULA VISTA 91911
DIVISION	G0175	OIL/GAS	OIL/GAS - DISTILLATE OIL	COMBUSTION TURBINE	17.50	18.00	11/01/1968	1968	SDG&E	SAN DIEGO	HARBOR DR & VESTA SAN DIEGO 92113
EL CAJON	G0189	OIL/GAS	OIL/GAS - DISTILLATE OIL	COMBUSTION TURBINE	18.00	18.00	11/01/1968	1968	SDG&E	SAN DIEGO	800 WEST MAIN STREET EL CAJON 92020
KEARNEY CT1-CT3	G0289	OIL/GAS	OIL/GAS - NATURAL GAS	COMBUSTION TURBINE	162.50	164.70	12/01/1969	1969	SDG&E	SAN DIEGO	5488 OVERLAND AVE SAN DIEGO 92123
MIRAMAR	G0360	OIL/GAS	OIL/GAS - NATURAL GAS	COMBUSTION TURBINE	43.10	47.20	5/01/1972	1972	SDG&E	SAN DIEGO	6897 CONSOLIDATED WAY SAN DIEGO 92121

PLANTNAME (ALIAS)	ID #	FACILITY	GENERAL SOURCE	TECHNOLOGY	ONLINE (MW)	GROSS (MW)	DATE ONLINE	YEAR ONLINE	SERVICE AREA	COUNTY	PLANT ADDRESS
NORTH ISLAND CT1-CT2	G0398	OIL/GAS	OIL/GAS - NATURAL GAS	COMBUSTION TURBINE WITH WASTE HEAT	41.00	52.20	6/01/1972	1972	SDG&E	SAN DIEGO	END OF HWY 282, WEST OF ORANGE AVE, ROGERS ROAD AT QUAY STREET CORONADO 92135
NAVAL STATION	G0389	OIL/GAS	OIL/GAS - NATURAL GAS (COGEN)	COMBUSTION TURBINE WITH WASTE HEAT	26.00	28.30	9/01/1976	1976	SDG&E	SAN DIEGO	VESTA STREET SAN DIEGO 92136
NAVAL STATION / NAVALTRAINING CENTER	G0626	OIL/GAS	OIL/GAS - NATURAL GAS (COGEN)	COMBINED CYCLE	49.90	46.30	7/12/1989	1989	SDG&E	SAN DIEGO	213 WARD ROAD SAN DIEGO 92136
HUNTERS POINT GT1, ST2-ST4	G0272	OIL/GAS	OIL/GAS - NATURAL, DISTILLATE	GAS COMBUSTION TURBINE,STEAM TURBINE	429.00	427.80	12/01/1948	1948	PG&E	SAN FRANCISCO	1000 EVANS AVENUE SAN FRANCISCO 94124
LODI	G0380	OIL/GAS	OIL/GAS - NATURAL GAS	COMBUSTION TURBINE	26.45	25.20	2/01/1986	1986	PG&E	SAN JOAQUIN	1120 NORTH LOWER SACRAMENTO RIVER LODI
WHEELABRATOR MARTELL INC.	E0051	WTE	BIOMASS - WOODWASTE (COGEN)	GRATE BOILER	18.00	18.00	3/13/1986	1986	PG&E	AMADOR	HWY 49 & RIDGE ROAD MARTELL 95654
HUMBOLDT PULP MILL	E0088	WTE	BIOMASS - WOODWASTE, HOG FUEL, (COGEN)		27.90	27.90	8/23/1982	1982	PG&E	HUMBOLDT	1900 BENDIXSEN ROAD FAIRHAVEN 95501
ULTRAPOWER (BLUE LAKE)	E0097	WTE	BIOMASS - WOODWASTE	GRATE BOILER	11.40	12.00	7/03/1985	1985	PG&E	HUMBOLDT	200 TAYLOR WAY BLUE LAKE 95525

LIST OF RECENTLY APPROVED AND PROPOSED POWER PLANTS

as of June 6, 2001

	Projects Approved Over 300 MW	Status	Capacity (MW)	Project Type	Location	Decision Date	On-line Date*
1	Sutter	Construction	500	Green Field	Sutter Co.	4/99	7/01
2	Los Medanos	Construction	559	Brown Field	Contra Costa	8/99	7/01
3	Sunrise	Construction	320	Green Field	Kern Co.	12/00	8/01
4	Huntington Beach	Construction	450	Repower	Orange Co.	5/01	8/01
	On Line by Summer 01		1,829				
5	La Paloma	Construction	1,048	Green Field	Kern Co.	10/99	12/01-3/02
6	Delta	Construction	880	Brown Field	Contra Costa	2/00	4/02
7	Moss Landing	Construction	1,060	Expansion	Monterey Co.	10/00	6/02
	On Line by Summer 02		2,988				
8	High Desert	Construction	720	Brown Field	San Bernardino	5/00	7/03
9	Elk Hills	Construction	500	Brown Field	Kern Co.	12/00	3/03
10	Blythe	Construction	520	Green Field	Riverside Co.	3/01	3/03
	Construction Subtotal		6,557				
11	Pastoria	Financing	750	Green Field	Kern Co.	12/00	1/03
12	Midway-Sunset	Financing	500	Expansion	Kern Co.	3/01	3/03
13	Mountainview	Financing	1,056	Expansion	San Bernardino	3/01	12/02
14	Otay Mesa	Financing	510	Green Field	San Diego Co.	4/01	4/03
15	Three Mountain	Financing	500	Brown Field	Shasta Co.	5/01	5/03
16	Contra Costa	Financing	530	Expansion	Contra Costa	7/01	7/03
	Subtotal		10,403				
	Projects Approved Under 300 MW						
1	*Wildflower Larkspur*	*Construction*	*90*	*Green Field*	*San Diego Co.*	*4/4/01*	*7/01*
2	*Wildflower Indigo*	*Construction*	*135*	*Green Field*	*Riverside Co.*	*4/4/01*	*7/01*
3	*Alliance Century*	*Construction*	*40*	*Brown Field*	*San Bernardino*	*4/25/01*	*8/01*
4	*Alliance Drews*	*Construction*	*40*	*Brown Field*	*San Bernardino*	*4/25/01*	*8/01*
5	*GWF Hanford*	*Construction*	*95*	*Brown Field*	*Kings Co.*	*5/10/01*	*8/01*
6	*Calpine Gilroy Phase I*	*Construction*	*135*	*Brown Field*	*Santa Clara Co.*	*5/21/01*	*9/01*
	Construction Total		535				
7	*Calpine King City*	*Financing*	*50*	*Brown Field*	*Monterey Co.*	*5/2/01*	*9/01*
8	*Pegasus Energy*	*Financing*	*180*	*Brown Field*	*San Bernardino Co.*	*6/6/01*	*9/01*
9	*Calpeak Escondido*	*Financing*	*49*	*Brown Field*	*San Diego Co.*	*6/6/01*	*9/01*
10	United Golden Gate	No site control	[51]	Brown Field	San Mateo Co.	3/7/01	
11	Hanford SPPE	Modified	[99]	Green Field	Kings Co.	4/11/01	Modified
	Subtotal		814				
	Approved Total		11,217				

	Projects in Review Over 300 MW	Process	Capacity (MW)	Project Type	Location	Decision Date	On-line Date*
1	Metcalf	12-mo. AFC	600	Green Field	Santa Clara Co.	7/01	7/03
2	Potrero	12-mo. AFC	540	Expansion	San Francisco	11/01	11/03
3	Golden Gate	6-mo AFC	570	Brown Field	San Mateo Co.	1/02	11/03
4	Morro Bay 1/	12-mo. AFC	1,200	Replacement	San Luis Obispo	1/02	1/04
5	Magnolia	6-mo. AFC	310	Expansion	Los Angeles Co.	1/02	11/03
6	ElSegundo Repower 2/	12-mo. AFC	630	Replacement	Los Angeles Co.	2/02	2/04
7	Rio Linda/Elverta	12-mo. AFC	560	Green Field	Sacramento Co.	5/02	5/04
8	East Altamont	12-mo. AFC	1,100	Green Field	Alameda Co.	3/02	5/04
9	Nueva Azalea	12-mo. AFC	[550]	Brown Field	Los Angeles Co.	suspended	suspended
10	Russell City	6-mo. AFC	600	Brown Field	Hayward	5/01	12/03
11	Ocotillo Peaker	4-mo. AFC	450	Green Field	Riverside Co.	5/01	6/02
	Subtotal		6,560				
	Projects in Review Under 300 MW	**Process**	**Capacity (MW)**	**Project Type**	**Location**	**Decision Date**	**On-line Date***
1	*Ramco Chula Vista*	*Emergency*	*62*	*Brown Field*	*San Diego Co.*	*6/01*	*9/01*
2	*Baldwin Hills Unit 1*	*Emergency*	*53*	*Brown Field*	*Los Angeles Co.*	*6/01*	*9/01*
3	*Lancaster La Jolla*	*Emergency*	*240*	*Brown Field*	*Los Angeles Co.*	*6/01*	*9/01*
4	*Evergreen Concord*	*Emergency*	*50*	*Green Field*	*Contra Costa*	*6/01*	*9/01*
	On Line by Summer 01		*405*				
5	Valero Cogeneration	4-mo. AFC	102	Brown Field	Solano Co.	9/01	4/02
	On Line by Summer 02		102				
6	Woodland II	SPPE	80	Brown Field	Stanislaus Co	9/01	10/03
7	Pastoria II	6-mo. AFC	250	Green Field	Kern Co.	1/02	4/04

LIST OF RECENTLY APPROVED AND PROPOSED POWER PLANTS

as of June 6, 2001

	Subtotal		837				
	Review Total		7,397				
	Projects Announced Over 300 MW	**Process**	**Capacity (MW)**	**Project Type**	**Location**	**Filing Date**	**On-line Date***
1	Blythe Peaker	4-mo. AFC	320	Green Field	Riverside Co.	6/01	5/02
2	Reliant Etiwanda Peaker	6-mo. AFC	400	Brown Field	San Bernardino	6/01	5/02
	Total by 9/02		720				
3	Colusa Comb. Cycle	12-mo. AFC	600	Green Field	Colusa County	6/01	7/04
4	Salton Sea Geo.	6-mo. AFC	300	Green Field	Imperial Co.	6/01	12/03
5	Sempra Escondido	6-mo. AFC	500	Green Field	San Diego Co.	7/01	8/04
6	Roseville	12-mo. AFC	750	Green Field	Placer Co.	8/01	8/04
7	Antelope Valley	12-mo. AFC	1,000	Green Field	Kern Co.	8/01	10/04
8	SMUD Comb. Cycle	12-mo. AFC	1,000	Green Field	Sacramento Co.	8/01	10/04
9	South City	12-mo. AFC	550	Green Field	San Mateo Co.	?	
10	Long Beach	12-mo. AFC	500	Green Field	Los Angeles Co.	?	
11	Redondo Beach	12-mo. AFC	1,000	Replacement	Los Angeles Co.	?	
	Subtotal		6,920				
	Projects Announced Under 300 MW						
1	*Chino Organic Power*	*Emergency*	*160*	*Brown Field*	*San Bernardino Co*	*6/01*	*9/01*
2	*Calpeak Border*	*Emergency*	*49*	*Green Field*	*San Diego Co.*	*6/01*	*9/01*
	On Line by Summer 01		*209*				
3	Padre Dam La Jolla	4-mo. AFC	50	Brown Field	Los Angeles Co.	6/01	2/02
4	Kern Co. Restart	3-mo. AFC	160	Repower	Kern Co.	6/01	2/02
5	Calpine Gilroy Phase II	4-mo. AFC	135	Expansion	Santa Clara Co.	6/01	3/02
6	Lancaster Hanover	4-mo. AFC	86	Brown Field	Los Angeles Co.	6/01	3/02
7	City of Santee La Jolla	4-mo. AFC	50	Brown Field	Los Angeles Co.	6/01	3/02
8	Kimberly Clark La Jolla	4-mo. AFC	50	Brown Field	Los Angeles Co.	6/01	3/02
9	Calpine US Dataport	4-mo. AFC	180	Brown Field	Santa Clara Co.	6/01	4/02
10	Spartan Peaker	4-mo. AFC	96	Brown Field	Santa Clara	7/01	5/02
11	City of Vernon	4-mo. AFC	120	Brown Field	Los Angeles Co.	7/01	5/02
12	Carson Expansion	4-mo. AFC	85	Expansion	Los Angeles Co.	7/01	8/02
	On Line by Summer 02		1,012				
13	Ocotillo Comb. Cycle	amendment	260	Expansion	Riverside Co.	11/01	12/02
14	Spartan Comb. Cycle	amendment	28	Expansion	Santa Clara	11/01	12/02
15	Sunrise Comb. Cycle	amendment	260	Expansion	Kern Co.	5/01	6/03
16	Blythe Peaker	amendment	200	Expansion	Riverside Co.	11/01	12/02
17	Calpine US Dataport	amendment	70	Brown Field	Santa Clara Co.	11/01	12/02
	Subtotal		2,039				
	Announced Total		8,959				

Notes:

* Estimated on-line date if approved and constructed

Projects in italics are emergency siting projects.

Megawatts in [ ] are not included in totals.

/1 750 MW will be replaced with 1200 MW for a net increase of 450 MW

/2 350 MW will be replaced with 630 MW for a net increase of 280 MW

Approved	
In Review	
Expected and disclosed	

Greenfield - undeveloped site

Brownfield - developed site

Expansion - New unit at existing power plant site, no loss of existing generation

Repower - Modification of existing equipment

Replacement - Demolition of old plant and construction of new plant

Detailed Discussion on System Efficiency

For a given level of demand, the overall average system efficiency can be improved by adding more generation resources that do not consume fuel or sources that consume fuels more efficiently than the average. Some efficient new natural gas-fired power plants are expected to come on-line over the next few years. These plants use efficient new aero-derivative gas turbines to generate electricity directly and also capture some of the heat energy of the exhaust to power a steam cycle that generates more electricity. As shown in Figure III-1, these so-called combined cycle power plants have average heat rates of about 7,000 btu / kWh. Figure III-1 also shows the effect of adding about 10,000 MW of new generation, mostly new combined cycle plants, to the Western System resource mix. The average heat rate of existing and new gas-fired generation could drop to about 8,500 btu / kWh, with corresponding savings in fuel and reductions in power plant emissions. These additions of combined cycle power plants, plus a few hundred megawatts of added wind and geothermal power plants, could reduce the overall average system heat rate to about 8,100 btu / kWh by 2004.

Generally, overall system efficiency is better at lower levels of demand and worse at higher levels. This occurs because generating resources are “economically dispatched” to meet increasing loads, that is, the least expensive (and usually most efficient) resources are turned on before the more expensive (and usually most inefficient). At times when the demand for electricity is at a peak, typically during hot summer afternoons, most resources will be helping to serve the load. The least efficient of the plants serving load could have a heat rate as high as 22,000 btu / kWh, but these plants would be used very few hours of the year.

Figure III-2 shows the marginal heat rate (heat rate of the last unit needed to be dispatched to serve load that hour) for each hour of a typical year for groups of California power plants. The most inefficient units are used for relatively few hours of the year (note the spike at the left end of the graph, corresponding to summer afternoon hours). For most of the hours of the year, the system marginal heat rate fluctuates within a fairly narrow range (note the broad, relatively flat part of the curve) and many power plants of fairly similar heat rates are dispatched to meet fairly moderate demand levels.

On Line Electric Generation Capacity by County						
County	On Line Capacity (in MW)	Square Miles	Statewide Percent of On Line Capacity	Generation Capacity per Square Mile	On Line Capacity Ranking	Generation Ranking per Square Mile
Alameda	566.3	821.3	1%	0.69	22	9
Alpine	0.0	743.2	0%	0.00	53	38
Amador	285.8	604.3	1%	0.47	32	16
Butte	1,179.2	1,677.2	2%	0.70	12	8
Calaveras	522.7	1,036.9	1%	0.50	23	15
Colusa	26.7	1,156.3	<1%	0.02	50	35
Contra Costa	3,680.3	802.2	7%	4.59	3	1
Del Notre	0.0	1,229.8	0%	0.00	53	38
El Dorado	711.5	1,791.3	1%	0.40	16	17
Fresno	2,842.9	6,017.9	5%	0.47	6	16
Glenn	5.5	1,327.2	<1%	0.00	52	37
Humboldt	182.4	4,052.5	<1%	0.05	34	32
Imperial	861.4	4,482.1	2%	0.19	14	25
Inyo	313.6	10,227.7	1%	0.03	31	34
Kern	2,677.2	8,162.0	5%	0.33	7	20
Kings	28.2	1,391.6	<1%	0.02	49	35
Lake	761.8	1,329.6	1%	0.57	15	13
Lassen	94.7	4,720.6	<1%	0.02	40	35
Los Angeles	12,414.1	4,752.3	23%	2.61	1	2
Madera	356.2	2,153.4	1%	0.17	28	26
Marin	0.0	828.2	0%	0.00	53	38
Mariposa	102.5	1,462.9	<1%	0.07	39	30
Mendocino	28.8	3,878.5	<1%	0.01	48	36
Merced	451.8	1,972.0	1%	0.23	25	23
Modoc	0.0	4,203.6	0%	0.00	53	38
Mono	137.5	3,131.9	<1%	0.04	37	33
Monterey	1,336.1	3,771.1	3%	0.35	10	18
Napa	17.7	788.3	<1%	0.02	51	35
Nevada	124.1	974.5	<1%	0.13	38	28
Orange	691.6	947.9	1%	0.73	17	7
Placer	510.0	1,500.2	1%	0.34	24	19
Plumas	675.4	2,613.7	1%	0.26	18	21
Riverside	575.0	7,303.8	1%	0.08	21	29
Sacramento	663.5	995.7	1%	0.67	19	10
San Benito	0.0	1,390.8	0%	0.00	53	38
San Bernardino	3,020.2	20,106.4	6%	0.15	5	27
San Diego	4,411.0	4,525.9	8%	0.97	2	5
San Francisco	430.5	231.9	1%	1.86	26	3
San Joaquin	576.3	1,426.4	1%	0.40	20	17
San Luis Obispo	3,168.1	3,615.7	6%	0.88	4	6
San Mateo	38.0	741.1	<1%	0.05	45	32
Santa Barbara	185.2	3,789.6	<1%	0.05	33	32
Santa Clara	334.1	1,304.5	1%	0.26	29	21

On Line Electric Generation Capacity by County						
County	On Line Capacity (in MW)	Square Miles	Statewide Percent of On Line Capacity	Generation Capacity per Square Mile	On Line Capacity Ranking	Generation Ranking per Square Mile
Santa Cruz	33.8	607.7	<1%	0.06	46	31
Shasta	2,196.0	3,847.6	4%	0.57	8	13
Sierra	32.0	962.0	<1%	0.03	47	34
Siskiyou	81.9	6,347.8	<1%	0.01	41	36
Solano	69.8	906.9	<1%	0.08	42	29
Sonoma	1,130.2	1,768.3	2%	0.64	13	11
Stanislaus	322.2	1,514.8	1%	0.21	30	24
Sutter	148.5	608.9	<1%	0.24	36	22
Tehama	38.8	2,962.3	<1%	0.01	44	36
Trinity	156.0	3,207.8	<1%	0.05	35	32
Tulare	42.2	4,839.4	<1%	0.01	43	36
Tuolumne	1,217.4	2,274.5	2%	0.54	11	14
Ventura	2,155.8	2,208.4	4%	0.98	9	4
Yolo	32.0	1,022.9	<1%	0.03	47	34
Yuba	377.2	643.6	1%	0.59	27	12

As of June 2001

25 Largest In-State Electric Generating Facilities				
Plant Name	**On-Line (MW)**	**County**	**Facility**	**Owner**
Diablo Canyon - Units 1&2	2160	San Luis Obispo	Nuclear	PG&E
San Onofre - Units 2&3 (Unit 1 Retired)	2150	San Diego	Nuclear	Ownership divided among : SCE(75%), SDG&E(20%), Anaheim(3.2%), Riverside(1.8%)
Alamitos Generating Station - Units 1-7	2088	Los Angeles	Oil/Gas	AES Corp. c/o Williams
Pittsburg - Units 1-7 (Units 1-4 Non-Operational)	2022	Contra Costa	Oil/Gas	Southern Energy Delta LLC
Haynes - Units 1-6	1570	Los Angeles	Oil/Gas	Los Angeles Dept. of Water and Power
Ormond Beach - Units 1&2	1500	Ventura	Oil/Gas	Reliant Energy
Castaic - Units 1-7	1495	Los Angeles	Hydroelectric	Los Angeles Dept. of Water and Power
Redondo Beach Generating Station Units 1-8 (Units 1-4 Non-Operational)	1310	Los Angeles	Oil/Gas	AES Corp.
Helms Pumped Storage - Units 1-7	1212	Fresno	Hydroelectric	PG&E
Moss Landing - Units 6-7 (Units 1-5 Retired)	1090	Monterey	Oil/Gas	Duke Energy
El Segundo - Units 1-4	1020	Los Angeles	Oil/Gas	NRG/DESTEC
Morro Bay - Units 1-4 (Units 1&2 Non-Operational)	1002	San Luis Obispo	Oil/Gas	Duke Energy
Encina Power Plant - St1-St5, Gt1	965	San Diego	Oil/Gas	Dynergy Power And NRG Energy, INC.
Etiwanda - Units 1-5	911	San Bernardino	Oil/Gas	Reliant Energy
Scattergood - Units 1-3	803	Los Angeles	Oil/Gas	Los Angeles Dept. of Water and Power
Edward C Hyatt - Units 1-6	780.9	Butte	Hydroelectric	California Dept. of Water Resources
South Bay - St1-St4, Gt1	693	San Diego	Oil/Gas	Dynergy Power And NRG Energy, INC.
Contra Costa - Units 6-7 (Units 1-5 Retired)	680	Contra Costa	Oil/Gas	Southern Energy Delta LLC
Coolwater - Units 1-4	628	San Bernardino	Oil/Gas	Reliant Energy
Shasta - S1&S2, Units 1-5	611.4	Shasta	Hydroelectric	U.S. Bureau of Reclamation
Huntington Beach - Units 1-5	563	Orange	Oil/Gas	AES Corp.
Long Beach - Units 1-9	530	Los Angeles	Oil/Gas	NRG/DESTEC
Valley - Units 1-4	517	Los Angeles	Oil/Gas	Los Angeles Dept. of Water and Power
Mandalay - Units 1-3	435	Ventura	Oil/Gas	Reliant Energy
Hunters Point - Gt1, St2-St4	429	San Francisco	Oil/Gas	PG&E
Total MW	27,165.3 :al installed generating capacity of 53,204)			

California's Operating Electric Generation Facilities by Age and Type

Age	Total MW (No. of facilities)	By Type							
		Coal (15)	Geothermal (47)	Hydroelectric (386)	Oil/Gas (333)	Nuclear (2)	Solar (14)	Wind (97)	WTE (103)
More than 90yrs old (1893-1909)	106 (25)			106 (25)					
81-90yrs old (1910-1919)	398 (19)			398 (19)					
71-80yrs old (1920-1929)	899 (31)			899 (31)					
61-70yrs old (1930-1939)	165 (5)			135 (4)	30 (1)				
51-60yrs old (1940-1949)	3,582 (20)			1,250 (15)	2,332 (5)				
41-50yrs old (1950-1959)	14,106 (39)			1,310 (22)	12,795 (17)				
31-40yrs old (1960-1969)	9,818 (54)			4,520 (42)	3,147 (11)	2,150 (1)			
21-30yrs old (1970-1979)	6,137 (37)	17 (1)	530 (5)	2,535 (14)	3,055 (17)				
11-20yrs old (1980-1989)	13,900 (597)	314 (8)	1,933 (35)	2,297(189)	4,617(201)	2,160 (1)	330 (9)	1,414 (80)	831 (74)
Less than 10yrs old (1990-present)	3,905 (170)	228 (6)	162 (7)	663 (25)	2,233 (81)		81 (5)	299 (17)	239 (29)
Total MW	53,020 (997)	560 (15)	2,626(47)	14,116(386)	28,213(333)	4,310 (2)	412(14)	1,713 (97)	1,070(103)

WTE means Waste to Energy facilities, including biomass (forest and agricultural waste), landfill gas and digester gas facilities.

CALIFORNIA POWER PLANTS STATEWIDE

Online Dates Prior to 1970

Power Plants Shown Are Operating Only
100 KW (1 MW and Above)

GOVERNOR GRAY DAVIS
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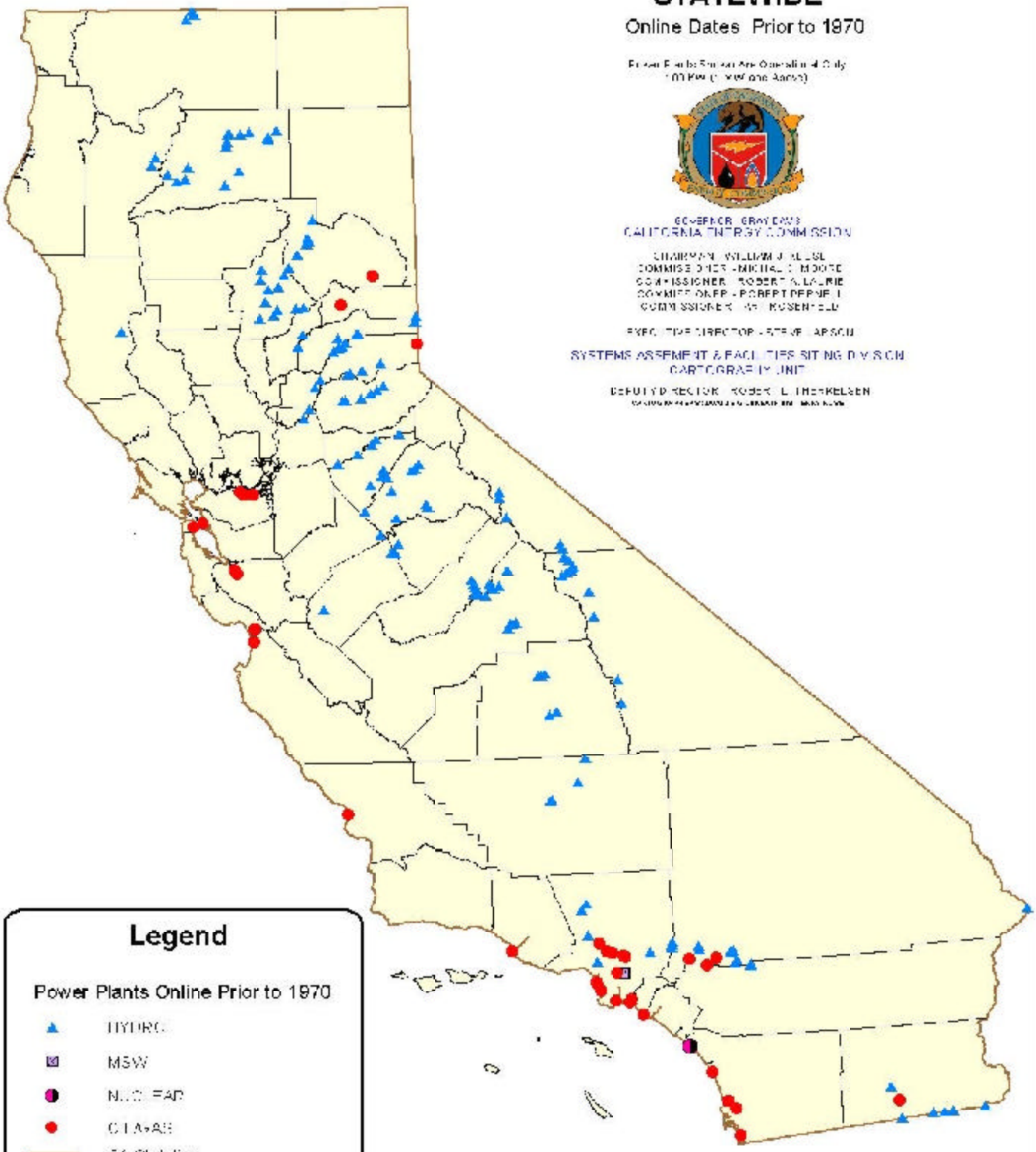
CHAIRWOMAN WILLIAM J. KEESE
COMMISSIONER MICHAEL L. MOORE
COMMISSIONER ROBERT A. LAURIE
COMMISSIONER ROBERT PERNELL
COMMISSIONER JAMES BOSENFELD

EXECUTIVE DIRECTOR ROBERT L. ANDERSON

SYSTEMS ASSESSMENT & FACILITIES SITING DIVISION
CARTOGRAPHY UNIT

DEPUTY DIRECTOR ROBERT L. THERKELSEN



CALIFORNIA POWER PLANTS STATEWIDE

Online Dates After 1970 to Current

Power Plants Shown Are Operating Only
(10 MW or more Above)

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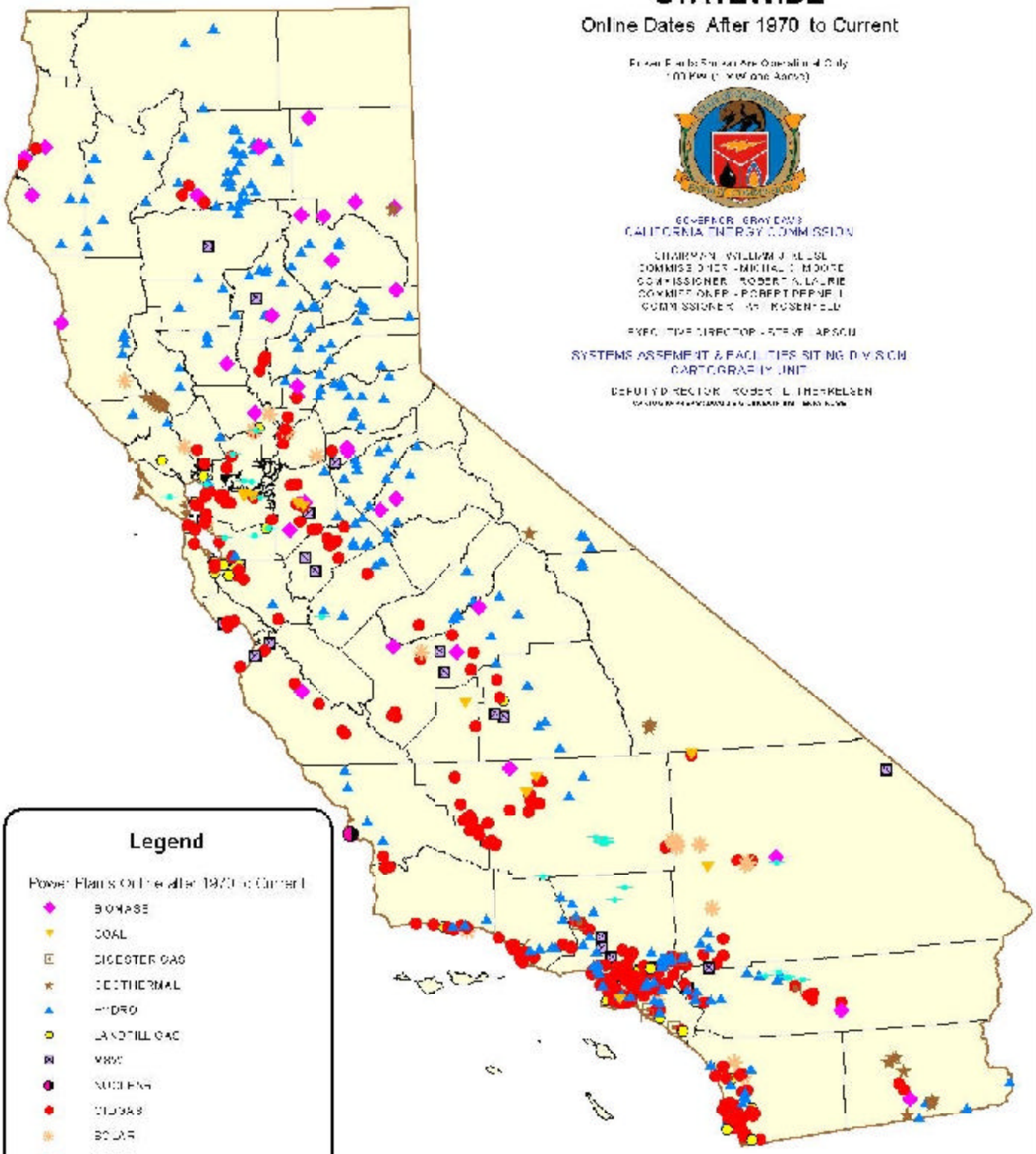
EXECUTIVE DIRECTOR STEVE LARSON

SYSTEMS ASSESSMENT & FACILITIES SITING DIVISION
CARTOGRAPHY UNIT

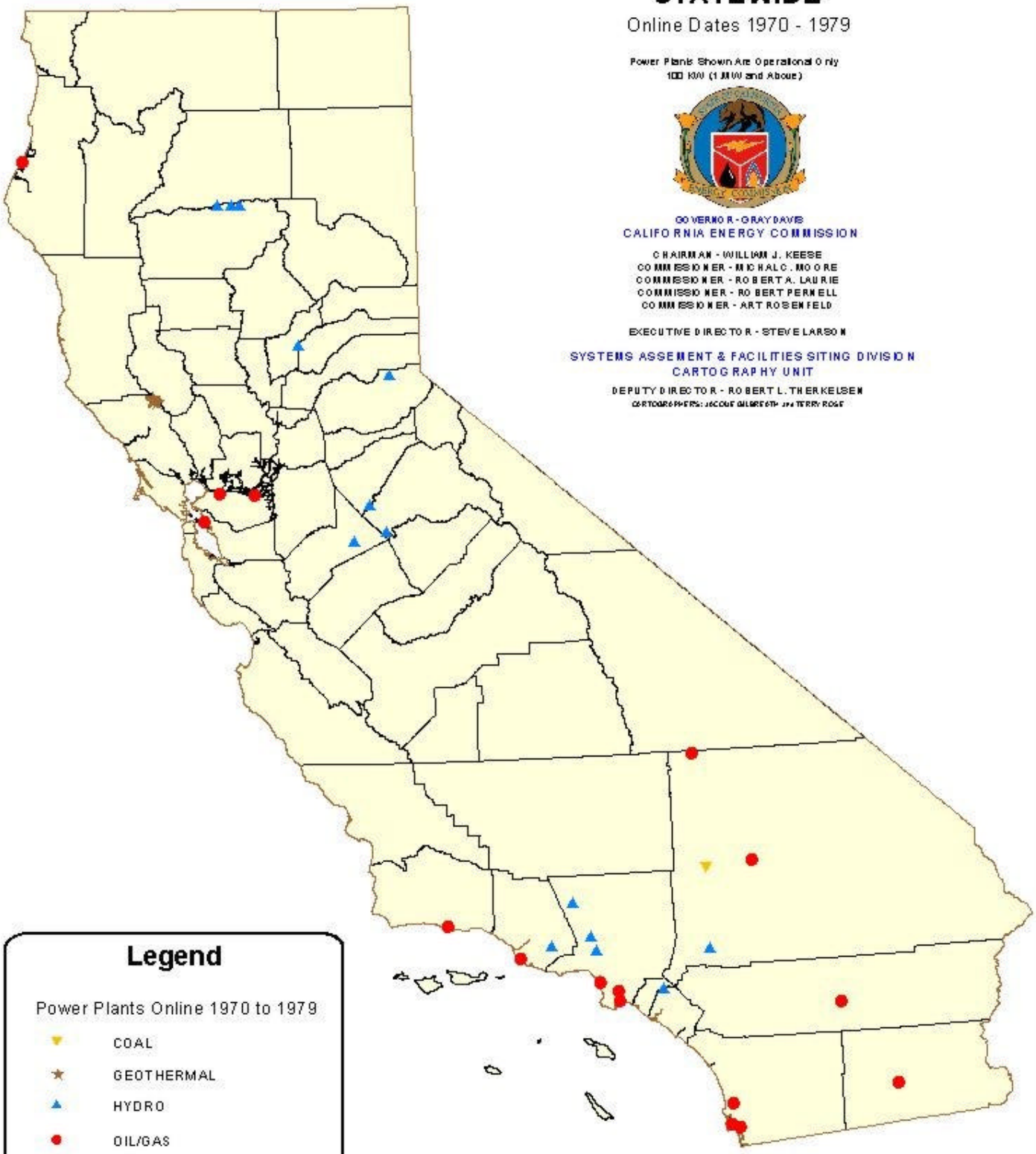
DEPUTY DIRECTOR ROBERT L. THERKELSEN



CALIFORNIA POWER PLANTS STATEWIDE

Online Dates 1970 - 1979

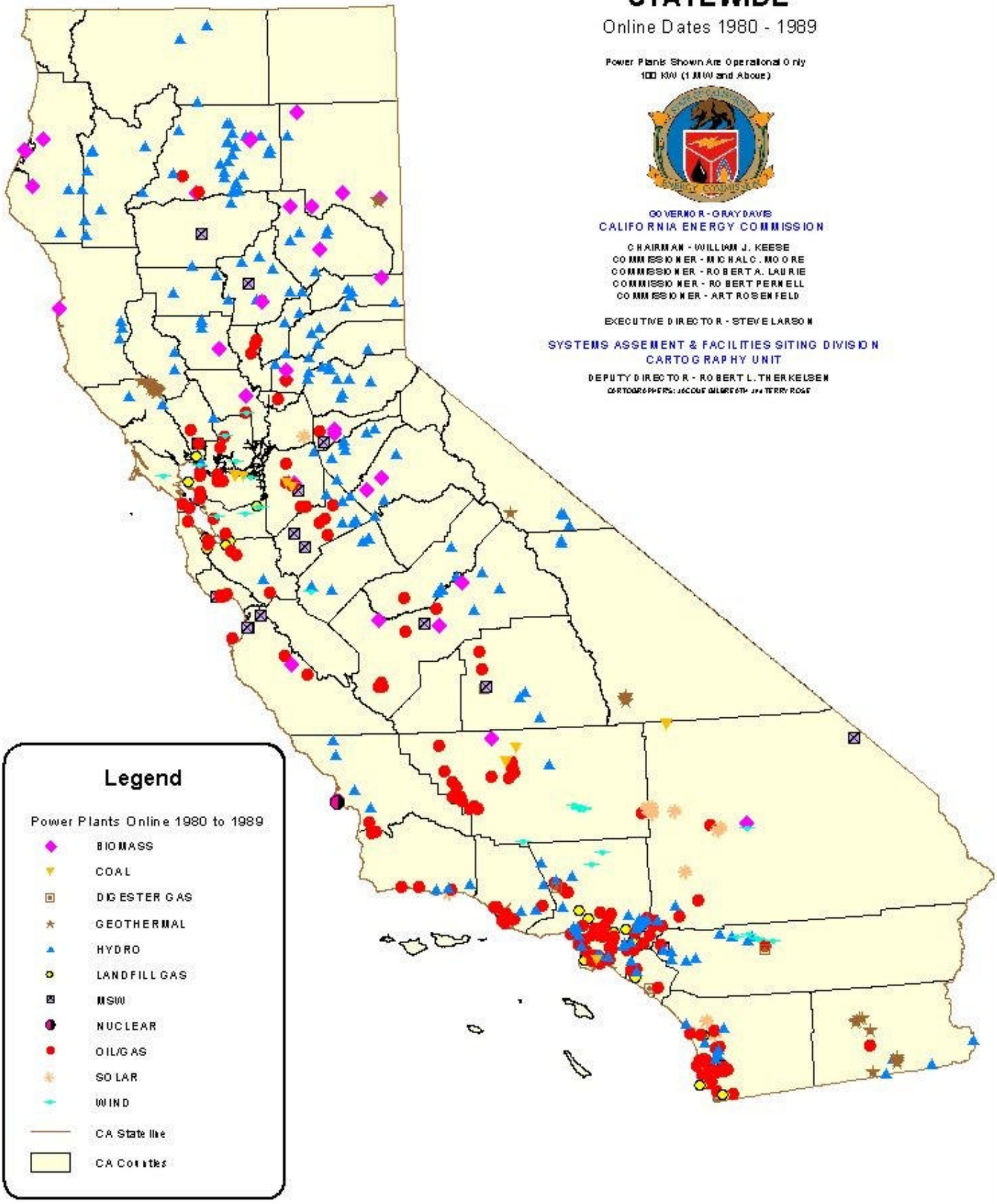
Power Plants Shown Are Operational Only
100 KW (1 MW and Above)



CALIFORNIA POWER PLANTS STATEWIDE

Online Dates 1980 - 1989

Power Plants Shown Are Operational Only
100 KW (1 MW and Above)



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SYSTEMS ASSEMENT & FACILITIES SITING DIVISION
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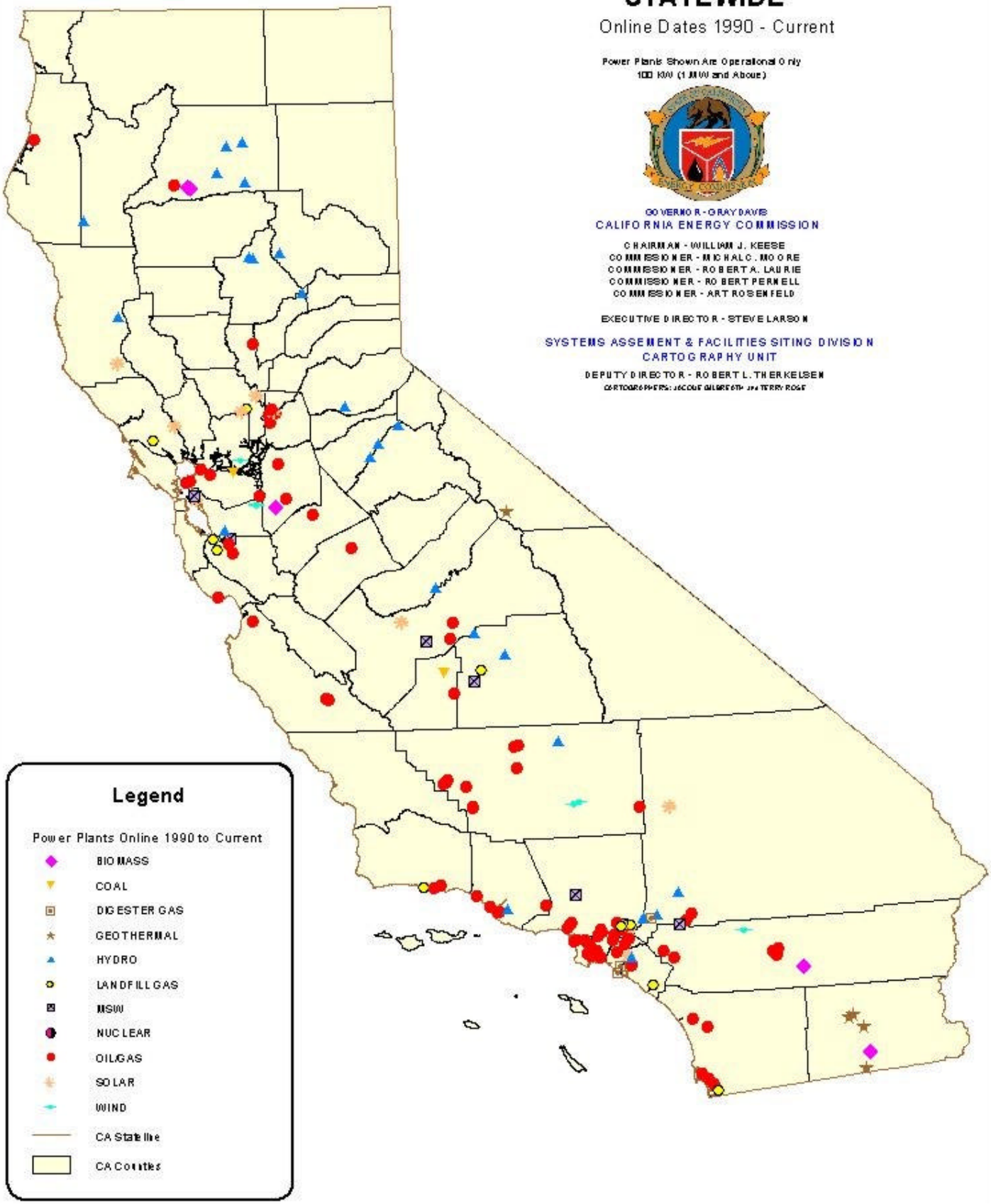
DEPUTY DIRECTOR - ROBERT L. THERKELSEN
CARTOGRAPHERS: JACQUE GILBREATH and TERRY ROSE

CALIFORNIA POWER PLANTS STATEWIDE

Online Dates 1990 - Current

Power Plants Shown Are Operational Only
100 KW (1 MW and Above)



CALIFORNIA
ENERGY
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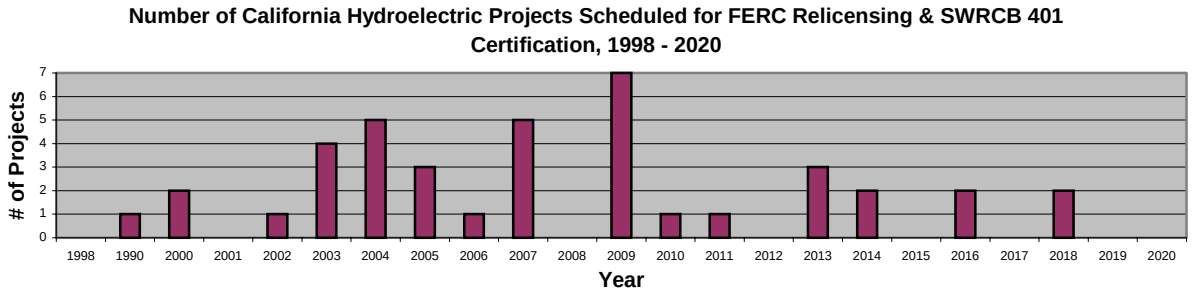
Appendix III

Environmental Performance Report

July 2001
P700-01-001

Gray Davis, *Governor*



Source: U.S. Dept. of Energy, http://hydropower.inel.gov/facts/license.html

20 of the Oldest and Largest Steam Boiler Power Plants in California

Project Name	Year Built	Original Owner	Location (by County)	MW	Site Size (Acres)	Located on Coast? (Yes/No)	Uses once-through cooling? (Yes/No)
Redondo Beach	1948	SCE	Los Angeles	1090	56	y	y
Hunters Point	1948	PG&E	San Francisco	680	38	y	y
El Centro	1949	Imperial ID	Imperial	1310	140	n	n
Potrero	1949	PG&E	San Francisco	911	26	y	y
Moss Landing	1950	PG&E	Monterey	2022	380	y	y
Contra Costa	1951	PG&E	Contra Costa	517	200	y	y
Etiwanda	1953	SCE	San Bernardino	429	209	n	n
Valley	1954	LADWP	Los Angeles	239	NA*	n	n
Pittsburg	1954	PG&E	Contra Costa	965	1000	y	y
Encina	1954	SDG&E	San Diego	1020	300	y	y
El Segundo	1955	SCE	Los Angeles	1002	33	y	y
Morro Bay	1955	PG&E	San Luis Obispo	2088	140	y	y
Alamitos	1956	SCE	Los Angeles	803	234	y	y
Scattergood	1958	LADWP	Los Angeles	563	NA*	y	y
Huntington Beach	1958	SCE	Orange	435	106	y	y
Mandalay	1959	SCE	Ventura	693	205	y	y
South Bay	1960	SDG&E	San Diego	628	149	y	y
Cool Water	1961	SCE	San Bernardino	363	2395	n	n
Haynes	1962	LADWP	Los Angeles	1570	NA*	y	y
Ormand	1971	SCE	Ventura	1500	693	y	y
			Total	18828	6304	16 coastal	16 once-through
			Average	941.4	370.8		

* LADWP did not provide the CEC with the size of their facilities

Sources:

California Public Utilities Commission, Mitigated Negative Declaration and Initial Study on Southern California Edison Company's Application to Divest 12 Thermal Power Plants in Southern California, August 1997.

Pacific Gas and Electric Company, Proponent's Environmental Assessment on the Proposed Sale of Four Generating Plants, November, 1996.

Proponent's Environmental Assessment on the Proposed Sale of Four Bay Area Electric Generating Stations, January 1998.B31

San Diego Gas and Electric Company, www.sdge.com/VPPT/vppt_2001.html (Accessed 5/2001)

Imperial Irrigation District, May 11, 2001, Personal Communiction with Orlando Foot, Attorney for Imperial Irrigation District

27 New Combustion Turbine Power Plants Certified or Under Application Review In California (Current as of 4/20/01)

Project Name	Owner	Location (by County)	MW	Site Size (acres)	Greenfield/ Brownfield	Repower*? (Yes/No)	Source of Cooling Water	Status of Project
East Altamont Energy Center	Calpine	Alameda	1100	55	g	n	reclaimed	Application under review
Delta Energy Center	Calpine/Bechtel	Contra Costa	880	20	b	n	reclaimed	Certified
Los Medanos	Pittsburg District Energy Facility	Contra Costa	559	12	b	n	reclaimed	Certified
Contra Costa Modernization	Mirant purchased from Southern Energy Delta	Contra Costa	530	20	b	y	once-through	Application under review
La Paloma	La Paloma Generating Comp.	Kern	1048	23	g	n	water district	Certified
Pastoria	Calpine purchased from Pastoria Energy Facility	Kern	750	30	g	n	water district	Certified
Western Midway Sunset	Western Midway Sunset Cogeneration Comp.	Kern	500	10	b	y	water district	Certified
Elk Hills	Elk Hills Power	Kern	500	12	b	n	water district	Certified
Sunrise	Sunrise Cogeneration and Power	Kern	320	16	b	n	recycle own steam	Certified
Pastoria Energy Facility Expansion	Calpine purchased from Enron NA	Kern	250	30	g	n	water district	Certified
Hanford Energy Park	GWF Power Systems Comp.	Kings	99	5	g	n	groundwater	Certified
El Segundo	El Segundo Power II	Los Angeles	630	33	b	y	mix w/once-through	Application under review
Moss Landing	Duke Energy NA	Monterey	1060	239	b	y	once-through	Certified
Huntington Beach	AES Huntington Beach	Orange	1000	12	b	y	once-through	Certified
Blythe Energy	Blythe Energy	Riverside	520	15	b	n	groundwater	Certified
Indigo Energy Facility	Wildflower Energy LP	Riverside	135	10	g	n	water district	Certified
Mountainview	AES recently purchased from Mountainview	San Bernardino	1056	16	b	y	groundwater	Certified
High Desert	High Desert Power Project	San Bernardino	720	25	b	n	mixture	Certified
Otay Mesa	Calpine purchased from Otay Mesa Generating	San Diego	510	15	g	n	none (dry cool)	Certified
Larkspur Energy Facility	Wildflower Energy LP	San Diego	90	8	g	n	water district	Certified
Potrero Unit 7	Mirant Corporation	San Francisco	540	6.5	b	y	once-through	Application under review
United Golden Gate Phase I	United Golden Gate Power Comp.	San Francisco	51	2	b	n	reclaimed	Certified
United Golden Gate Phase II	United Golden Gate Power Comp.	San Francisco	50	2	b	n	reclaimed	Application under review
Morro Bay	Duke Energy Morro Bay	San Luis Obispo	600	107	b	y	once-through	Application under review
Metcalf	Calpine/Bechtel	Santa Clara	600	14	g	n	reclaimed/groundw	Application under review
Three Mountain	Three Mountain Power	Shasta	500	40	b	y	groundwater	Application under review
Sutter Power	Calpine	Sutter	500	16	g	n	none (dry cool)	Certified
		Total	15098.0	793.5	10 Greenfield			
		Average	559.2	29.4	17 Brownfield			

Source: California Energy Commission Files (Applications for Certification and Final Staff Assessments)

*** Repower: Repower projects include repowering, expanding capacity, or re-starting un-used facilities**

Power Facilities with existing outfalls in the Pacific Ocean

(** facility discharges into bay, river or estuary directly associated with ocean)

- San Onofre
- Huntington Beach
- Encinas – Carlsbad **
- South Bay Facility **
- Redondo Beach
- Ormond Beach
- Mandalay
- Diablo Canyon
- Morro Bay
- Moss Landing
- Humboldt Bay **
- El Segundo
- Harbor **
- Potrero **
- Hunters Point **
- Contra Costa **
- Pittsburg **
- Alamitos
- Haynes **
- Scattergood **

Characteristics of Operating Plants	No. of Plants	Percent of Plants	Total Generating Capacity	Percent of Total Generating Capacity
Power Plants that Create Air Emissions				
Coal	15	1%	560	1%
Oil/Gas	340	34%	28290	53%
Geothermal	47	5%	2626	5%
Solar/Gas	9	1%	409	1%
Waste to Energy	103	10%	1071	2%
Subtotal	**514**	**51%**	**32956**	**62%**
Power Plants that do not Create Air Emissions				
Hydro	386	38%	14116	27%
Wind	105	10%	1818	3%
Solar PV	5	<1%	4	<1%
Nuclear	2	<1%	4310	8%
Subtotal	**498**	**49%**	**20248**	**38%**
TOTAL	**1012**	**100%**	**53204**	**100%**

CALIFORNIA
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Appendix IV

Environmental Performance Report

July 2001
P700-01-001

Gray Davis, *Governor*

Estimated Socioeconomic Benefits and Impact Mitigation Fees for Recently Approved and Proposed Power Plants

Plant Name and Status	Employment Benefits	Property Tax Revenues[1] and Impact Mitigation Fees	Sales Tax Revenues
Sutter Power Project – Approved and in construction	256 construction workers at peak, $20 million construction payroll over 24 months. 20 operations workers, $1 million/year payroll	$2.5 to $2.85 million per year Plus, one-time Sutter County development impact fee: $27,152.82 One time impact fee: $7,512.44 Annual special tax: $1,896.56 School district developer impact fee: $2,210	$135 million worth of material and equipment will generate $362,500 in sales tax revenues.
Sunrise Power Project – Approved and in construction Estimated plant life: 20 years	255 construction workers at peak, $18 to 23 million construction payroll over 15 months. 24 operations workers, $1 million/year payroll	$1.75 to $1.95 million per year One-time impact fees paid to school district: 11,550	$95 to $105 million worth of materials and equipment purchased for construction will generate sales tax revenues. $1 to $1.2 million/year for operating supplies will generate sales tax revenues.
Pastoria Phase I – Approved (Phase II – In review) Estimated plant life: 25 years	365 construction workers at peak, $146 million construction payroll over 20 to 24 months. 25 operations workers, $2.5 million/year payroll	$3.1 million per year Plus, one-time impact fees paid to school district: 11,550	$42 to $43 million worth of materials and equipment will generate sales tax revenues. $6.1 to $7 million/year for operating supplies

[1] Proposition 13 established a base year value, limited annual increases in assessed value to 2 percent, and designated the valuation method as the lower of fair market value or adjusted base year value.

Plant Name and Status	Employment Benefits	Property Tax Revenues[2] and Impact Mitigation Fees	Sales Tax Revenues
Moss Landing – Approved and in construction	732 construction workers at peak, $136 million construction payroll over 26 months 10 additional operations workers (88 existing operations workers)	$4 to $5 million per year	$42 to $43 million worth of materials and equipment will generate sales tax revenues. $6.1 to $7 million/year for operating supplies will generate sales tax revenues. $19 to $22 million sales tax increase
Los Medanos Energy Center – Approved and in construction	294 construction workers at pead, $264 million construction payroll over 21 months. 20 operations workers, $1.4 million/year payroll	$2 to $3 million per year, distributed to Pittsburg Redevelopment Agency Plus, one-time fire facilities fee Plus, one-time developer fees to school district: $6,138	$170 million worth of materials and subcontractors will generate sales tax revenues.
La Paloma Generating Project – Approved and in construction Estimated plant life: 35 years	747 construction workers at peak, $146 million payroll over 19 months 35 operations workers, $6 million/year payroll	$50,988,000 for first 10 years	$42 to $43 million worth of materials and equipment will generate sales tax revenues. $6.1 to 7 million/year for operating supplies will generate sales tax revenues.

[2] Proposition 13 established a base year value, limited annual increases in assessed value to 2 percent, and designated the valuation method as the lower of fair market value or adjusted base year value.

Plant Name and Status	Employment Benefits	Property Tax Revenues[3] and Impact Mitigation Fees	Sales Tax Revenues
High Desert Power Plant Project – Approved	370 construction workers at peak, construction payroll over 18 months not available. 27 operations workers, $1.4 million/year payroll ($63,000 in state payroll taxes)	Property is owned by federal government, which pays no property taxes. Power plant will pay possessory interest on taxable leasehold and improvements. Property taxes will be determined after construction, based on building permits. Plus, one-time development impact fee to City of Victorville: $15,750 Plus, one-time developer fee to Adelanto School District: $13,500.	$2 million/year in non-fuel operating costs: $150,000 in sales tax
Elk Hills Power Project - Approved Estimated plant life – 30 years	352 construction workers at peak, $43 million construction payroll over 15 months. 20 operations workers, $2 million/year payroll	$20 million for first 10 years Kern County provided a $4 million "tax incentive" to reimburse for public infrastructure expenses.	$25 million worth of construction materials and equipment which will generate $1.8 million in sales tax revenues. $3 million/year in operating supplies which will generate $217,000 in sales tax revenues.

[3] Proposition 13 established a base year value, limited annual increases in assessed value to 2 percent, and designated the valuation method as the lower of fair market value or adjusted base year value.

Plant Name and Status	Employment Benefits	Property Tax Revenues[4] and Impact Mitigation Fees	Sales Tax Revenues
Delta – Approved and in construction	575 construction workers at peak, $36 million construction payroll over 24 months 24 operations workers, $1.2 million/year payroll	$3.5 to $4.5 million Note: Parcel reconfigured into a state enterprise zone, so that plant owner could receive tax benefits, including: Credit for sales and use tax paid on certain machinery Credit for hiring certain qualified employees; Business expense deduction for the cost of certain property	$5 to $10 million worth of construction materials and equipment will generate sales tax revenues. $2 to $4 million annual operations budget and $10 to $15 million annual maintenance budget will generate sales tax revenues.
Western Midway Sunset -- Approved Estimated plant life: 30 years	400 construction workers at peark, $25 million construction payroll over 20 months 5 operations workers, $475,000/year payroll	$2.4 million per year.	$22.4 to $25.2 million worth of materials and equipment $300,000/year for operating supplies
United Golden Gate – Phase I – approved (Phase II – in review)	Construction payroll: $750,000 to $1,000,000 Operation staff information not available.	Not available.	$2 to $4 million worth of materials and equipment will generate sales tax revenues.

[4] Proposition 13 established a base year value, limited annual increases in assessed value to 2 percent, and designated the valuation method as the lower of fair market value or adjusted base year value.

Plant Name and Status	Employment Benefits	Property Tax Revenues[5] and Impact Mitigation Fees	Sales Tax Revenues
Otay Mesa – Approved	348 construction workers on average, $25 million construction payroll over 21 months 25 operations workers, $3 million/year payroll	$2.7 million per year. Plus, one-time impact fee to school district: $2,030 (at 14 cents per square foot)	$160 million worth of equipment and materials will generate sales tax revenues.
Blythe Energy – Approved	385 construction workers at peak. Construction schedule and payroll information not available. 20 Operation workers, $ 1.2 million in annual payroll.	$2 million per year	Estimated $150 million in materials and $10 million annual operation cost will generate sales tax revenues.
Three Mountain – In review	350 construction workers at peak, $23.8 to $27.2 million construction payroll 20 to 25 operations workers, $1.5 million/year payroll	$2.5 million per year	$2 to 4 million worth of materials will generate sales tax revenues.

[5] Proposition 13 established a base year value, limited annual increases in assessed value to 2 percent, and designated the valuation method as the lower of fair market value or adjusted base year value.

Plant Name and Status	Employment Benefits	Property Tax Revenues[6] and Impact Mitigation Fees	Sales Tax Revenues
Hanford Energy Park Project – In review	129 workers at peak, $9.2 million construction payroll. 8 operation workers. Operation payroll information not available.	$700,000 per year in property taxes. $16,430 school impact fee.	$2.1 million supplies and materials will generate $150,000 in sales tax revenue. $30,000 of local purchases will generate $2,250 in sales tax revenue.
Contra Costa Power Plant Project – In review	285 construction workers at peak. Construction schedule and payroll information not available. 10 additional operation workers are added with annual payroll of $1 to $2 million.	$2.1 million in property taxes One time fee of $49,980 for Antioch school district.	$20 - $25 million of materials and $2 to $3 million operating cost will generate sales tax revenues. 8.25% Sales tax rate
El Segundo Modernization Project – In review	250 average construction workers, $60-65 million construction payroll. 53 Operation Workers. $1.6 million/year operation payroll.	350-400 Million dollar project	$2-3 million in materials $5-$10 million in operation costs $1-$3 million in local tax revenues.

[6] Proposition 13 established a base year value, limited annual increases in assessed value to 2 percent, and designated the valuation method as the lower of fair market value or adjusted base year value.

Plant Name and Status	Employment Benefits	Property Tax Revenues[7] and Impact Mitigation Fees	Sales Tax Revenues
Huntington Beach Modernization Project – In review	548 workers at peak, $43 million construction payroll. 10 operation workers, $ 1.5 million operation payroll.	$1 million property taxes. Plus $187,000 in additional property tax revenue. High School and Elementary School Districts will receive $264,000 and $268,000 annually, respectively.	Supplies and equipment will be purchased outside the city therefore there is little sales tax to be made.
Metcalf Energy Center – In review	399 Construction workers at peak. Construction schedule and payroll information not available. 20 operation personnel. Annual payroll estimates not available.	$3 –$5 Million in property taxes If the facility is assessed at between $300 and $400 million	$5 –$10 million worth of materials and equipment bought. This spending will generate 8.25 percent sales tax revenues for Santa Clara County.
Morro Bay Power Plant Project – In review	385 construction workers at peak. Annual payroll of $58 million. 91 Operation workers. $8.6 million dollars in operational payroll.	Increase in $2 million of property taxes. $755 one-time school impact fee.	

[7] Proposition 13 established a base year value, limited annual increases in assessed value to 2 percent, and designated the valuation method as the lower of fair market value or adjusted base year value.

Plant Name and Status	Employment Benefits	Property Tax Revenues[8] and Impact Mitigation Fees	Sales Tax Revenues
Mountainview Power Plant – Approved	568 construction workers at peak. Construction payroll at $30 million. 33 Operation workers. Payroll at $1.97 million per year.	$3.5 to $4 million in local property tax revenues.	$5 million in materials will generate sales tax revenues..
Potrero Power Plant Project – In review	287 construction workers at peak. $70 – $90 million in construction payroll. 10 operation workers. $1 – $1.5 million in operation payroll.	The existing property tax revenue of $671,000 accrued to City and County of San Francisco in 1997.	$25 – $30 million in construction materials will generate sales tax revenues..
Rio Linda/Elverta Power Plant Project – In review	406 construction workers at peak. $6.4 Million construction payroll. 23 operation employees. $2.4 million operation payroll.	$3 million in property tax based on $360-$380 million capital cost of the facility.	Annual sales tax of $500,000 based on estimated local purchases per year.

[8] Proposition 13 established a base year value, limited annual increases in assessed value to 2 percent, and designated the valuation method as the lower of fair market value or adjusted base year value.

Rationale and Methodology for Selecting Power Plants and Demographic and Socioeconomic Factors for Socioeconomic Impacts Analysis

SB 110 did not specify which factors or which electric generating facilities to assess. Rather than assess more than 1,000 electric generating facilities, the Energy Commission staff chose a sample of 13 old and large oil/gas-fired facilities. These facilities were built between 1941 to 1971 in incorporated cities and currently range in size from 272 MW to 2,088 MW. The rationale for using this sample is as follows.

- Choosing older electric generating facilities was thought to provide a better opportunity to observe changes in demographic and socioeconomic factors than choosing newer facilities to evaluate.
- Electric generating facilities built in the 1980's and 1990's were primarily small-scale renewable energy and cogeneration facilities, which have less choice about where they can be sited, compared to oil/gas-fired facilities. Renewable energy facilities must be built near adequate supplies of the renewable energy resource and cogeneration facilities need industrial or commercial customers for their process steam or hot water. Furthermore, larger electric generating facilities were chosen, because they were deemed to be more likely to create socioeconomic impacts than small-scale facilities.
- Lastly, only facilities built in incorporated cities were used, because incorporated cities are the smallest geographic unit for which historical demographic and socioeconomic data could be obtained. Historical census tract data is inappropriate to use, because census tract boundaries are not constant decade-to-decade. County data was deemed inappropriate, because counties encompass much larger geographical areas, including areas far away from the power plants.

The initial, selected sample was the 13 oldest and largest oil/gas-fired power plants. These facilities were identified using the Energy Commission's power plant database of operating facilities greater than 100 KW.

The database was sorted twice: first by on-line year and then by type and size.

Looking at both sorts side by side, power plants at the top of both lists were noted. The sample, therefore, did not include plants that were "old" list, but were not "large."

Then, Energy Commission staff examined the geographic distribution of the top 12 selected plants and noted that the sample included (too) many Southern California facilities. To increase the number of northern California plants represented in the same, the Contra Costa power plant in the San Francisco Bay Area became the 13th plant.

The sample size was kept small, because collecting data for each facility would be very time consuming.

How demographic and socioeconomic factors were selected

Per SB 110: …"The assessment shall describe the socioeconomic and demographic factors that existed when the facilities were constructed and the current status of these factors." These factors were not specified by the legislation.

Energy Commission sought the definitions of the words "factors," "demographic" and "socioeconomic." The dictionary defines "factors" to mean the same as "characteristics." Researched possible "characteristics."

Staff then found a publication entitled *California Cities, Towns and Counties,* which compiled demographic and socioeconomic characteristic data for all incorporated cities in California. Based on the potential characteristics that could have been collected for this study, the Energy Commission chose four: population, racial composition (both demographic factors) and median family income and housing ownership (both socioeconomic factors). These factors were selected because they seemed to be the most relevant to potential socioeconomic impacts from power plants.

Population Trends

City	County	Facility Name	On-line Year {a}	Est Pop in On-Line Year {b}	1940 Census Population {c}	1950 Census Population {c}	1960 Census Population {c}	1970 Census Population {c}	1980 Census Population {c}	1990 Census Population {c}	2000 Census Population {b}
Pittsburg	Contra Costa	Pittsburg	1954	15100	9520	12763	19062	20651	33034	47564	56769
Antioch	Contra Costa	Contra Costa	1951	11500	5106	11051	17305	28060	42683	62195	90532
El Centro	Imperial	El Centro	1949	n/c	10017	12590	16811	19272	23996	31384	37835
Long Beach	Los Angeles	Alamitos	1956	304500	164271	250767	344168	358633	361334	429433	461522
Long Beach	Los Angeles	Haynes	1962	352600	164271	250767	344168	358879	361334	429433	461522
Redondo Beach	Los Angeles	Redondo Beach	1948	22500	13092	25226	46986	56075	57102	60167	63261
El Segundo	Los Angeles	El Segundo	1958	5800	3738	8011	14219	15620	13752	15223	16033
El Segundo	Los Angeles	Scattergood	1955	5800	3738	8011	14219	15620	13752	15223	16033
Glendale	Los Angeles	Grayson	1941	n/c	82582	95702	119442	132664	139060	180038	194973
Pasadena	Los Angeles	Broadway	1955	n/c	81864	104577	116407	112951	118072	131591	133936
Los Angeles County	Los Angeles	n/a	n/a	n/a	n/c	4151687	6038771	7032075	7477503	8863164	9519338
Hawthorne	Los Angeles	n/a	n/a	n/a	8263	16316	33035	53304	56447	71349	84122
Los Angeles	Los Angeles	n/a	n/a	n/a	1504277	1970358	2479015	2816061	2966850	3485398	3694820
Torrance	Los Angeles	n/a	n/a	n/a	9950	22241	100991	134584	129881	133107	137946
Castroville	Monterey	Moss Landing	1950	n/c	n/a	1865	2838	3235	4396	5272	6724
Huntington Beach	Orange	Huntington Beach	1958	n/c	3738	5237	11492	115960	170505	181519	189594
Rancho Cucamonga	San Bernardino	Etiwanda	1953	n/c	n/a	n/a	n/a	5796	55250	101409	127743
Carlsbad	San Diego	Encina	1954	n/c	n/a	4383	9253	14944	35490	63126	78247
Chula Vista	San Diego	South Bay	1960	41400	5138	15927	42034	67901	83927	135163	173556
Morro Bay	San Luis Obispo	Morro Bay	1955	n/c	n/a	1659	3692	7109	9064	9664	10350
Oxnard	Ventura	Ormond Beach	1971	73600	8519	21567	40265	71225	108195	142216	170358

References:
{a} Energy Commission
{b} Department of Finance
{c} US Census

City	1950 Non-White {c}	1950 White {c}	1960 Non-White {c}	1960 White {c}	1970 Non-White {c}	1970 White {c}	1980 Non-White {c}	1980 White {c}	1990 Non-White {c}	1990 White {c}
Pittsburg	1010	11753	3100	15962	n/c	n/c	n/c	n/c	19690	27874
Antioch	64	10987	24	17281	n/c	n/c	n/c	n/c	9065	53130
El Centro	1638	16663	2108	14703	n/c	n/c	n/c	n/c	12567	18817
Long Beach	6587	244180	14798	329355	n/c	n/c	n/c	n/c	178717	250716
Long Beach	6587	244180	14798	329355	n/c	n/c	n/c	n/c	178717	250716
Redondo Beach	234	24992	367	46619	n/c	n/c	n/c	n/c	7796	52371
El Segundo	10	8001	52	14167	152	15468	814	12938	1443	13780
El Segundo	10	8001	52	14167	152	15468	814	12938	1443	13780
Glendale	276	95426	564	118878	n/c	n/c	n/c	n/c	46768	133270
Pasadena	9778	94799	17894	98513	n/c	n/c	n/c	n/c	56249	75342
Los Angeles County	273743	3877944	584905	5453866	1025576	6006499	2403886	5073617	3828061	5035103
Hawthorne	141	16175	285	32750	3618	49686	18327	38120	41183	30166
Los Angeles	211585	1758773	417207	2061808	642401	2173660	1150089	1816761	1644216	1841182
Torrance	721	21520	1398	99593	5430	129154	20879	109002	35963	97144
Castroville	n/a	n/a	221	2617	n/c	n/c	n/c	n/c	4266	2458
Huntington Beach	10	5227	244	11248	n/c	n/c	n/c	n/c	25205	156314
Rancho Cucamonga	n/a	n/a	n/a	n/a	n/c	n/c	n/c	n/c	21711	79698
Carlsbad	n/a	n/a	129	9124	n/c	n/c	n/c	n/c	6462	56664
Chula Vista	158	15769	406	41628	n/c	n/c	n/c	n/c	43600	91563
Morro Bay	39	4344	26	3666	n/c	n/c	n/c	n/c	610	9054
Oxnard	1363	20204	3115	37150	n/c	n/c	n/c	n/c	58788	83428

References:
{a} Energy Commission
{b} Department of Finance
{c} US Census

City	County	Facility Name	On-line Year {a}	1950 Median Family Income {c}	1960 Median Family Income {c}	1970 Median Family Income {c}	1980 Median Family Income {c}	1989 Median Family Income {b}	1990 Median Family Income {c}
Pittsburg	Contra Costa	Pittsburg	1954	$3,357.00	$6,100.00	n/c	n/c	$41,512.00	n/c
Antioch	Contra Costa	Contra Costa	1951	$3,765.00	$6,778.00	n/c	n/c	$44,939.00	n/c
County	Contra Costa	n/a	n/a	$3,808.00	$7,327.00	$12,423.00	$26,510.00	n/c	$51,651.00
El Centro	Imperial	El Centro	1949	$3,161.00	$6,508.00	n/c	n/c	$28,727.00	n/c
County	Imperial	n/a	n/a	n/c	$5,507.00	$8,257.00	$16,658.00	n/c	n/c
Long Beach	Los Angeles	Alamitos	1956	$2,995.00	$6,570.00	n/c	n/c	$36,305.00	n/c
Long Beach	Los Angeles	Haynes	1962	$2,995.00	$6,570.00	n/c	n/c	$36,305.00	n/c
Redondo Beach	Los Angeles	Redondo Beach	1948	$3,218.00	$6,880.00	n/c	n/c	$58,760.00	n/c
El Segundo	Los Angeles	El Segundo	1955	$3,774.00	$7,783.00	$12,433.00	$25,747.00	$53,215.00	n/c
El Segundo	Los Angeles	Scattergood	1958	$3,774.00	$7,783.00	$12,433.00	$25,747.00	$53,215.00	n/c
Glendale	Los Angeles	Grayson	1941	$3,438.00	$7,563.00	n/c	n/c	$39,652.00	n/c
Pasadena	Los Angeles	Broadway	1955	$2,740.00	$6,922.00	n/c	n/c	$40,435.00	n/c
County	Los Angeles	n/a	n/a	$3,669.00	$7,046.00	$10,972.00	$21,125.00	n/c	$39,035.00
Hawthorne	Los Angeles	n/a	n/a	$3,689.00	$7,645.00	$11,285.00	$20,957.00	n/c	$35,336.00
Los Angeles	Los Angeles	n/a	n/a	$3,575.00	$6,896.00	$10,535.00	$19,467.00	n/c	$34,364.00
Torrance	Los Angeles	n/a	n/a	$3,870.00	$8,050.00	$13,620.00	$28,641.00	n/c	$55,678.00
County	Monterey	n/a	n/a	$3,499.00	$5,770.00	$9,730.00	$20,001.00	n/c	$36,223.00
Huntington Beach	Orange	Huntington Beach	1958	$3,222.00	$6,065.00	n/c	n/c	$57,056.00	n/c
County	Orange	n/a	n/a	n/c	$7,219.00	$12,245.00	$25,918.00	n/c	n/c
Rancho Cucamonga	San Bernardino	Etiwanda	1953	n/a	n/a	n/a	n/a	$50,349.00	n/c
County	San Bernadino	n/a	n/a	$3,125.00	$5,998.00	$9,439.00	$20,038.00	n/c	$36,977.00
Carlsbad	San Diego	Encina	1954	$3,465.00	$5,852.00	n/c	n/c	$51,019.00	n/c
Chula Vista	San Diego	South Bay	1960	$3,465.00	$6,969.00	n/c	n/c	$36,655.00	n/c
County	San Diego	n/a	n/a	$3,456.00	$6,545.00	$10,133.00	$20,304.00	n/c	$39,798.00
Morro Bay	San Luis Obispo	Morro Bay	1955	n/c	$4,406.00	n/c	n/c	$33,361.00	n/c
County	San Luis Obispo	n/a	n/a	$3,120.00	$5,659.00	$8,738.00	$18,198.00	n/c	$37,086.00
Oxnard	Ventura	Ormond Beach	1971	$2,922.00	$6,471.00	n/c	n/c	$38,700.00	n/c
County	Ventura	n/a	n/a	$3,570.00	$6,466.00	$11,162.00	$23,602.00	n/c	$50,091.00

References:
{a} Energy Commission
{b} Department of Finance
{c} US Census

City	County	Facility Name	On-line Year {a}	1950 Total Dwelling Units {c}	1950 Total Owner Occupied {c}	1950 % Owner Occupied {c}	1950 Total Renter Occupied {c}	1960 Total Dwelling Units {c}	1960 Total Owner Occupied {c}	1960 % Owner Occupied {c}	1960 Total Renter Occupied {c}
Pittsburg	Contra Costa	Pittsburg	1954	3809	1878	49.3	1931	5742	3374	58.8	2368
Antioch	Contra Costa	Contra Costa	1951	3246	1968	60.6	1278	5177	3606	69.7	1571
County	Contra Costa	n/a	n/a	83371	46067	55.3	37304	117858	85690	72.7	32168
El Centro	Imperial	El Centro	1949	3655	1741	47.6	1914	4733	2750	58.1	1983
County	Imperial	n/a	n/a	12841	5530	43.1	7311	18481	10278	55.6	8203
Long Beach	Los Angeles	Alamitos	1956	91163	40932	44.9	50231	124706	61610	49.4	63096
Long Beach	Los Angeles	Haynes	1962	91163	40932	44.9	50231	124706	61610	49.4	63096
Redondo Beach	Los Angeles	Redondo Beach	1948	7938	4921	62.0	3017	14522	8578	59.1	5944
El Segundo	Los Angeles	El Segundo	1955	2509	1748	69.7	761	4689	2580	55.0	2109
El Segundo	Los Angeles	Scattergood	1958	2509	1748	69.7	761	4689	2580	55.0	2109
Glendale	Los Angeles	Grayson	1941	34345	18658	54.3	15687	46453	23740	51.1	22713
Pasadena	Los Angeles	Broadway	1955	36205	20414	56.4	15791	43832	22731	51.9	21101
County	Los Angeles	n/a	n/a	1371043	734715	53.6	636328	2011655	1097491	54.6	914164
Hawthorne	Los Angeles	n/a	n/a	4930	3354	68.0	1576	10389	6469	62.3	3920
Los Angeles	Los Angeles	n/a	n/a	666687	305393	45.8	361294	876010	404652	46.2	471358
Torrance	Los Angeles	n/a	n/a	6744	4435	65.8	2309	27588	21925	79.5	5663
Castroville	Monterey	Moss Landing	1958	489	233	47.6	256	n/c	n/c	n/c	n/c
County	Monterey	n/a	n/a	36857	18351	49.8	18506	52215	28729	55	23486
Huntington Beach	Orange	Huntington Beach	1958	1898	1033	54.4	865	3758	2085	55.5	1673
County	Orange	n/a	n/a	62568	38732	61.9	23836	203895	146382	71.8	57513
Rancho Cucamonga	San Bernardino	Etiwanda	1953	261	108	41.4	153	n/c	n/c	n/c	n/c
County	San Bernadino	n/a	n/a	85631	53526	62.5	32105	150178	101547	67.6	48631
Carlsbad	San Diego	Encina	1954	n/c	n/c	n/c	n/c	2834	1815	64.0	1019
Chula Vista	San Diego	South Bay	1960	4954	3136	63.3	1818	12725	8841	69.5	3884
County	San Diego	n/a	n/a	169010	88992	52.7	80018	305201	179892	58.9	125309
Morro Bay	San Luis Obispo	Morro Bay	1955	617	395	64.0	222	1468	1004	68.4	464
County	San Luis Obispo	n/a	n/a	16470	9307	56.5	7163	25492	15842	62.1	9650
Oxnard	Ventura	Ormond Beach	1971	5843	2239	38.3	3604	10322	6329	61.3	3993
County	Ventura	n/a	n/a	31960	15858	49.6	16102	54747	33232	60.7	21515

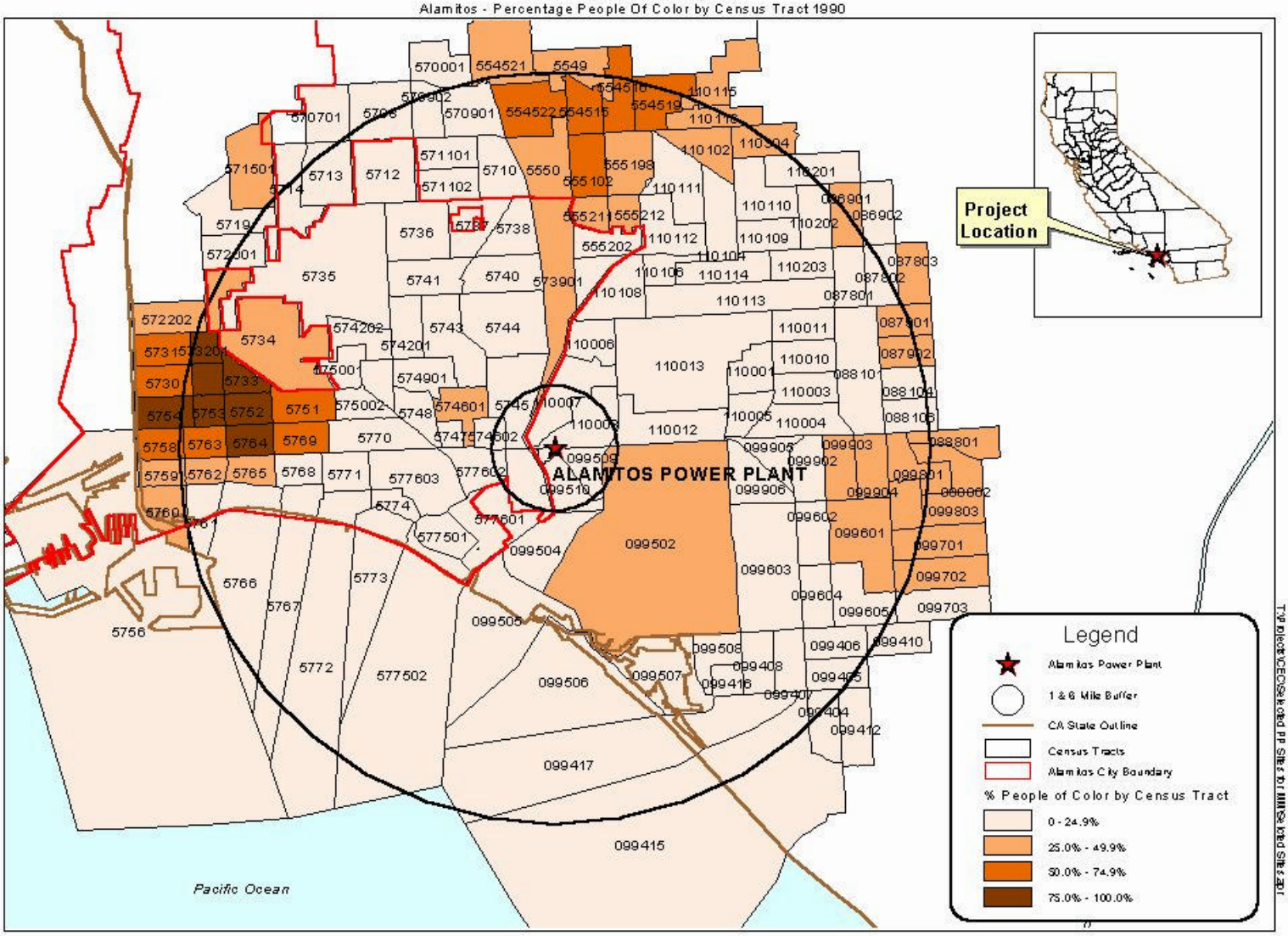
References:
{a} Energy Commission
{b} Department of Finance
{c} US Census

1970 Total Dwelling Units {c}	1970 Total Owner Occupied {c}	1970 % Owner Occupied {c}	1970 Total Renter Occupied {c}	1980 Total Dwelling Units {c}	1980 Total Owner Occupied {c}	1980 % Owner Occupied {c}	1980 Total Renter Occupied {c}	1990 Total Dwelling Units {c}	1990 Total Owner Occupied {c}	1990 % Owner Occupied {c}	1990 Total Renter Occupied {c}
n/c	n/c	n/c	n/c	11087	7769	70.1	3318	15643	9605	61.4	6038
n/c	n/c	n/c	n/c	14955	9925	66.4	5030	21401	13768	64.3	7633
172951	120034	69.4	52917	241534	164867	68.3	76667	300288	202894	67.6	97394
n/c	n/c	n/c	n/c	n/c	n/c	n/c	n/c	9633	5061	52.5	4572
21030	12164	57.8	8866	28157	16993	60.4	11164	n/c	n/c	n/c	n/c
142515	62348	43.7	80167	151611	65013	42.9	86598	158975	65117	41.0	93858
142515	62348	43.7	80167	151611	65013	42.9	86598	158975	65117	41.0	93858
18795	8362	44.5	10433	24637	9446	38.3	15191	26717	12390	46.4	14327
5761	2509	43.6	3252	5985	2427	40.6	3558	6773	2736	40.4	4037
5761	2509	43.6	3252	5985	2427	40.6	3558	6773	2736	40.4	4037
54454	23043	42.3	31411	59339	25316	42.7	34023	68604	26554	38.7	42050
n/c	n/c	n/c	n/c	47056	21494	45.7	25562	50199	23227	46.3	26972
2430822	1179415	48.5	1251407	2730469	1323427	48.5	1407042	2989552	1440830	48.2	1548722
19018	7836	41.2	11182	23021	7535	32.7	15486	27137	6933	25.5	20204
1027374	419801	40.9	607573	1135230	457375	40.3	677855	1217405	479868	39.4	737537
43790	25390	58.0	18400	49613	27650	55.7	21963	52615	29616	56.3	22999
14405	n/c	n/c	n/c	n/c	n/c	n/c	n/c	n/c	n/c	n/c	n/c
71232	37383	52.5	33849	95734	50790	53.1	44944	n/c	n/c	n/c	n/c
33638	24041	71.5	9597	61126	35187	57.6	25939	68879	40284	58.5	28595
436120	282047	64.7	154073	686267	415127	60.5	271140	827066	496782	60.1	330284
n/c	n/c	n/c	n/c	16979	14304	84.2	2675	33635	23638	70.3	9997
211385	135043	63.9	76342	308643	210999	68.4	97644	464737	294248	63.3	170489
n/c	n/c	n/c	n/c	13586	8664	63.8	4922	24995	15558	62.2	9437
22038	13444	61.0	8594	30398	17706	58.2	12692	47824	25487	53.3	22337
422767	238931	56.5	183836	670094	369253	55.1	300841	887403	477579	53.8	409824
1813	n/c	n/c	n/c	n/c	n/c	n/c	n/c	22511	2497	11.1	20014
33926	20175	59.5	13751	58204	35002	60.1	23202	n/c	n/c	n/c	n/c
19658	11310	57.5	8348	33087	17785	53.8	15302	39343	21144	53.7	18199
106469	69920	65.7	36549	172781	113031	65.4	59750	n/c	n/c	n/c	n/c

References:
{a} Energy Commission
{b} Department of Finance
{c} US Census

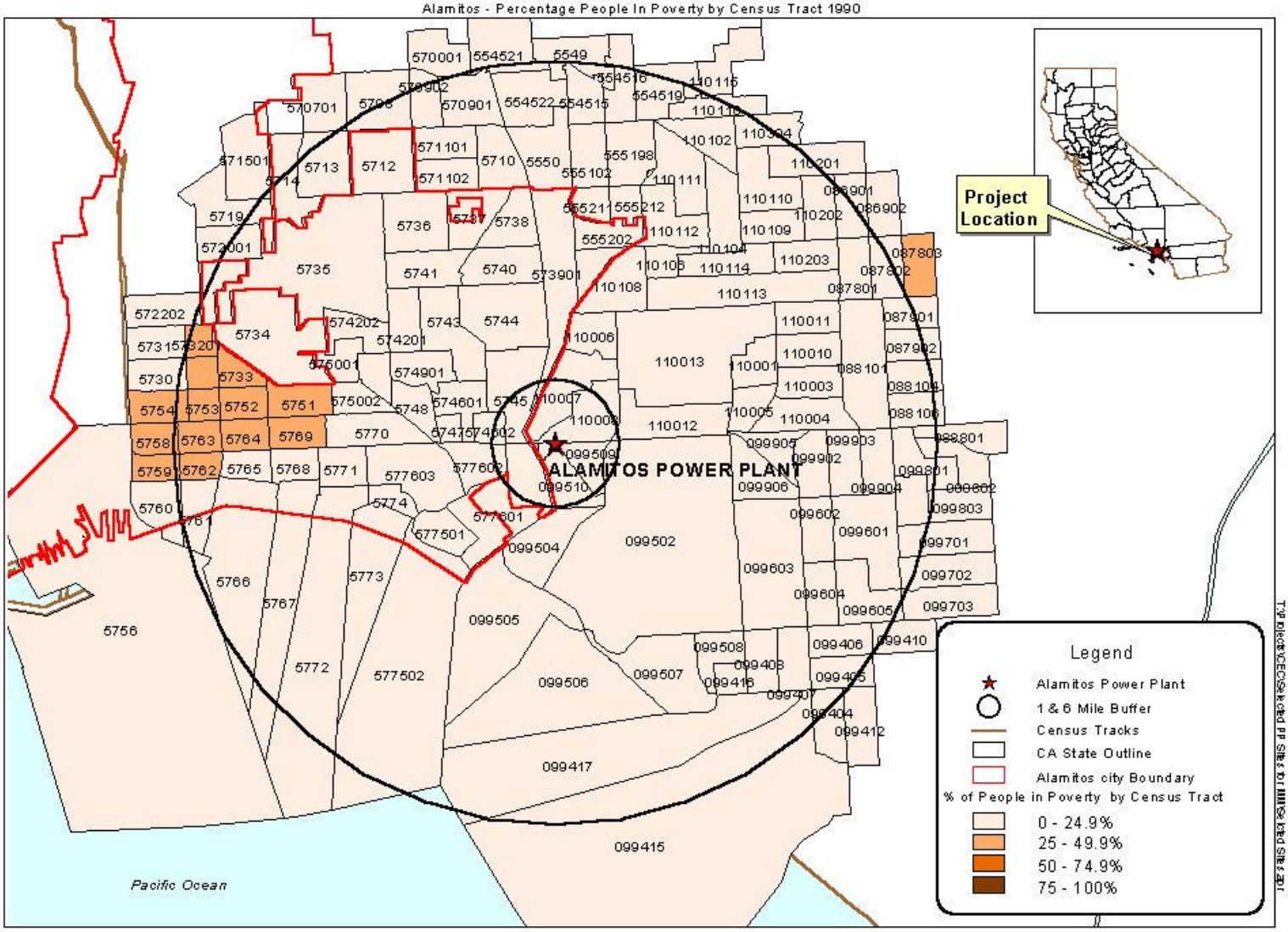
SOCIOECONOMICS - Figure 1

Alamitos - Percentage People Of Color by Census Tract 1990



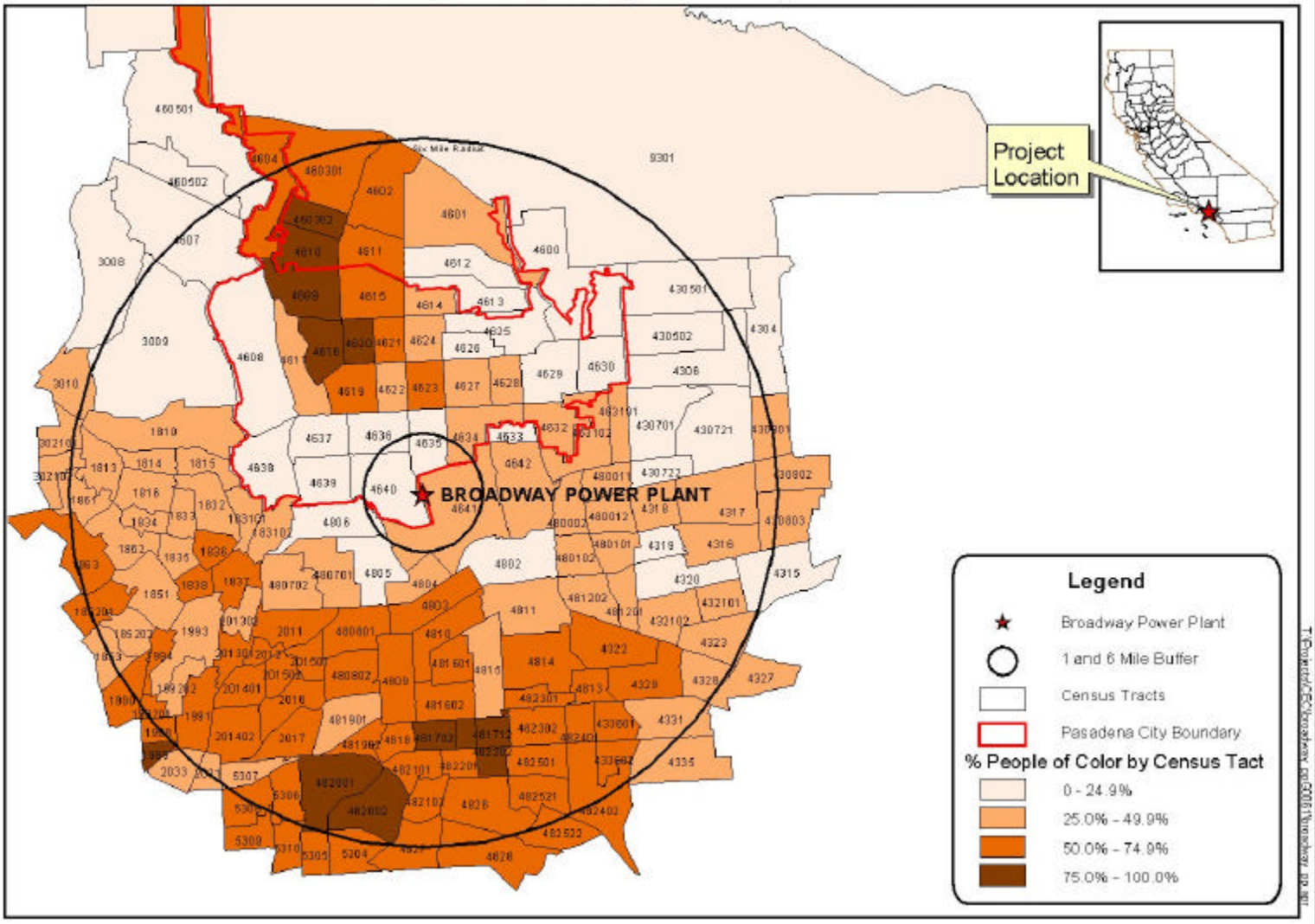
SOCIOECONOMICS - Figure 2

Alamitos - Percentage People In Poverty by Census Tract 1990



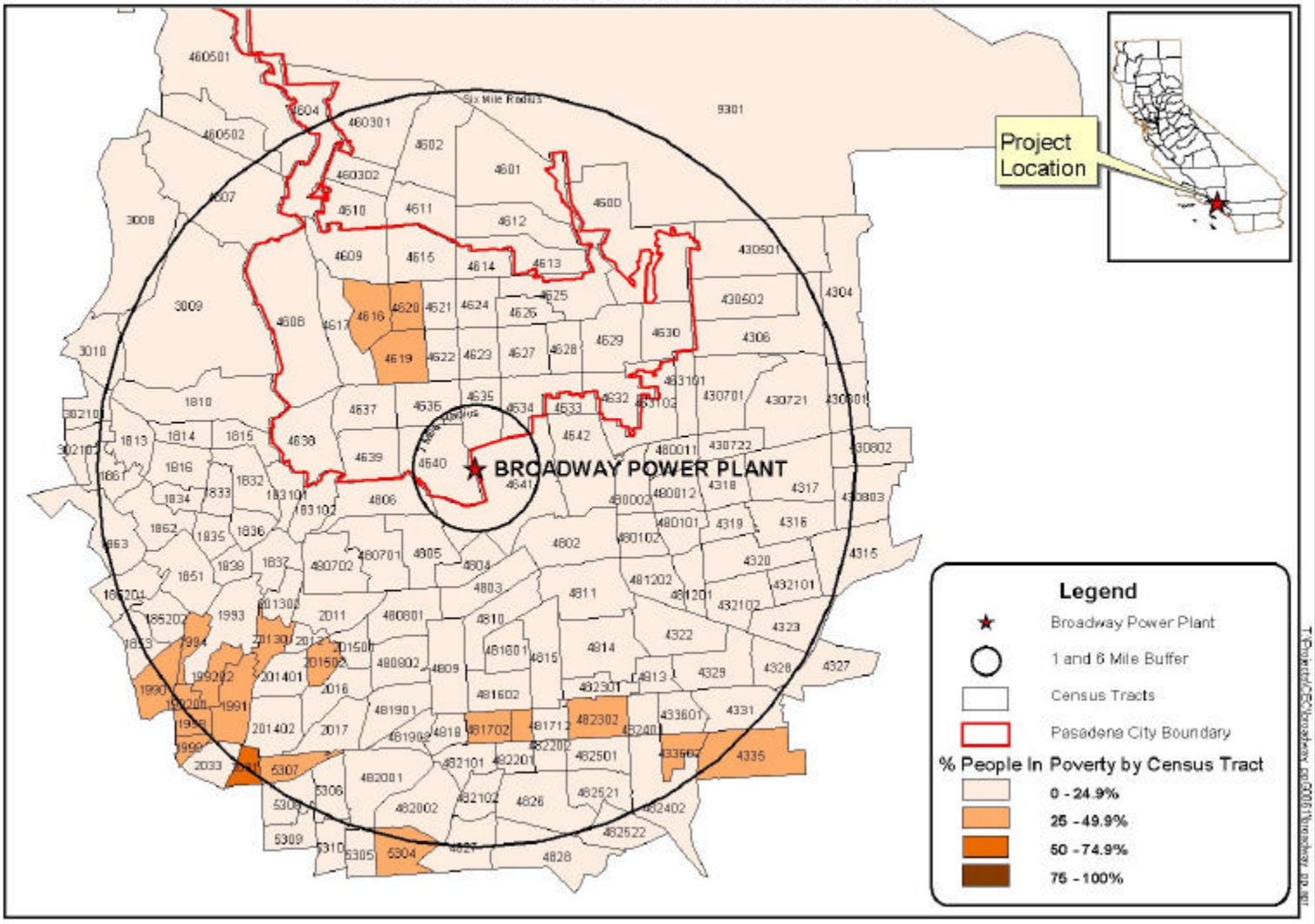
SOCIOECONOMICS - Figure 1

Broadway Power Plant - Percentage People of Color by Census Tract 1990



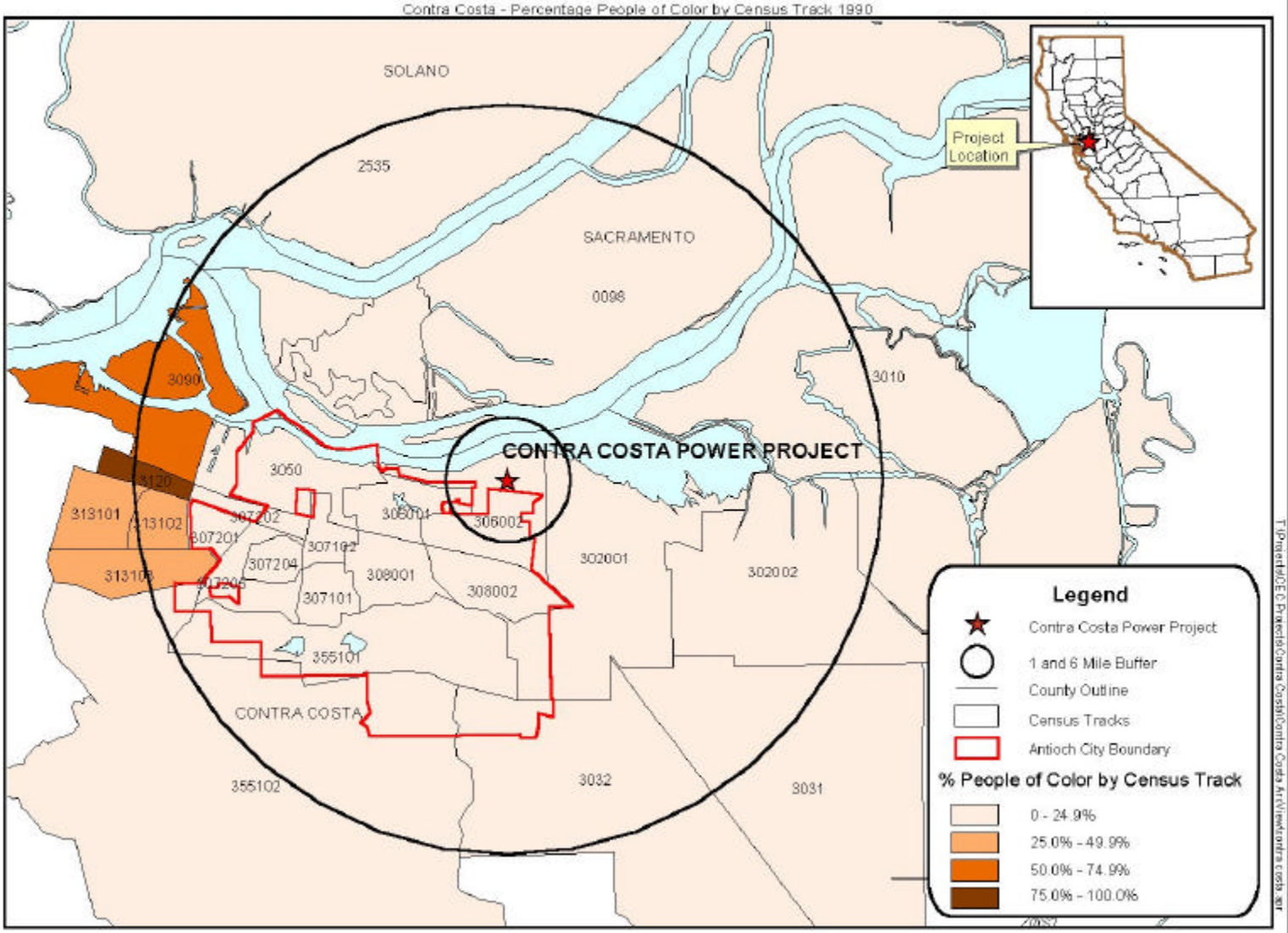
SOCIOECONOMICS - Figure 2

Broadway Power Plant - Percentage People of in Poverty by Census Tract 1990



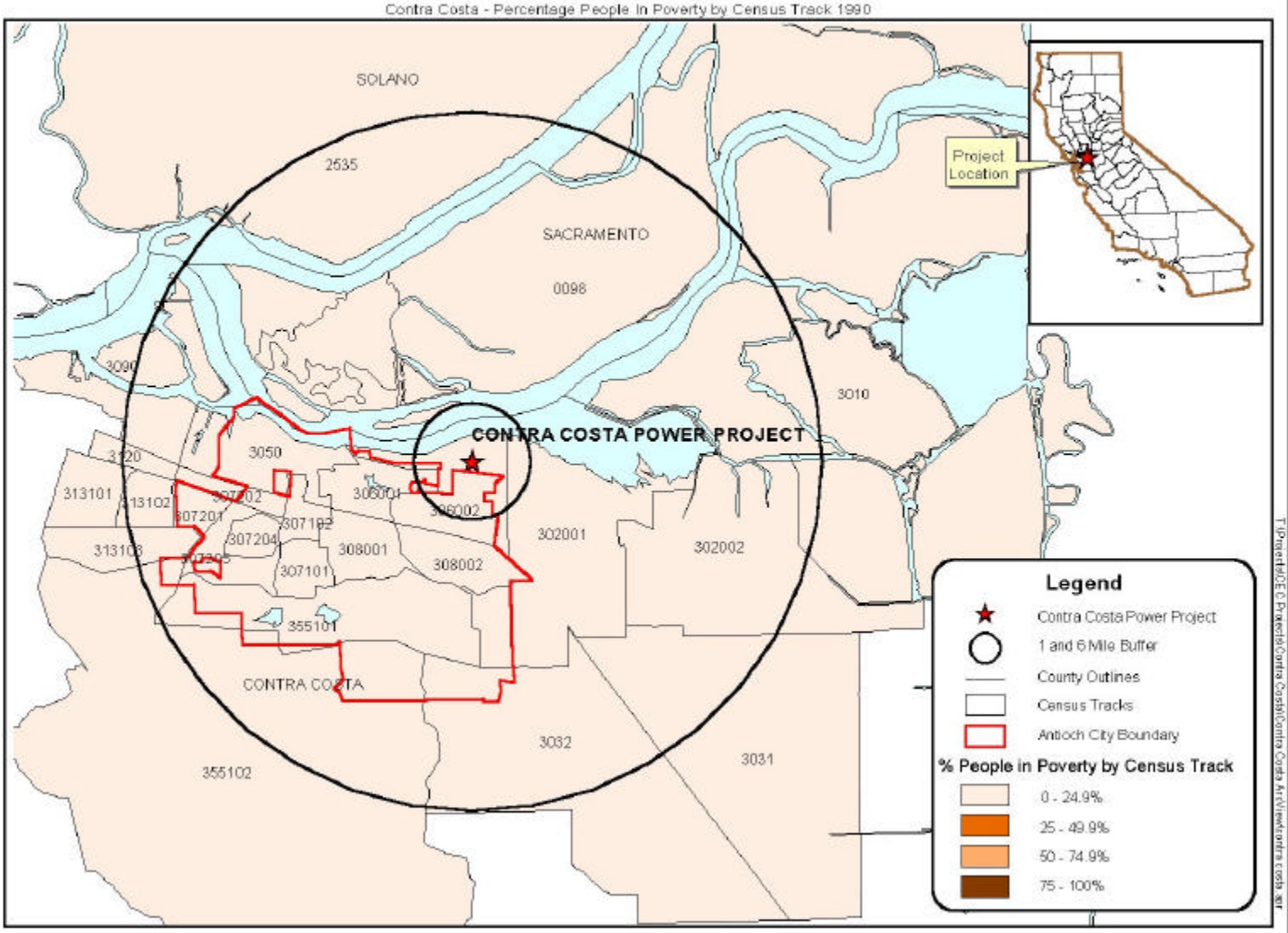
SOCIOECONOMICS - Figure 1

Contra Costa - Percentage People of Color by Census Track 1990



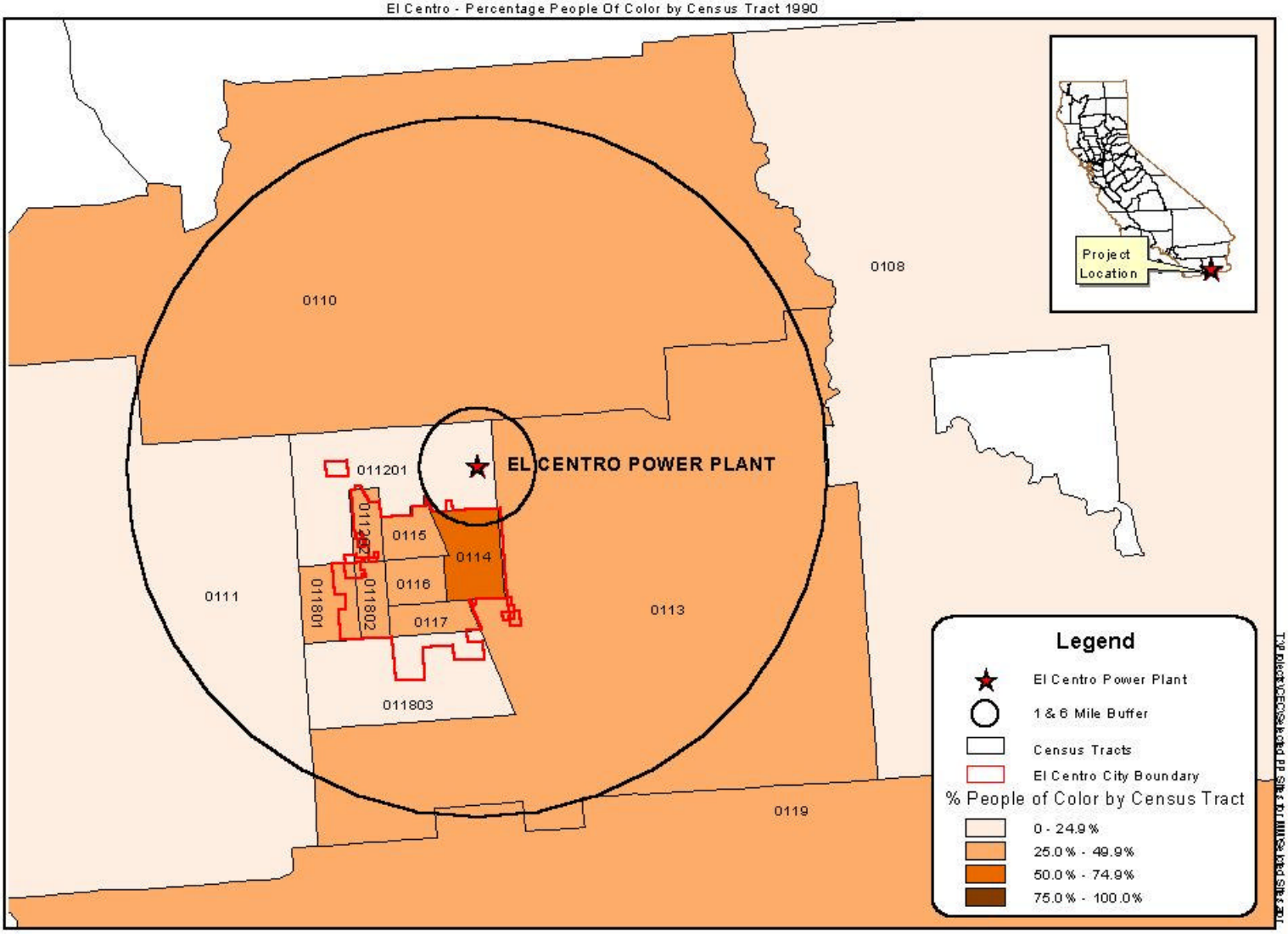
SOCIOECONOMICS - Figure 2

Contra Costa - Percentage People In Poverty by Census Track 1990



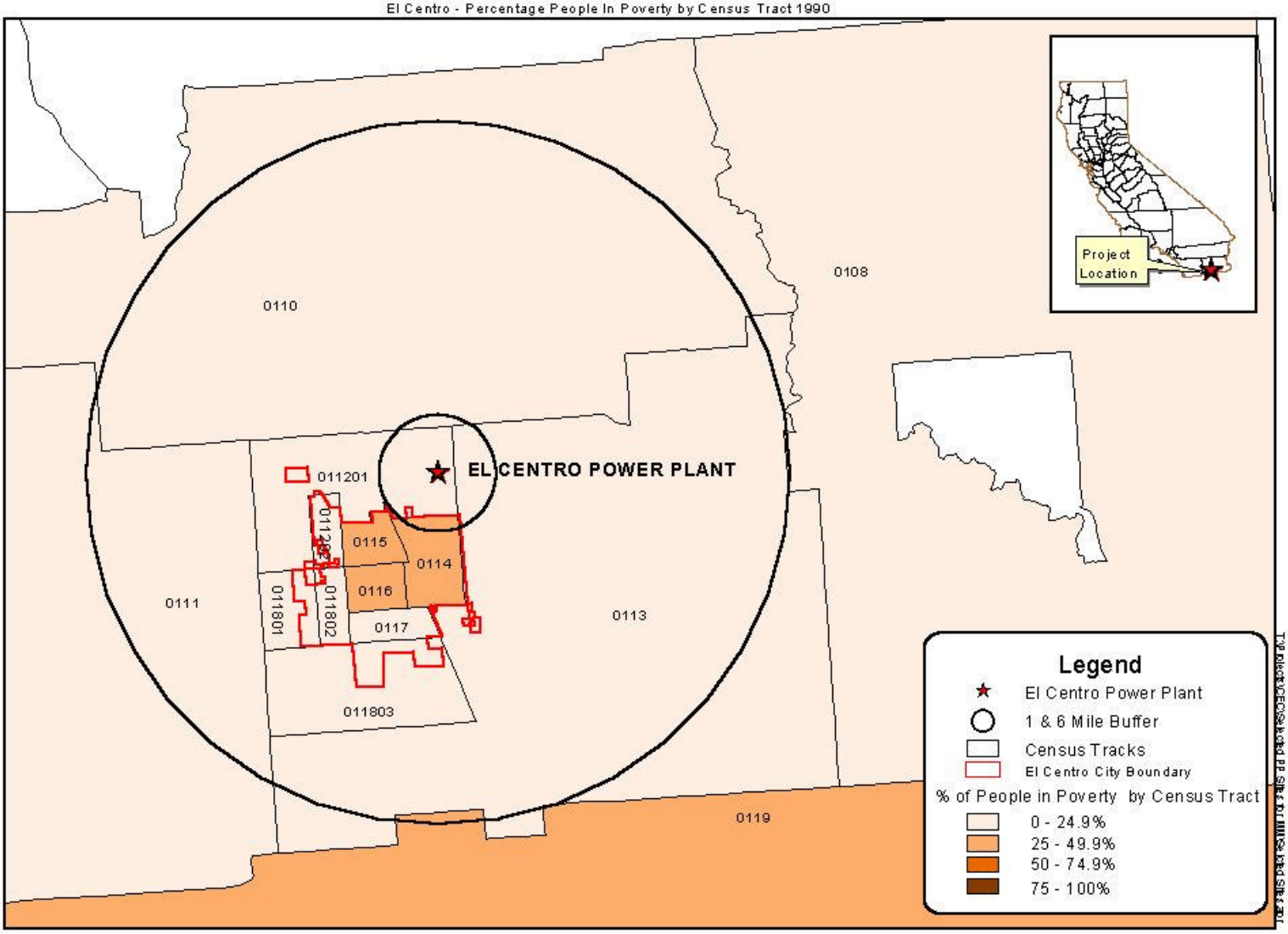
SOCIOECONOMICS - Figure 1

El Centro - Percentage People Of Color by Census Tract 1990



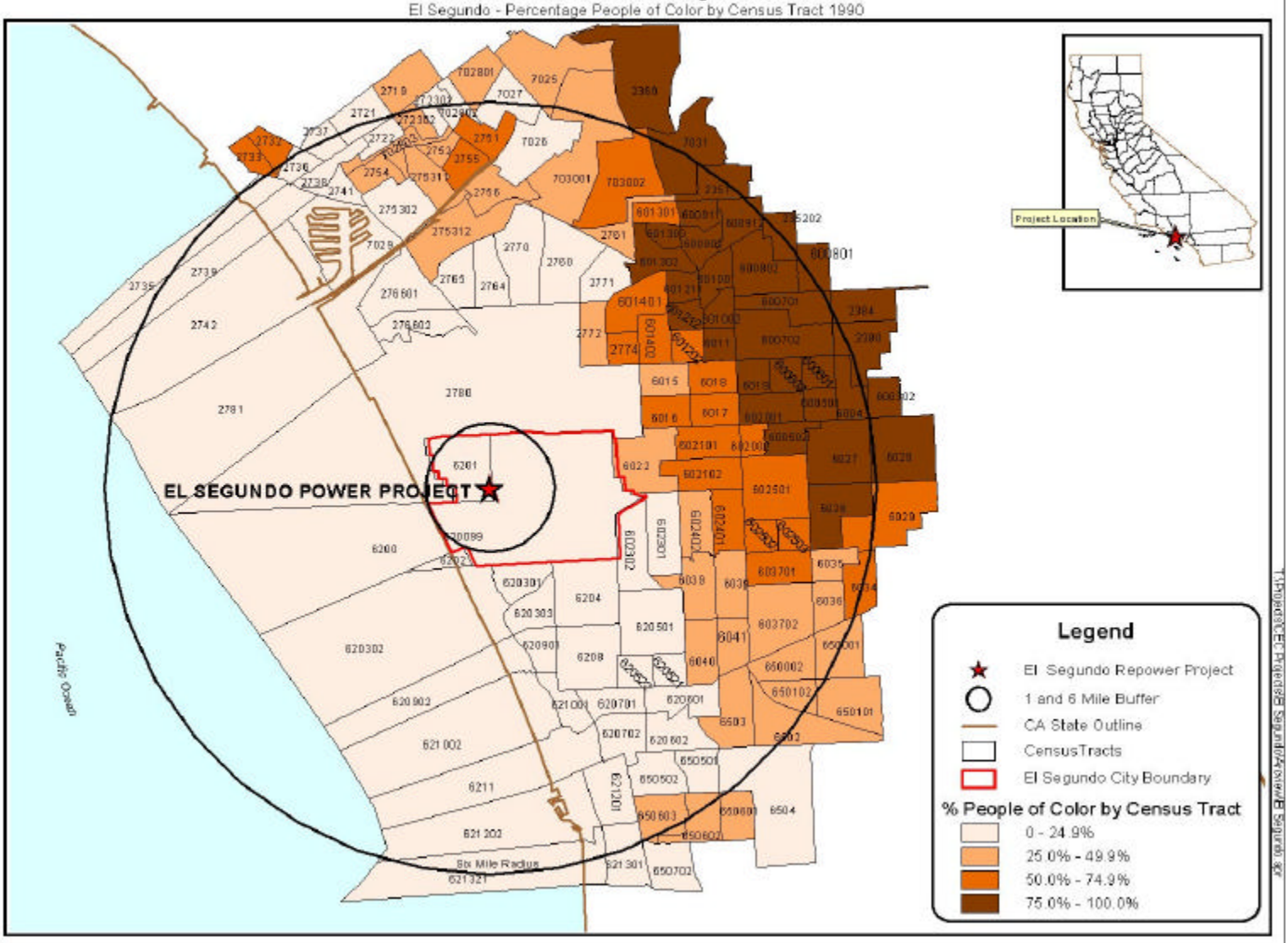
SOCIOECONOMICS - Figure 2

El Centro - Percentage People In Poverty by Census Tract 1990



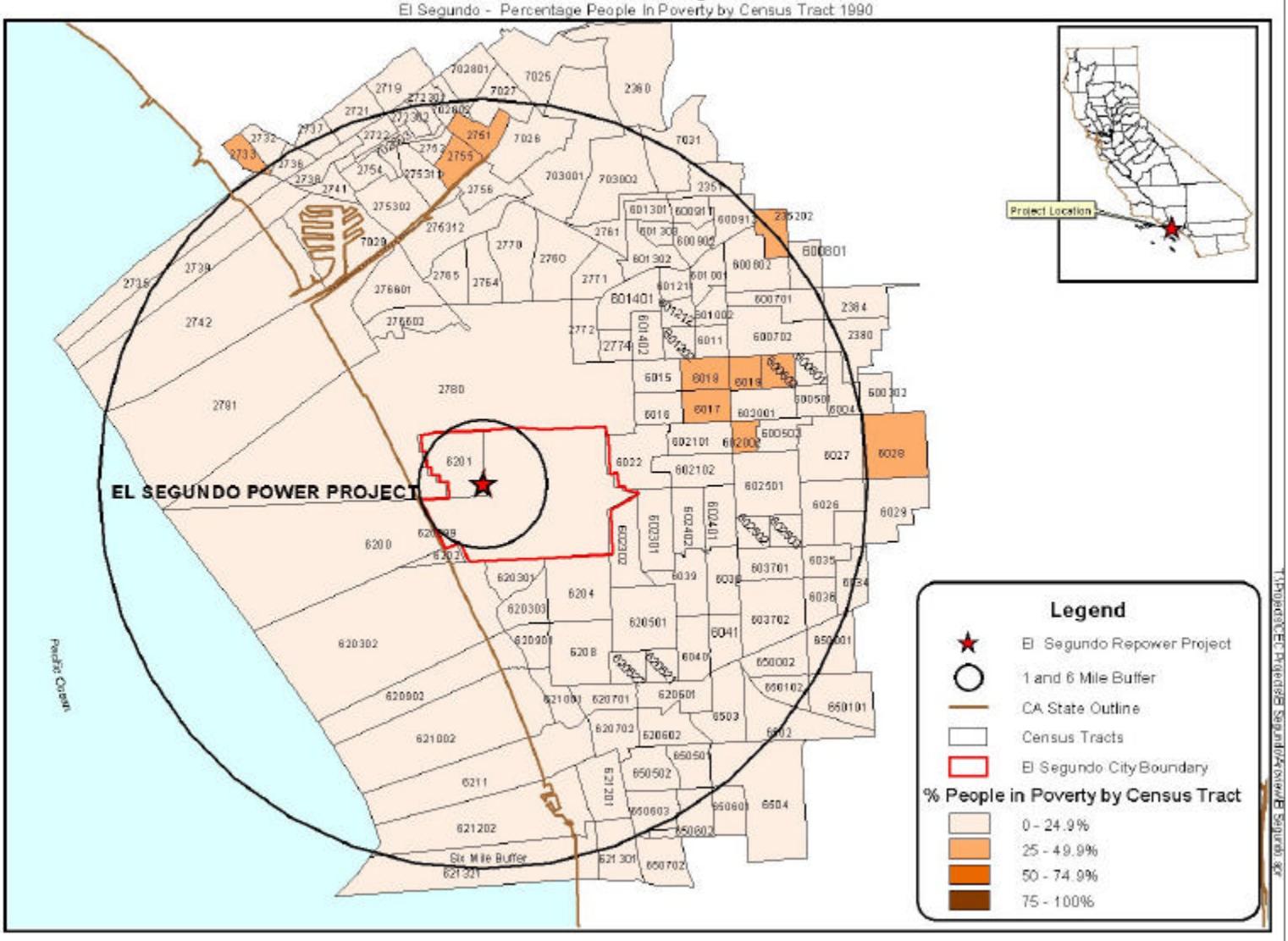
SOCIOECONOMICS - Figure 1

El Segundo - Percentage People of Color by Census Tract 1990



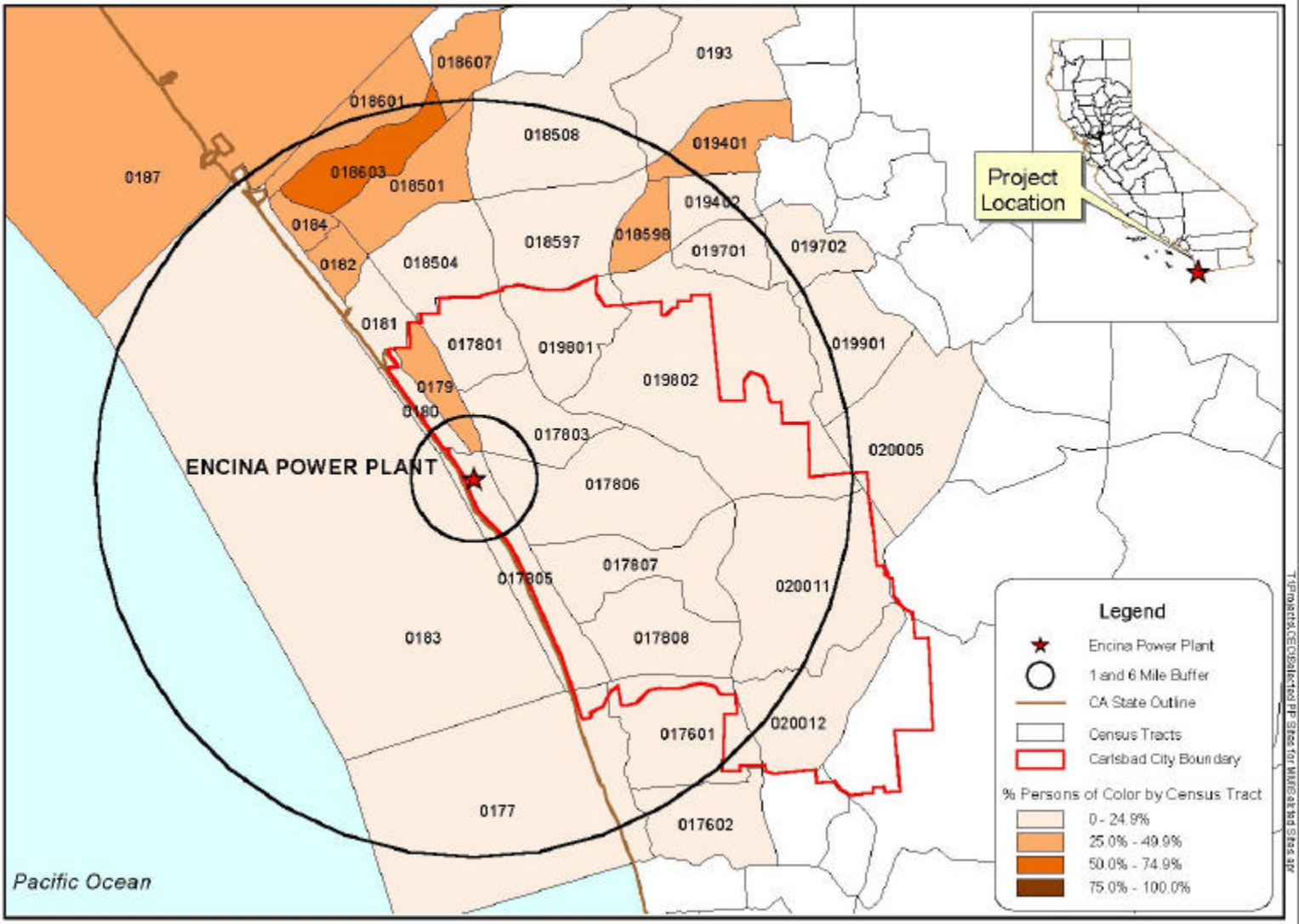
SOCIOECONOMICS - Figure 2

El Segundo - Percentage People In Poverty by Census Tract 1990

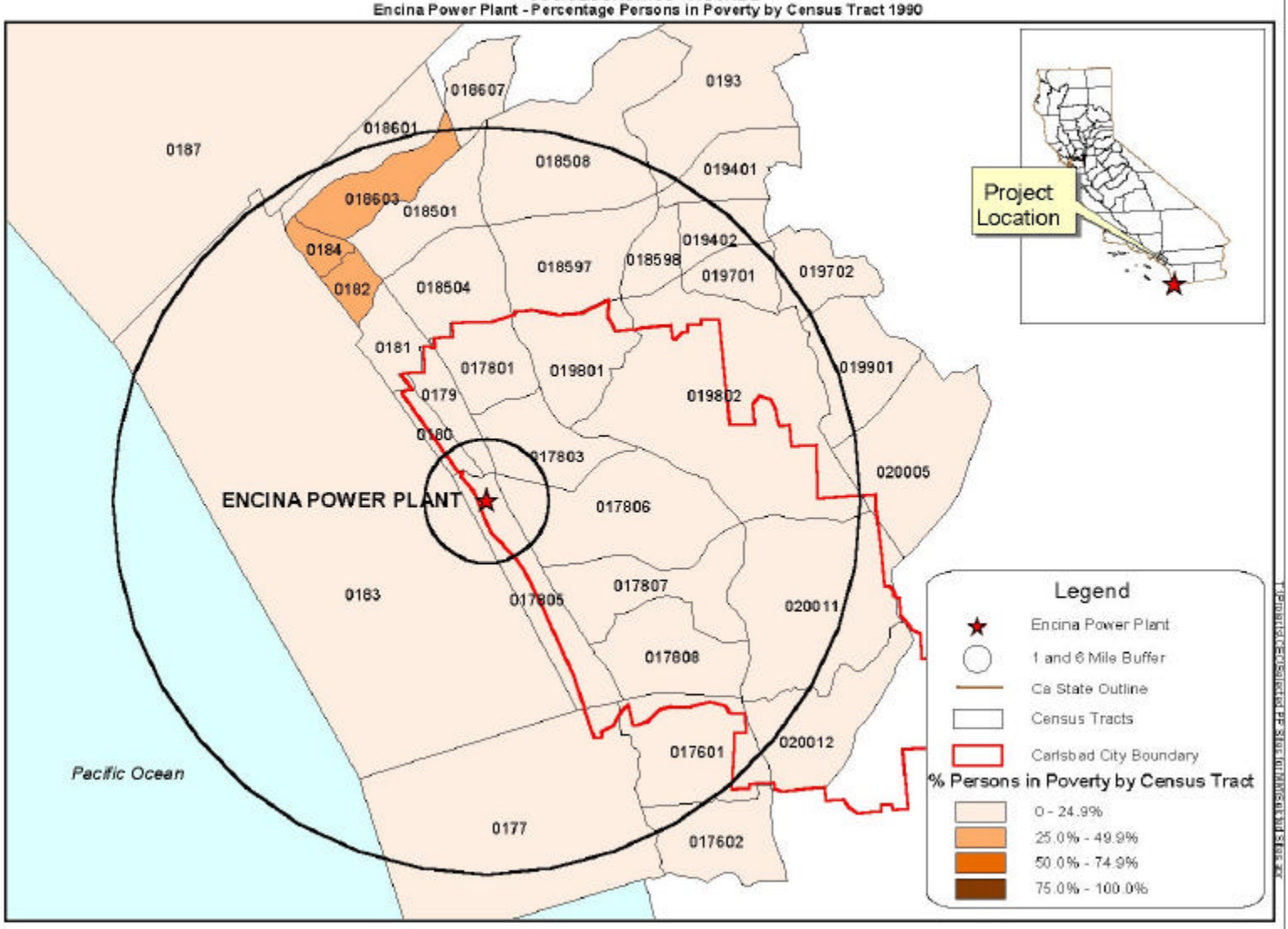


SOCIOECONOMICS - FIGURE 1

Encina Power Plant - Pecentage Persons of Color by Census Tract 1990

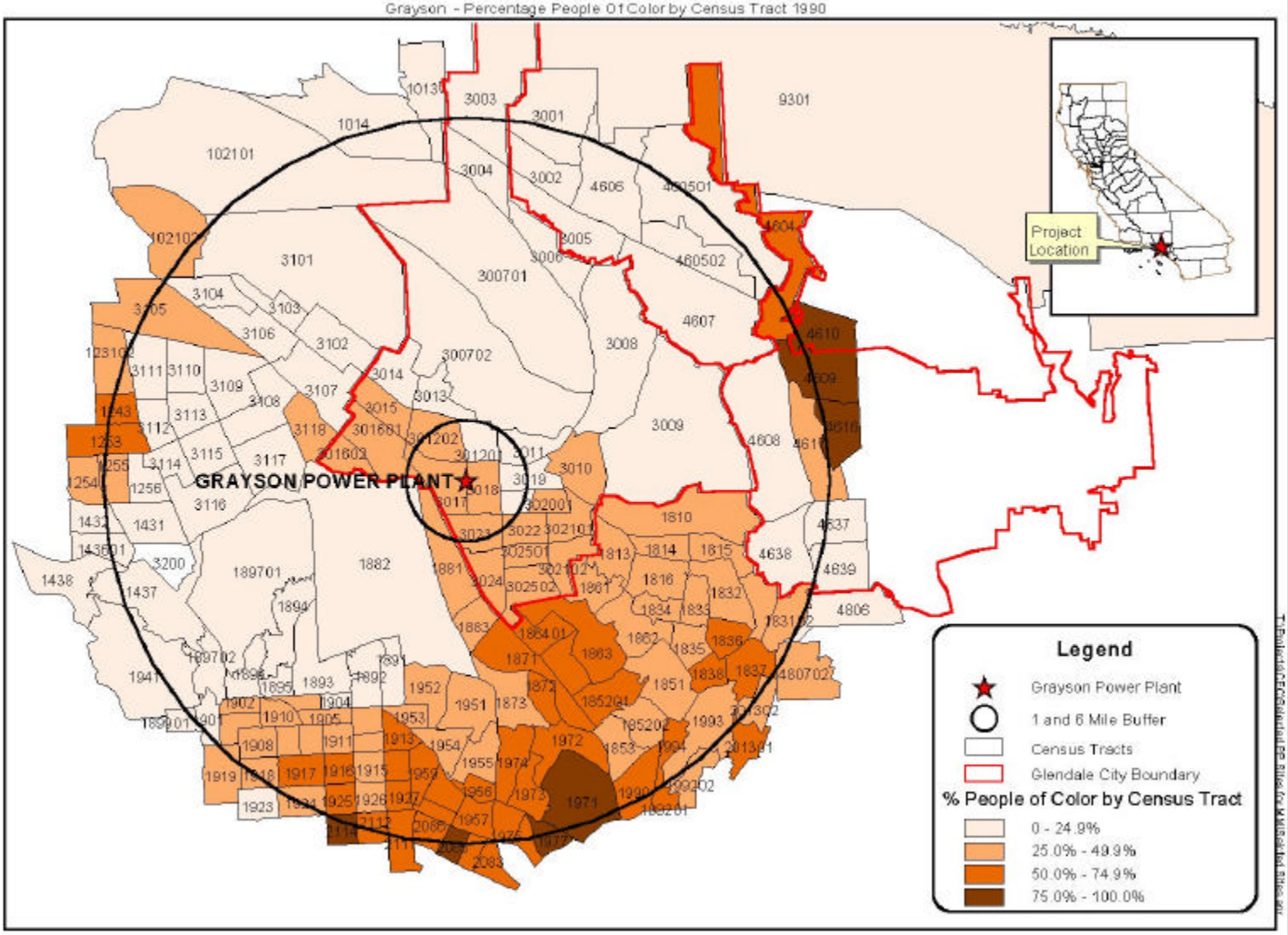


SOCIOECONOMICS - FIGURE 2
Encina Power Plant - Percentage Persons in Poverty by Census Tract 1990



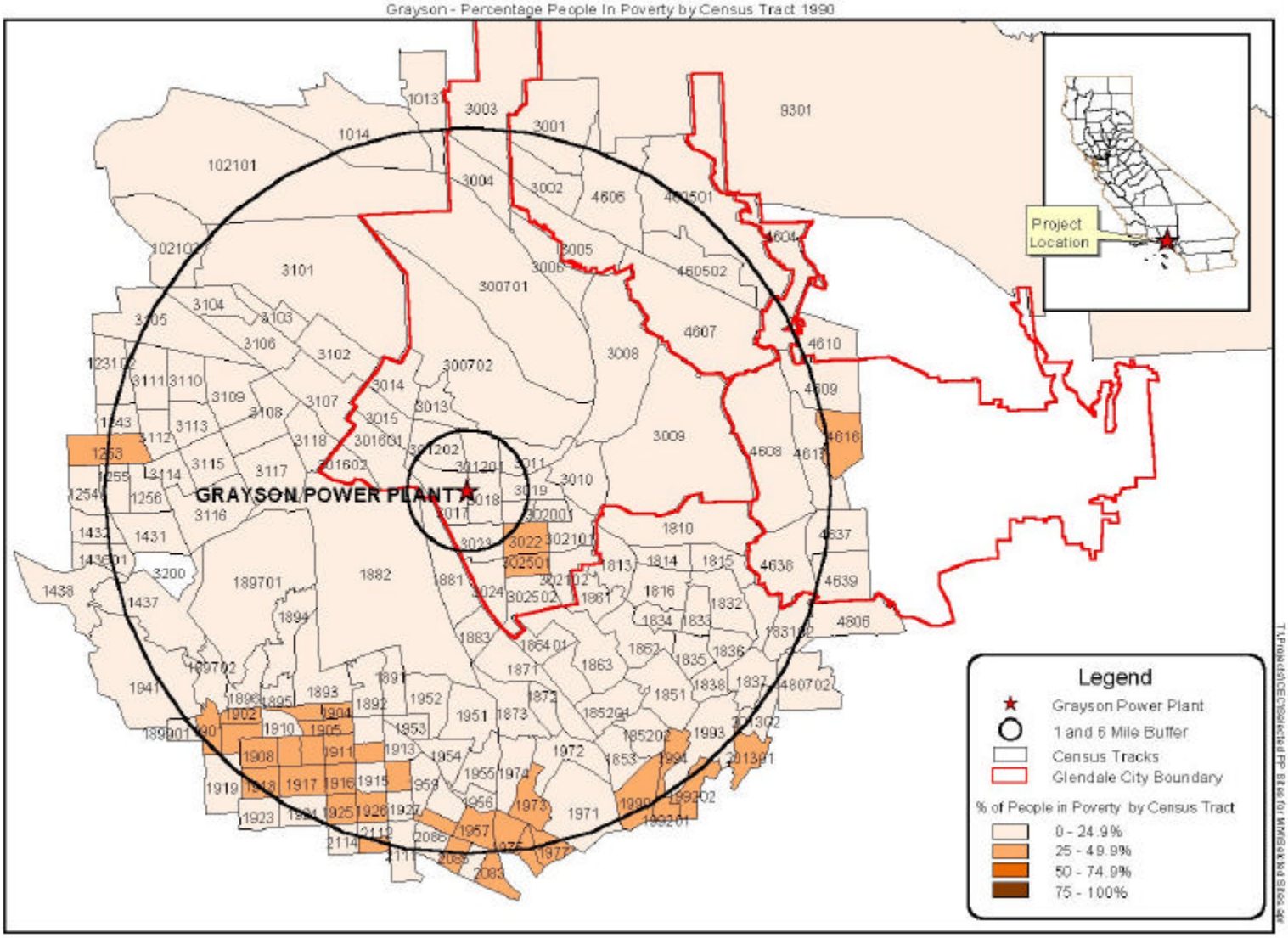
SOCIOECONOMICS - Figure 1

Grayson - Percentage People Of Color by Census Tract 1990



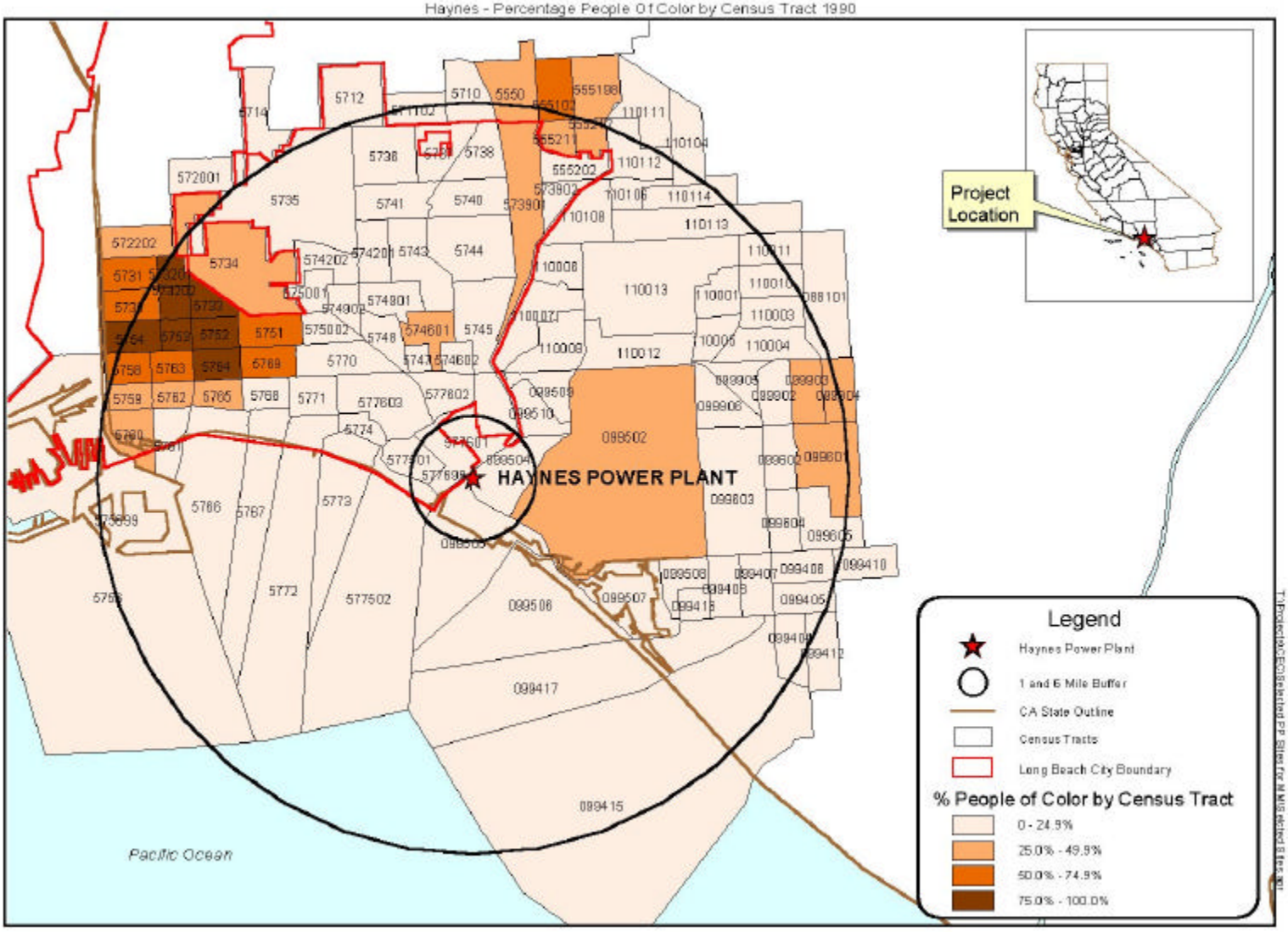
SOCIOECONOMICS - Figure 2

Grayson - Percentage People In Poverty by Census Tract 1990



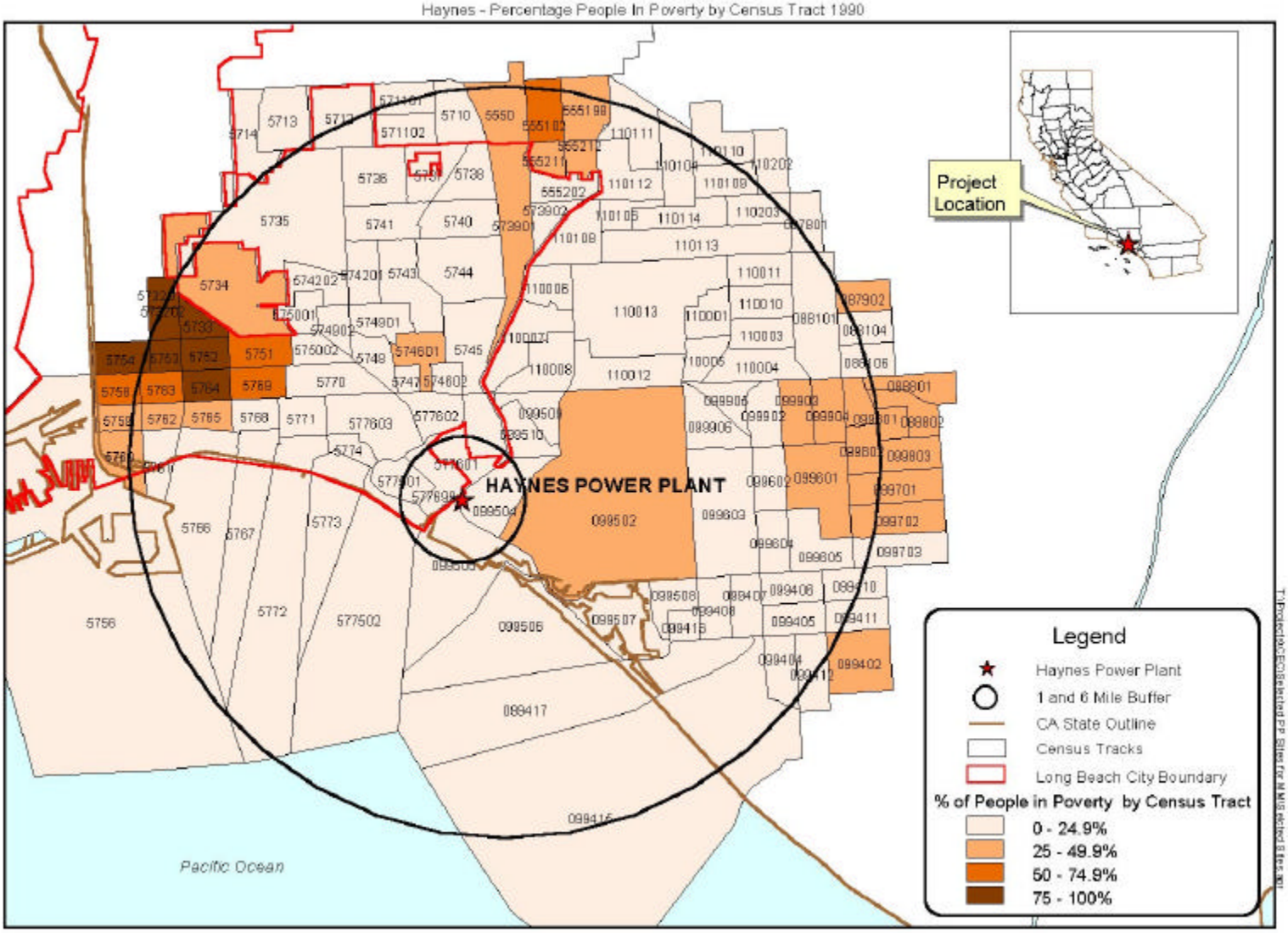
SOCIOECONOMICS - Figure 1

Haynes - Percentage People Of Color by Census Tract 1990



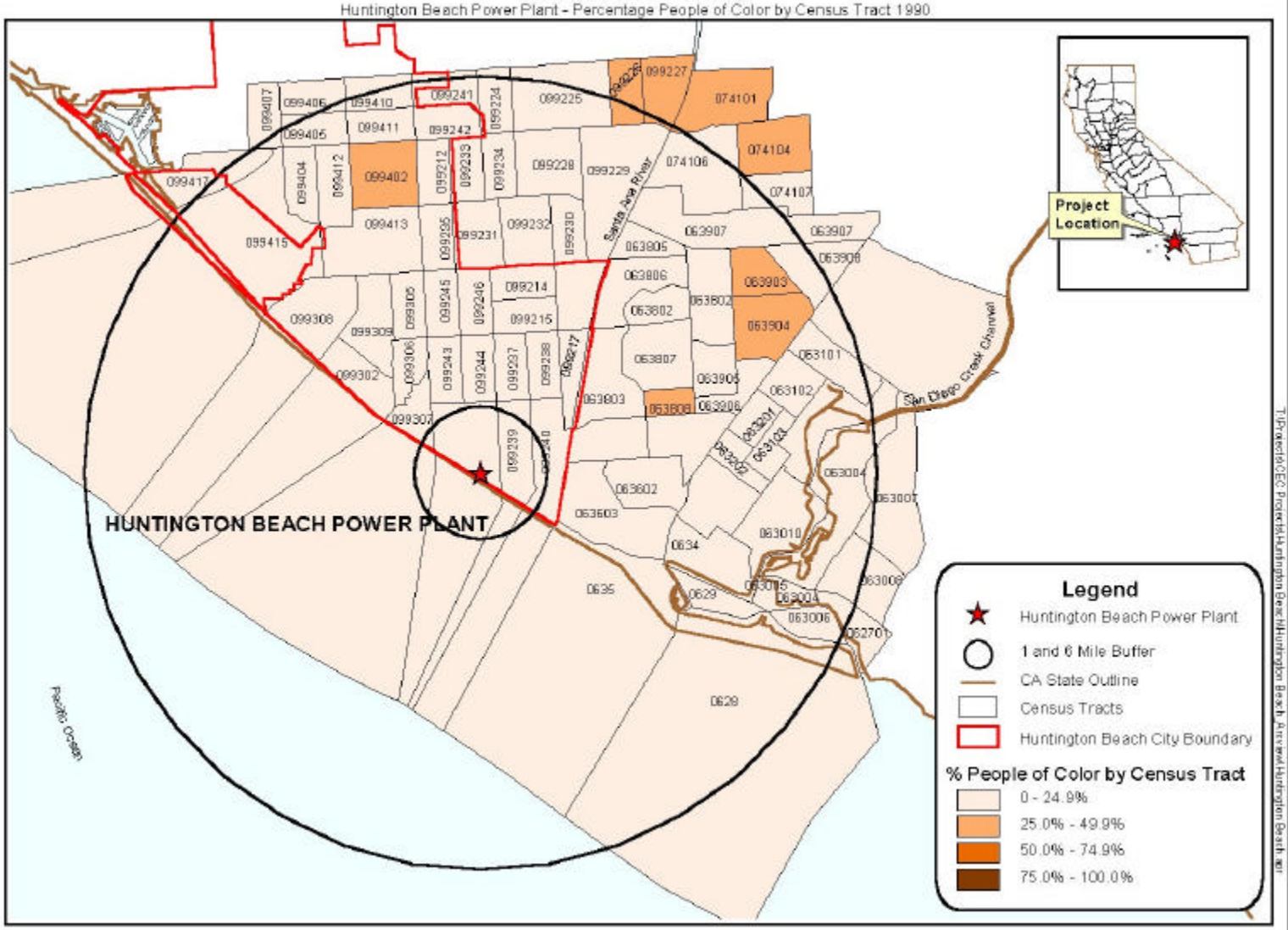
SOCIOECONOMICS - Figure 2

Haynes - Percentage People In Poverty by Census Tract 1990



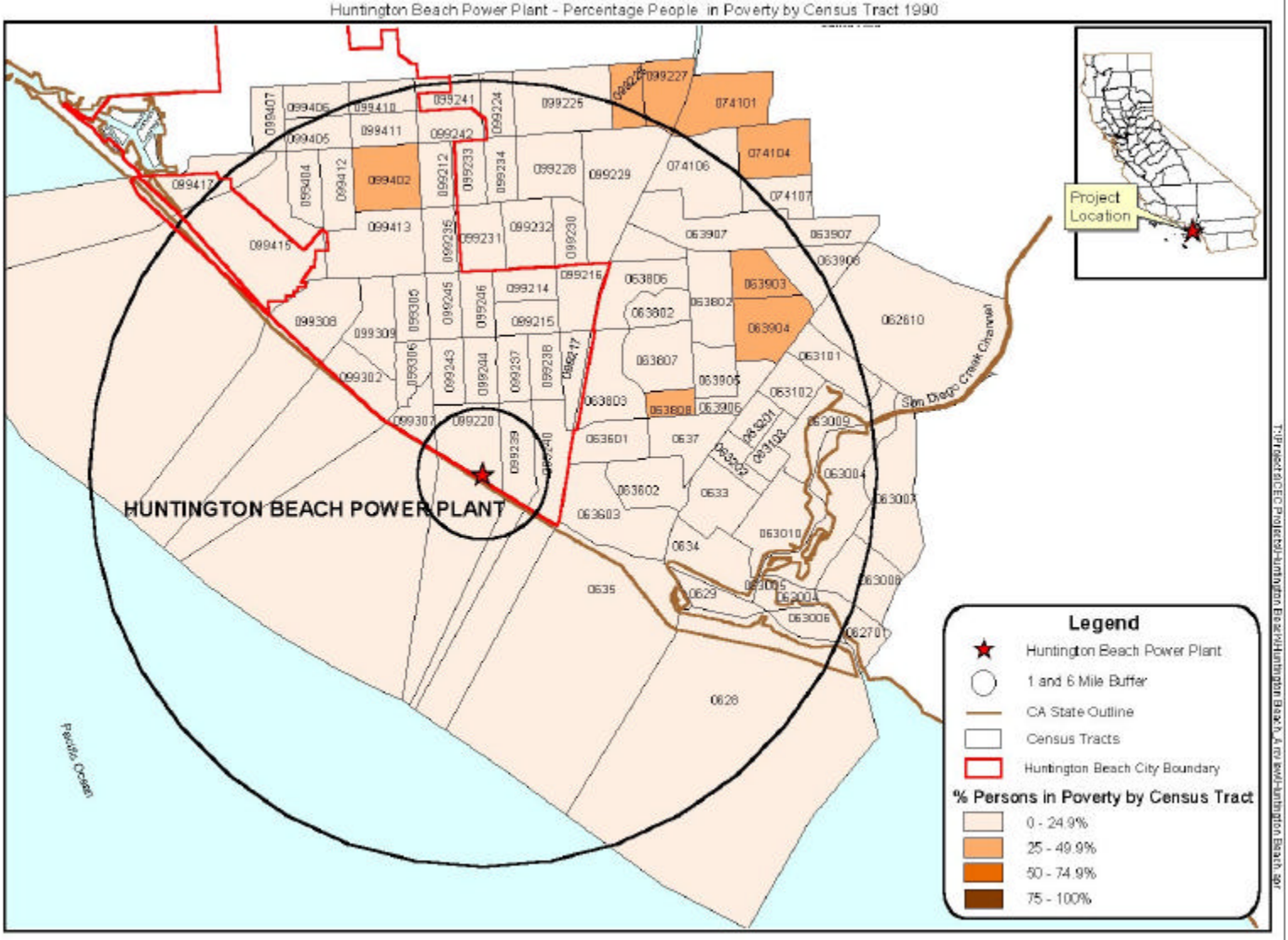
SOCIOECONOMICS - FIGURE 1

Huntington Beach Power Plant - Percentage People of Color by Census Tract 1990



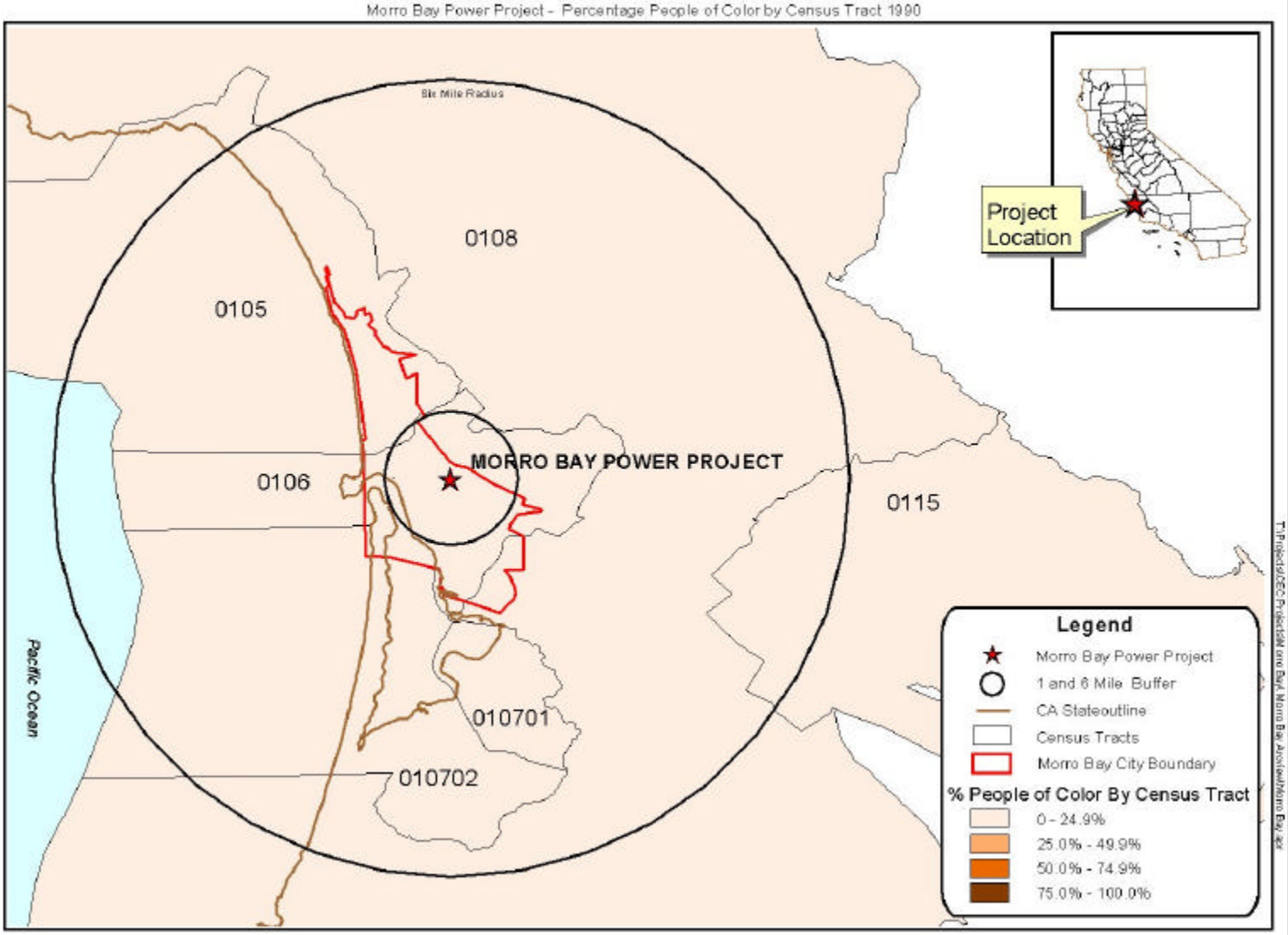
SOCIOECONOMICS - FIGURE 2

Huntington Beach Power Plant - Percentage People in Poverty by Census Tract 1990



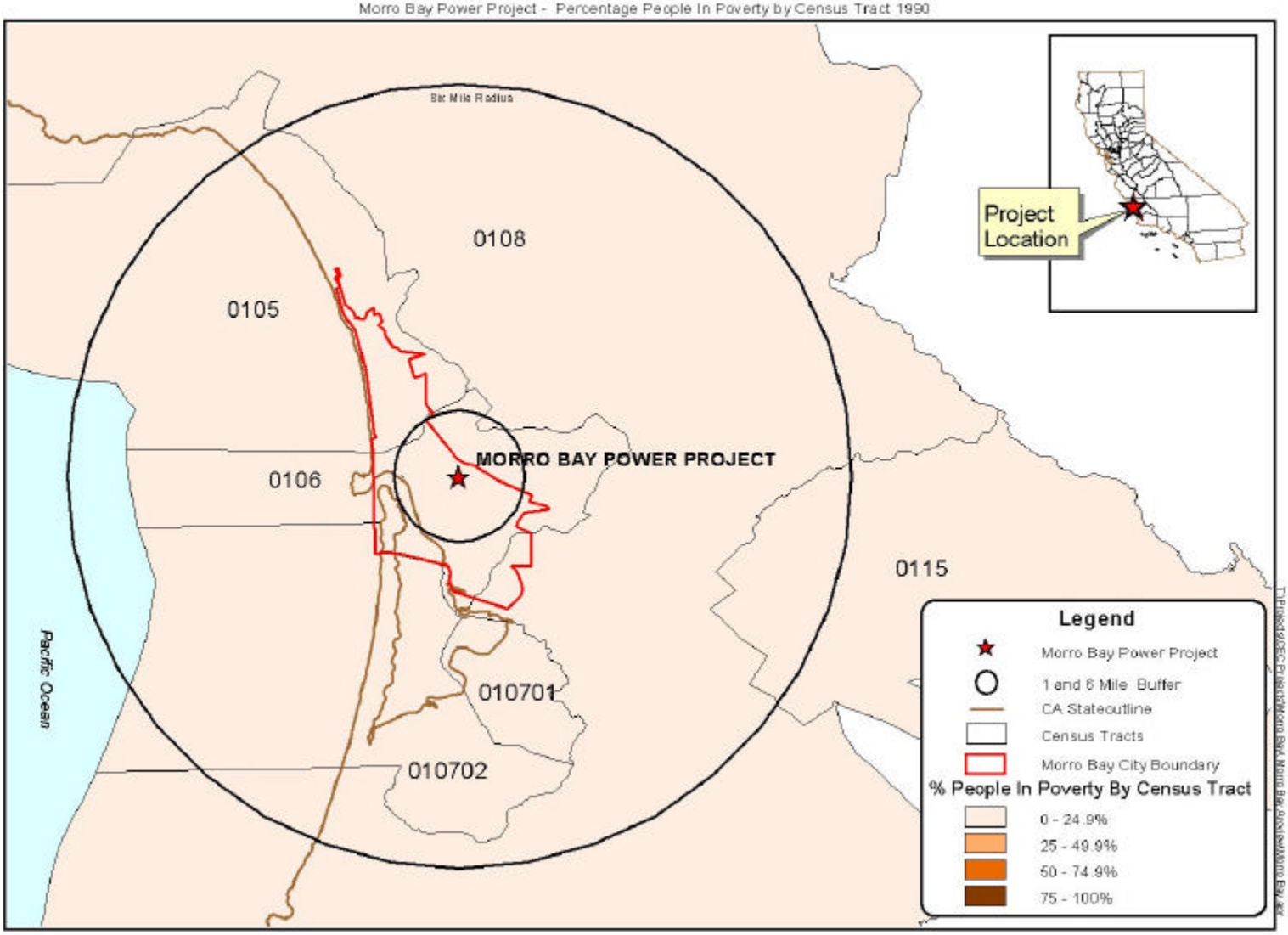
SOCIOECONOMICS - FIGURE 1

Morro Bay Power Project - Percentage People of Color by Census Tract 1990



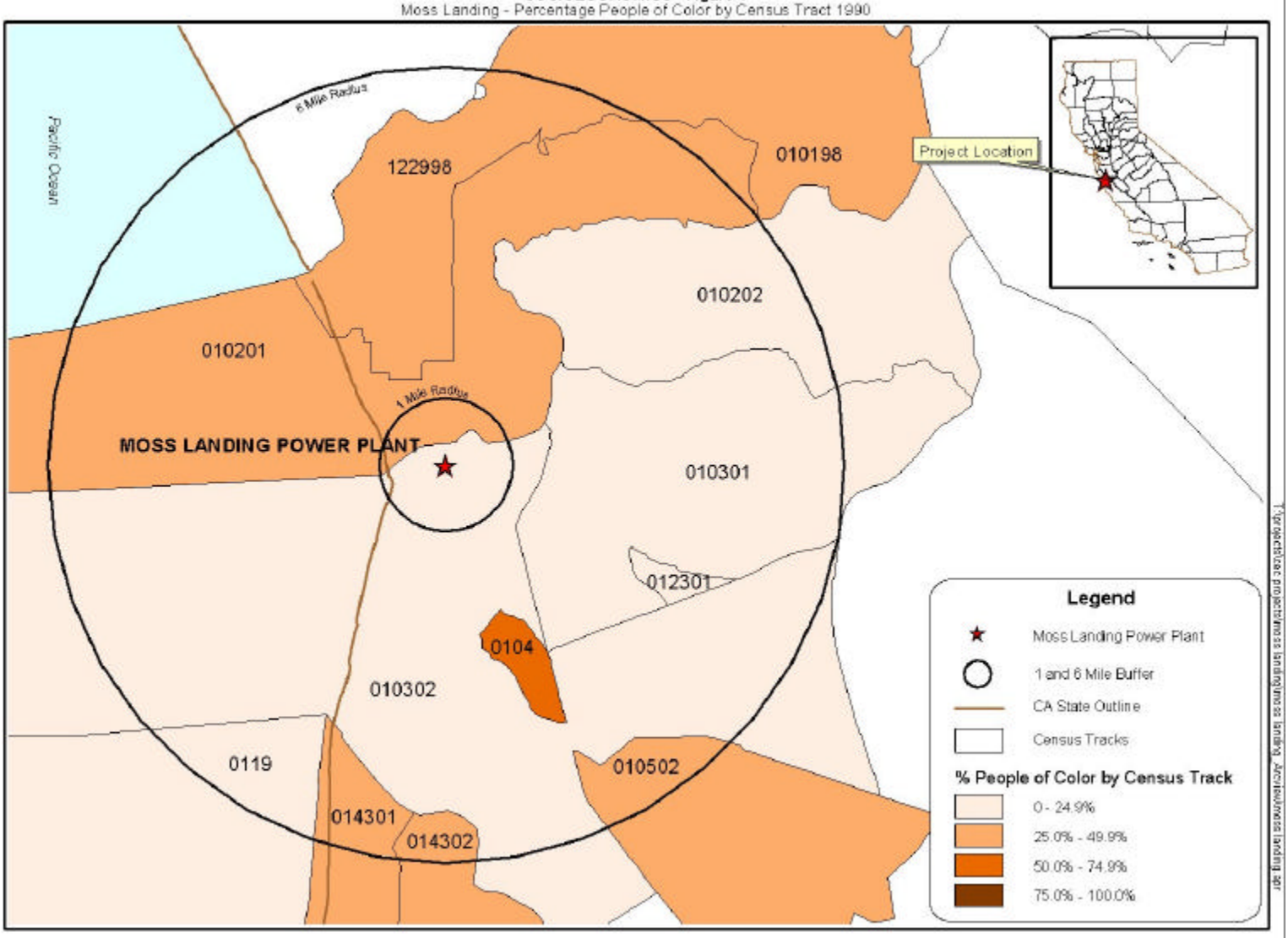
SOCIOECONOMICS - FIGURE 2

Morro Bay Power Project - Percentage People In Poverty by Census Tract 1990



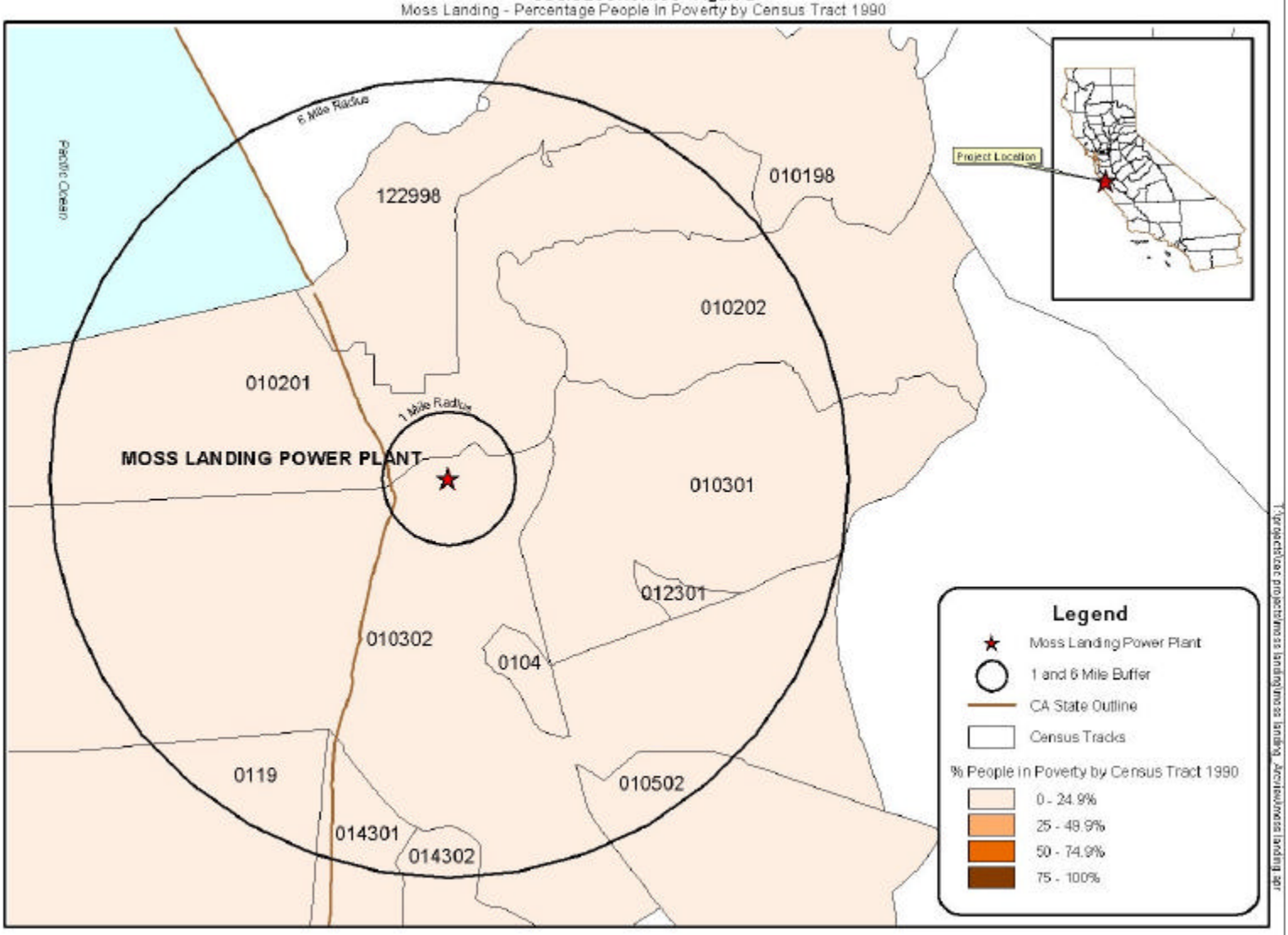
SOCIOECONOMICS - Figure 1

Moss Landing - Percentage People of Color by Census Tract 1990



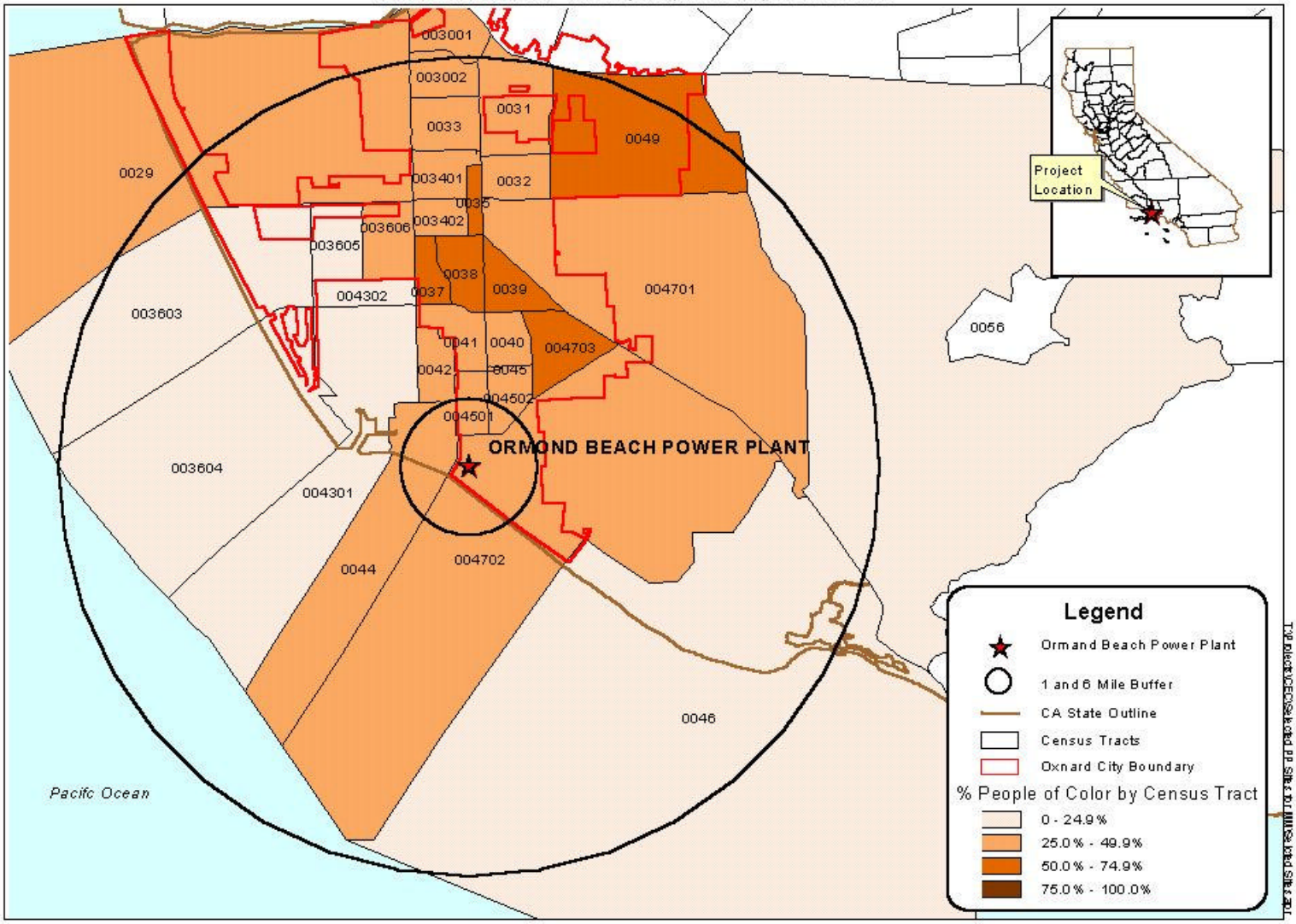
SOCIOECONOMICS - Figure 2

Moss Landing - Percentage People In Poverty by Census Tract 1990



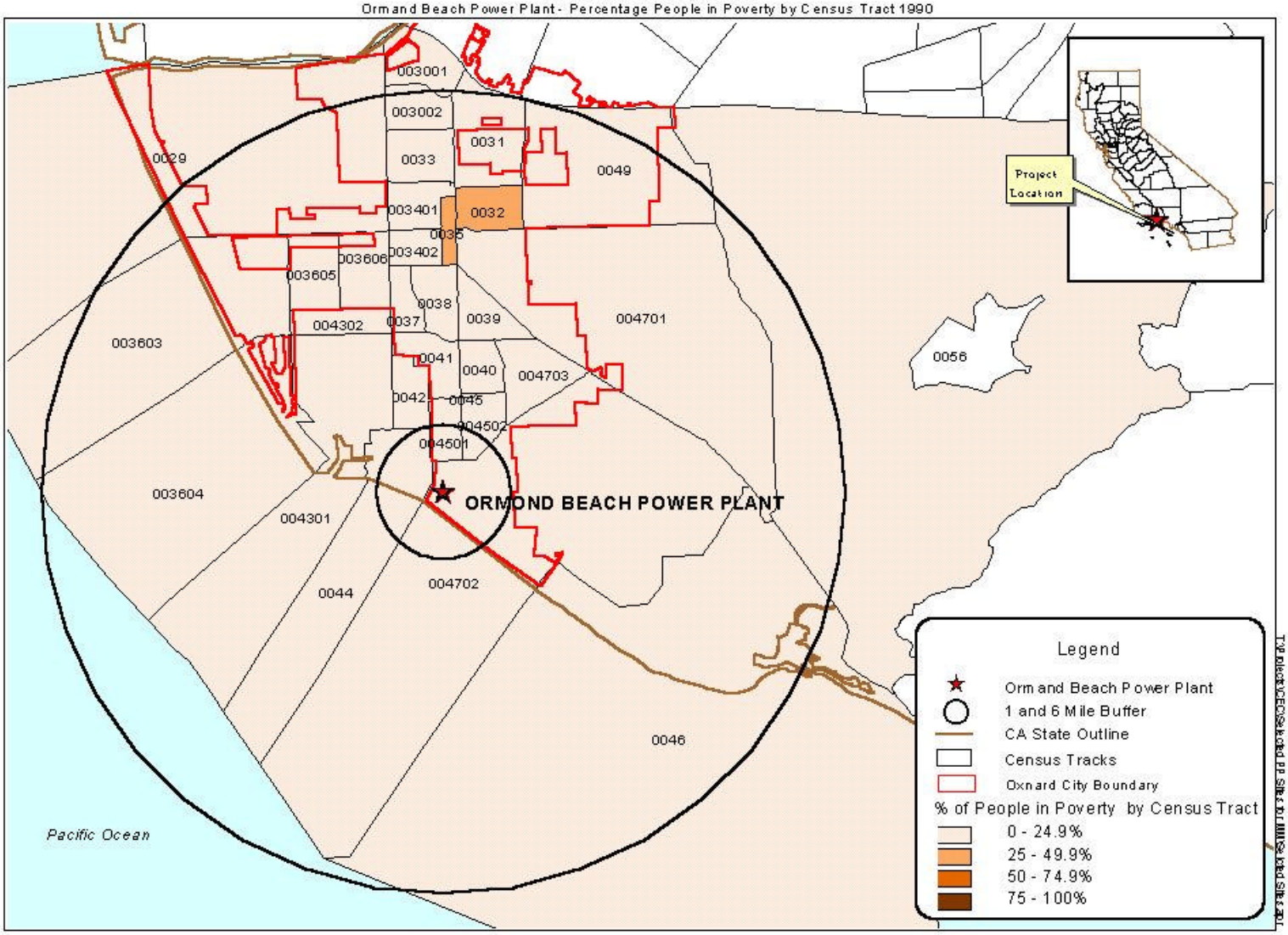
SOCIOECONOMICS - Figure 1

Ormand Beach Power Plant - Percentage People of Color by Census Tract 1990



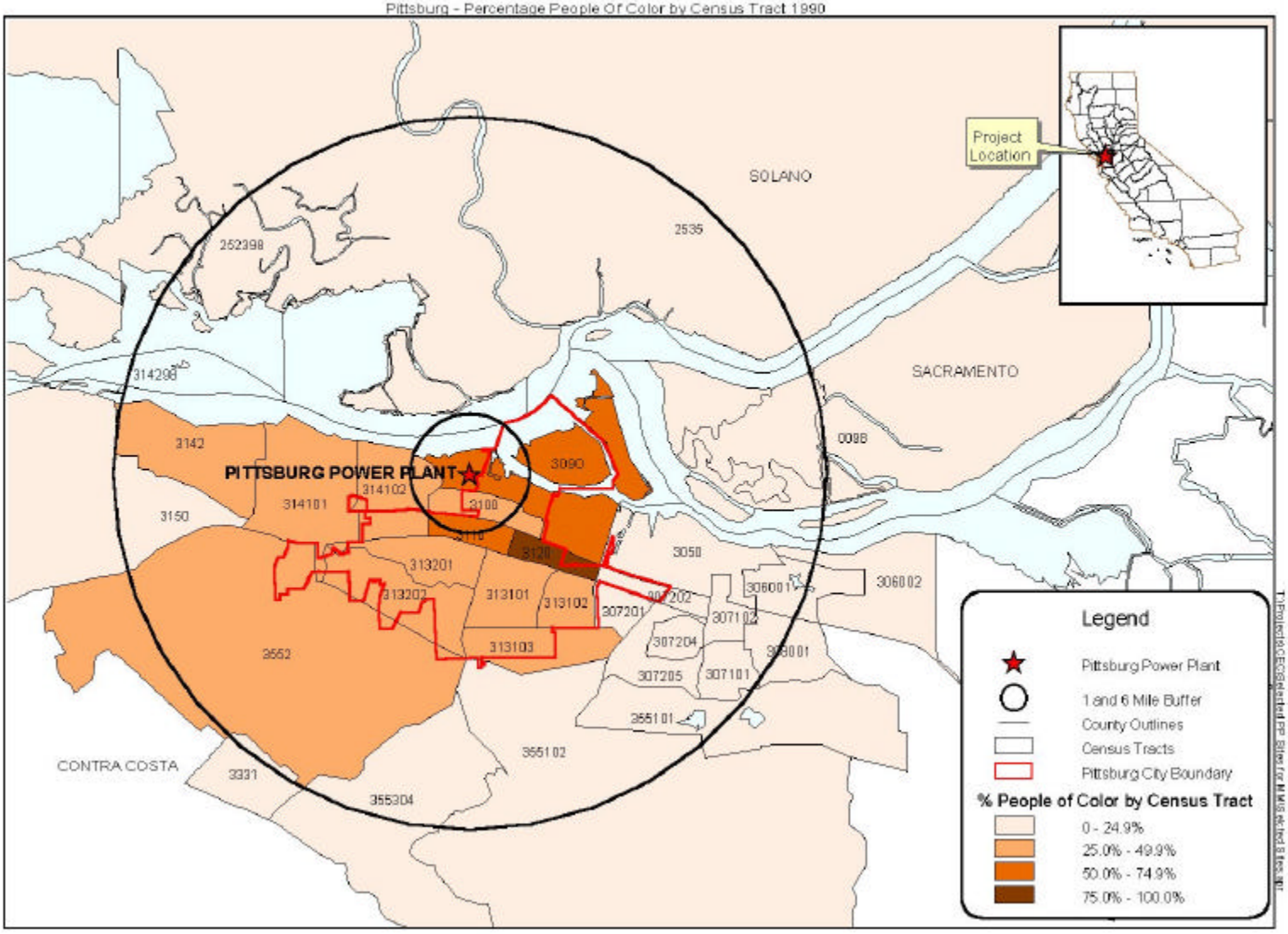
SOCIOECONOMICS - Figure 2

Ormand Beach Power Plant - Percentage People in Poverty by Census Tract 1990



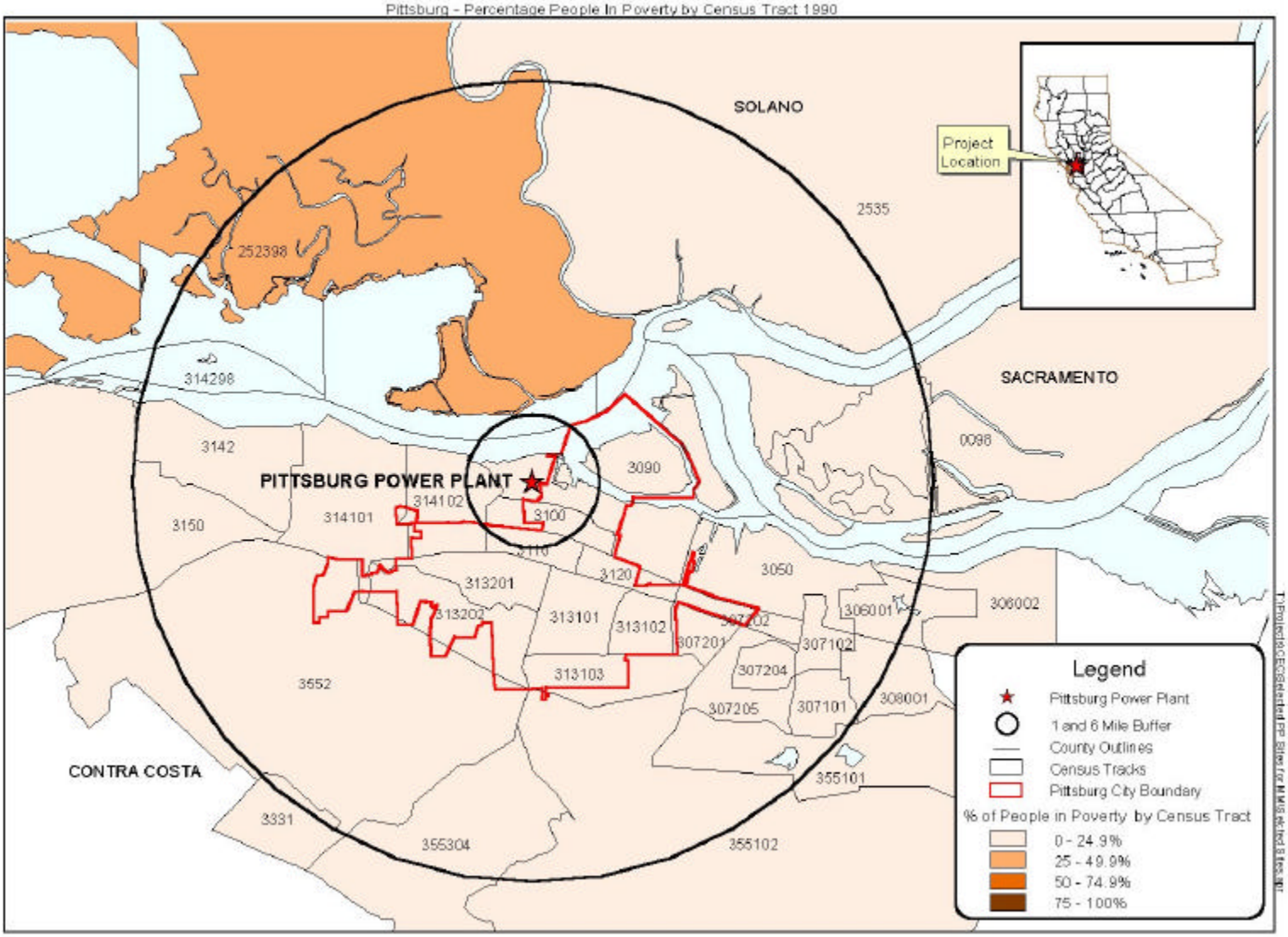
SOCIOECONOMICS - Figure 1

Pittsburg - Percentage People Of Color by Census Tract 1990



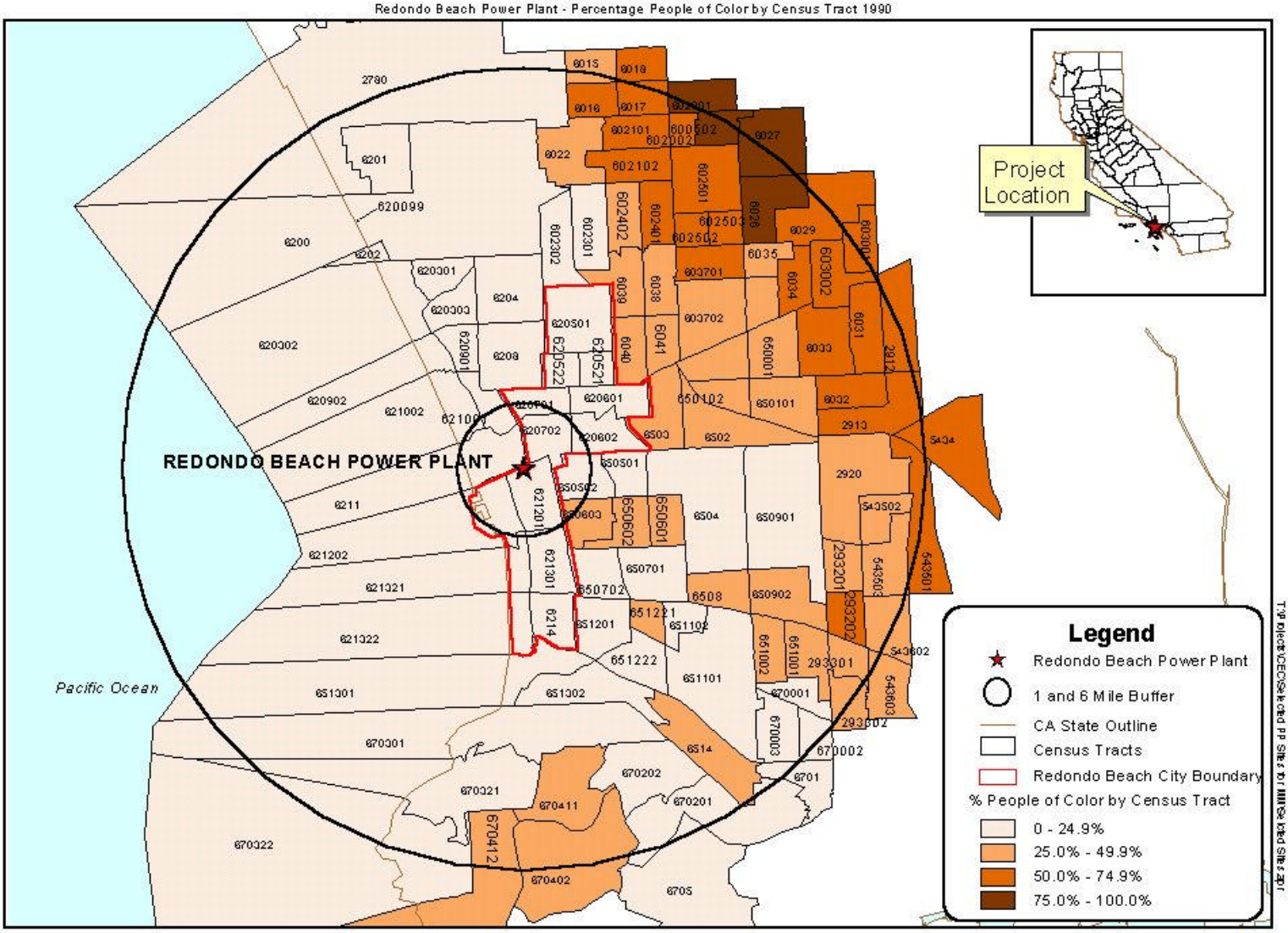
SOCIOECONOMICS - Figure 2

Pittsburg - Percentage People In Poverty by Census Tract 1990



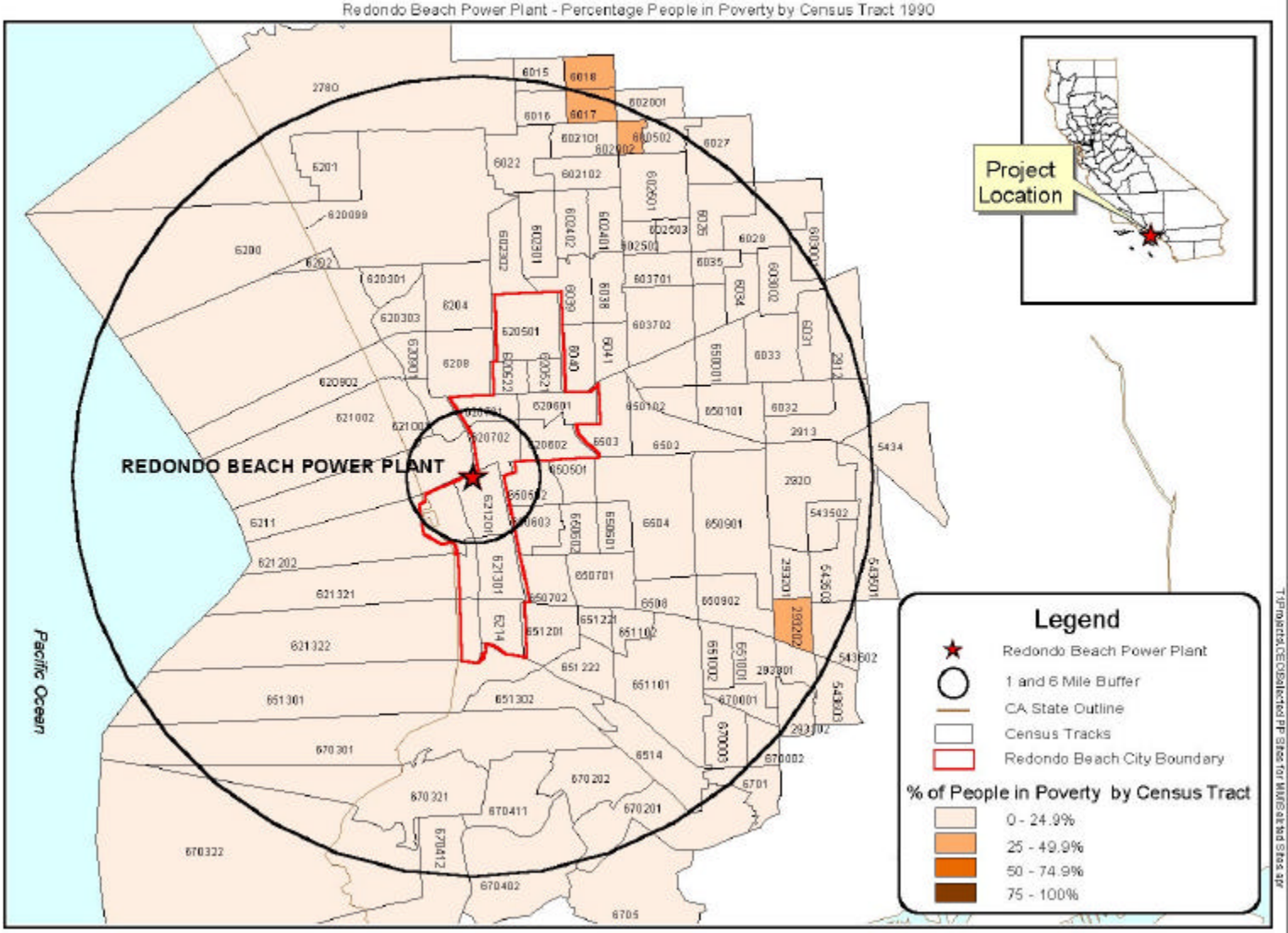
SOCIOECONOMICS - Figure 1

Redondo Beach Power Plant - Percentage People of Color by Census Tract 1990



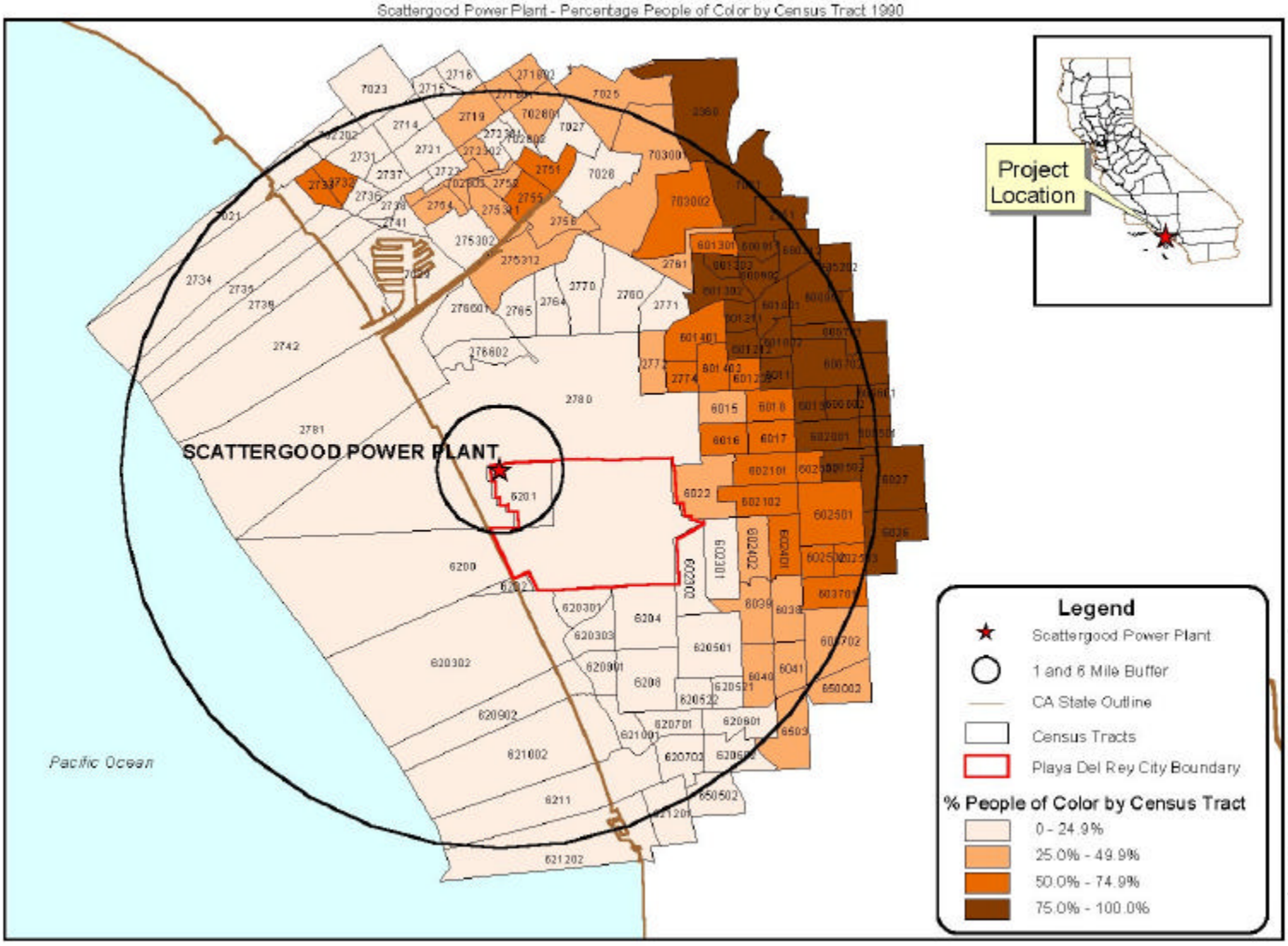
SOCIOECONOMICS - Figure 2

Redondo Beach Power Plant - Percentage People in Poverty by Census Tract 1990



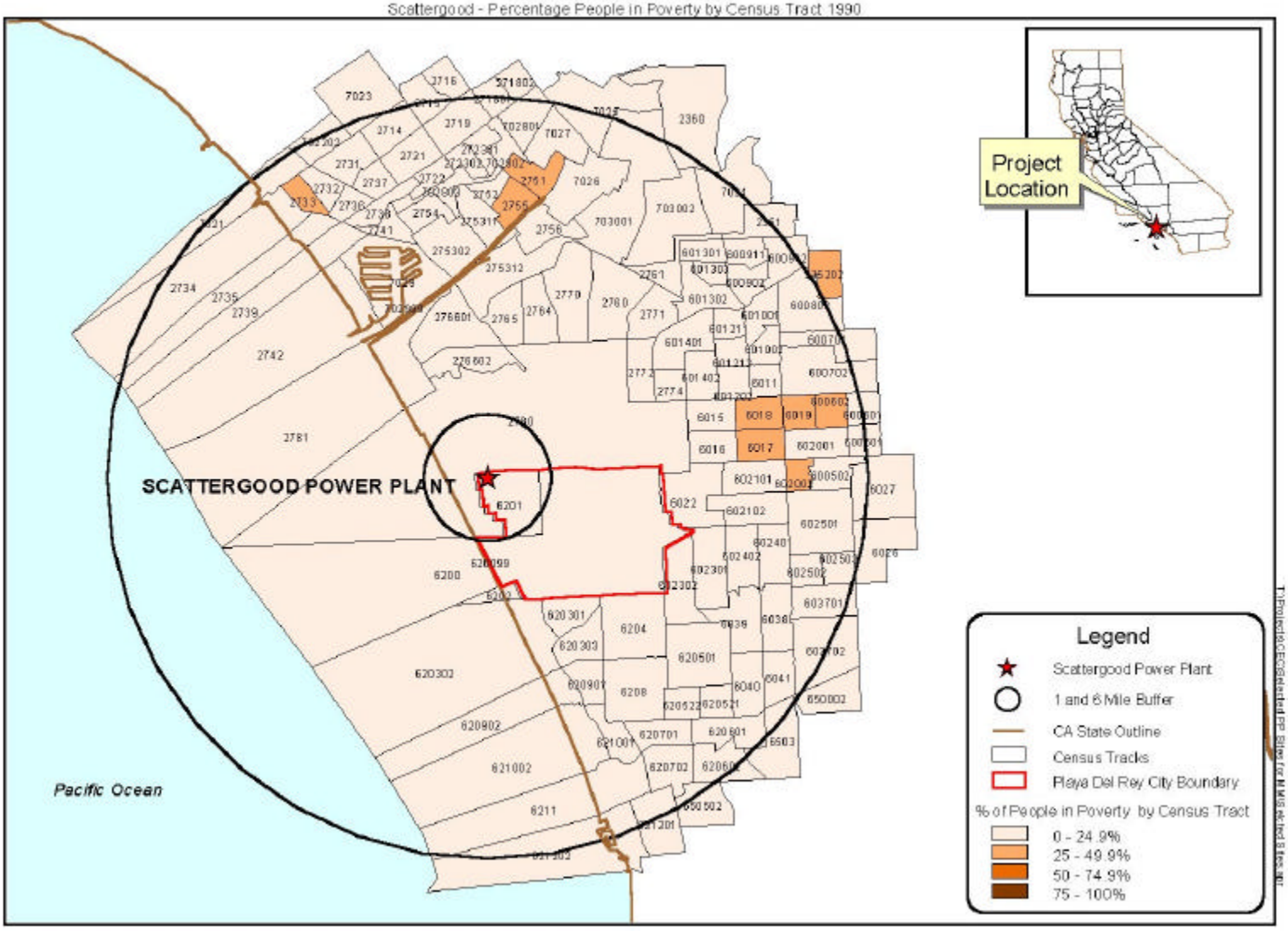
SOCIOECONOMICS - Figure 1

Scattergood Power Plant - Percentage People of Color by Census Tract 1990



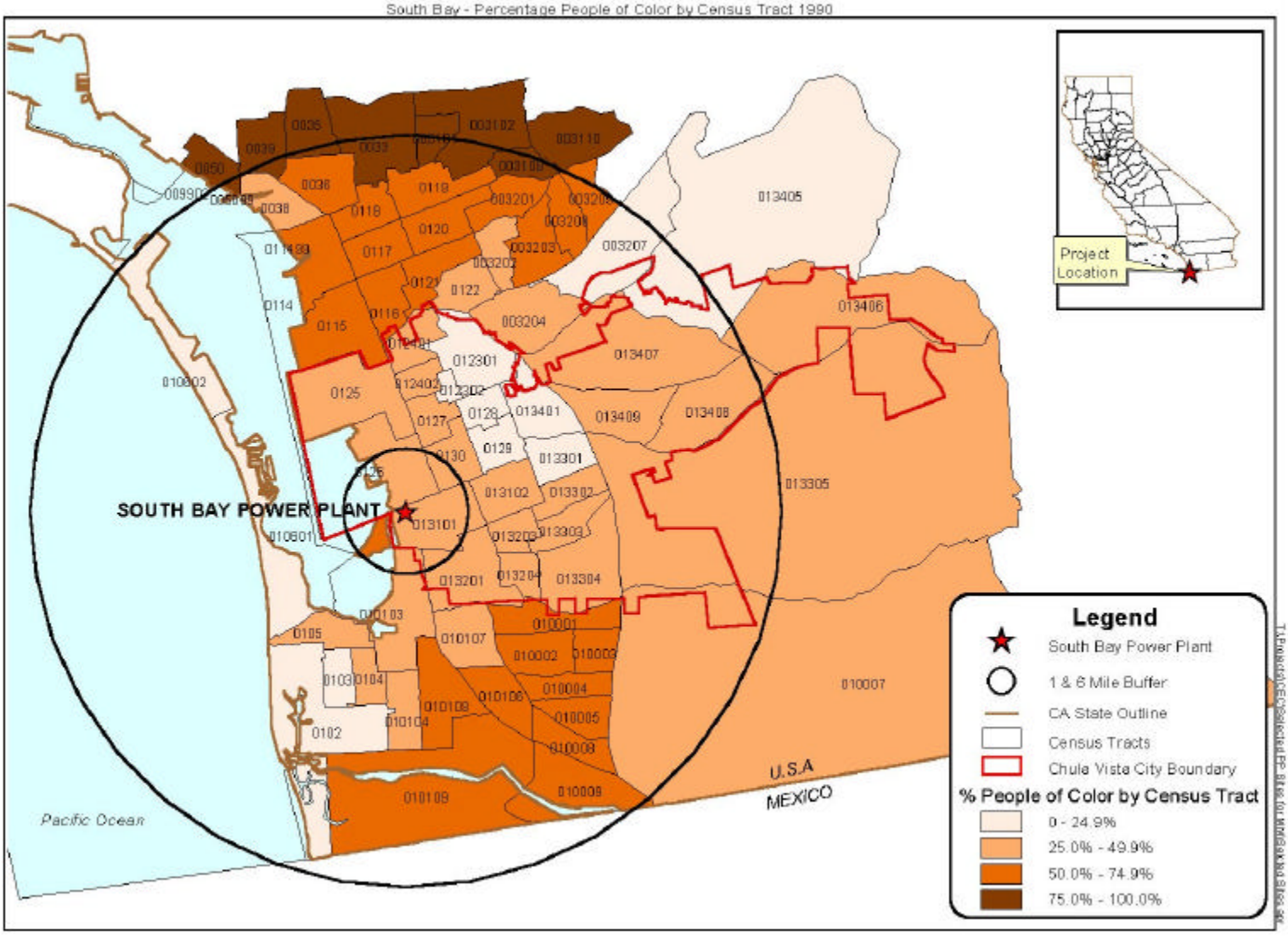
SOCIOECONOMICS - Figure 2

Scattergood - Percentage People in Poverty by Census Tract 1990



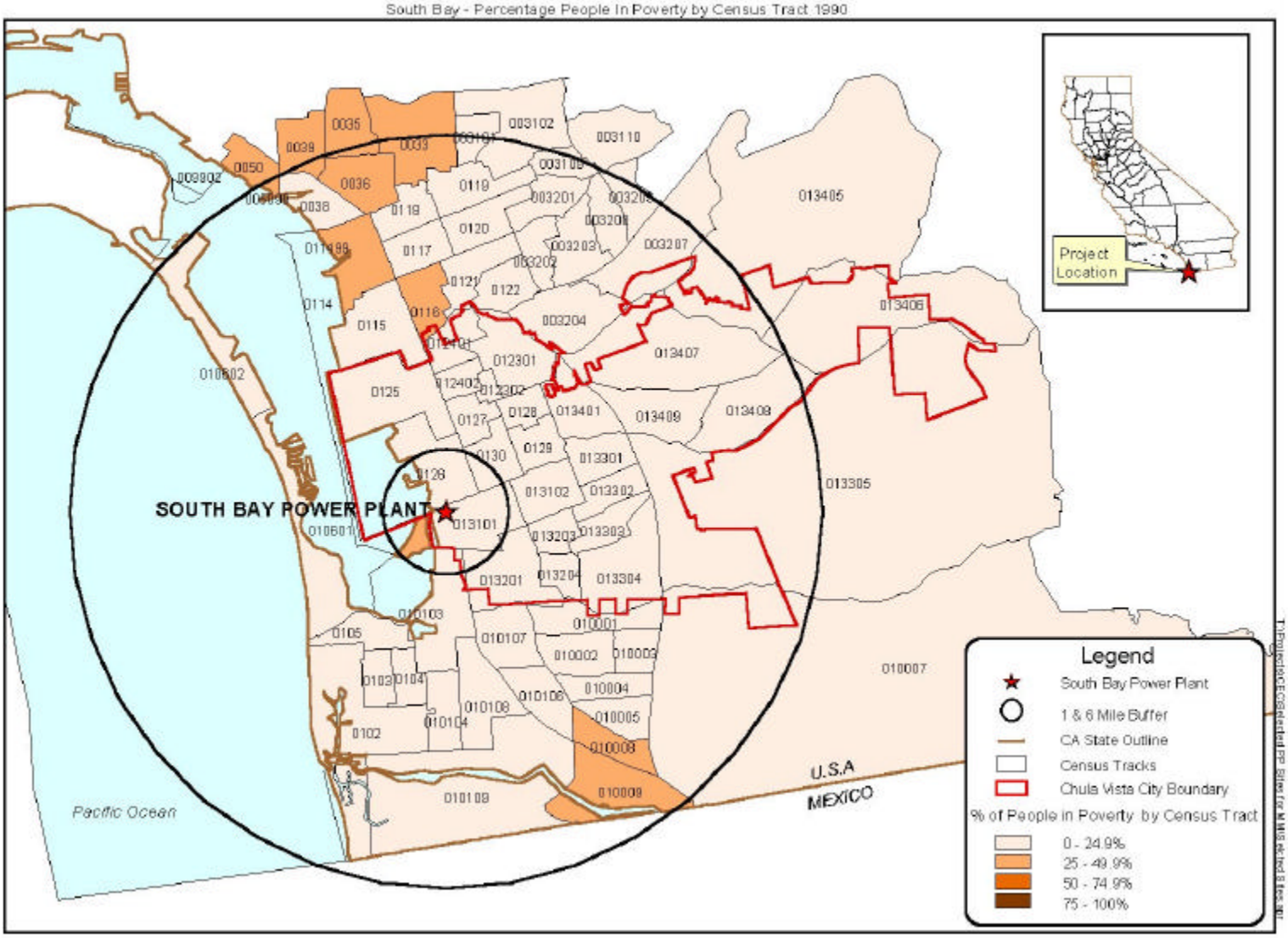
SOCIOECONOMICS - Figure 1

South Bay - Percentage People of Color by Census Tract 1990



SOCIOECONOMICS - Figure 2

South Bay - Percentage People In Poverty by Census Tract 1990



CALIFORNIA ENERGY COMMISSION - SITING PROJECT STATUS AND DEMOGRAPHICS

6/19/01

	12-Month Projects Approved	Status	Capacity (MW)	Project Type	Location	Decision Date	On-line Date*	Urban (U) or Rural (R)	Percent Minority	Percent Low-income
1	Sutter	Construction	500	Green Field	Sutter Co.	4/99	7/01	R	29	18
2	Los Medanos	Construction	559	Brown Field	Contra Costa	8/99	7/01	U	44	12
3	Sunrise	Construction	320	Green Field	Kern Co.	12/00	8/01	R	43	31
4	La Paloma	Construction	1,048	Green Field	Kern Co.	10/99	12/01-3/02	U	34	27
5	Delta	Construction	880	Brown Field	Contra Costa	2/00	4/02	U	33	10
6	High Desert	Construction	720	Brown Field	San Bernardino	5/00	7/03	R	36	27
7	Elk Hills	Construction	500	Brown Field	Kern Co.	12/00	3/03	R	34	27
8	Blythe	Construction	520	Green Field	Riverside Co.	3/01	3/03	R	54	19.3
9	Pastoria	Financing	750	Green Field	Kern Co.	12/00	1/03	R	19	9.8
10	Midway-Sunset	Financing	500	Expansion	Kern Co.	3/01	3/03	R	10	20
11	Mountainview	Financing	1,056	Expansion	San Bernardino	3/01	12/02	U	32	15
12	Otay Mesa	Financing	510	Green Field	San Diego Co.	4/01	4/03	R	58	2.9
13	Three Mountain	Financing	500	Brown Field	Shasta Co.	5/01	5/03	R	5	20

	Four- Month Projects Approved	Status	Capacity (MW)	Project Type	Location	Decision Date	On-line Date*	Urban (U) or Rural (R)	Percent Minority	Percent Low-income
1	United Golden Gate	No site control	[51]	Brown Field	San Mateo Co.	3/7/01		U	42	6
2	Hanford SPPE	Modified	[99]	Green Field	Kings Co.	4/11/01	Modified	R	46	25

	21-Day Projects Approved	Status	Capacity (MW)	Project Type	Location	Decision Date	On-line Date*	Urban (U) or Rural (R)	Percent Minority	Percent Low-income
1	*Wildflower Larkspur*	*Construction*	*90*	*Green Field*	*San Diego Co.*	*4/4/01*	*7/01*	R	72.3	5.11
2	*Wildflower Indigo*	*Construction*	*135*	*Green Field*	*Riverside Co.*	*4/4/01*	*7/01*	R	41.4	14.3
3	*Alliance Century*	*Construction*	*40*	*Brown Field*	*San Bernardino*	*4/25/01*	*8/01*	U	63	17
4	*Alliance Drews*	*Construction*	*40*	*Brown Field*	*San Bernardino*	*4/25/01*	*8/01*	U	65	16
5	*Calpine King City*	*Financing*	*50*	*Brown Field*	*Monterey Co.*	*5/2/01*	*9/01*	U	76**	11
6	*GWF Hanford*	*Construction*	*95*	*Brown Field*	*Kings Co.*	*5/10/01*	*8/01*	R	46**	25
7	*Calpine Gilroy Phase I*	*Construction*	*135*	*Brown Field*	*Santa Clara Co.*	*5/21/01*	*9/01*	R	57.6**	12.5
8	*Pegasus Energy*	*Financing*	*180*	*Brown Field*	*San Bernardino Co.*	*6/6/01*	*9/01*	U	51.1**	5.8
9	*Calpeak Escondido*	*Financing*	*49*	*Brown Field*	*San Diego Co.*	*6/6/01*	*9/01*	U	39**	10.9
10	*Ramco Chula Vista***	*Emergency*	*62*	*Brown Field*	*San Diego Co.*	*6/13/01*	*9/01*	U	49	13

	12-Month Projects in Review	Status	Capacity (MW)	Project Type	Location	Decision Date	On-line Date*	Urban (U) or Rural (R)	Percent Minority	Percent Low-income
1	Metcalf	12-mo. AFC	600	Green Field	Santa Clara Co.	7/01	7/03	U	38	5
2	Potrero	12-mo. AFC	540	Expansion	San Francisco	11/01	11/03	U	53.6	12.7
3	ElSegundo Repower 2/	12-mo. AFC	630	Replacement	Los Angeles Co.	2/02	2/04	U	70.2	7.8
4	Rio Linda/Elverta	12-mo. AFC	560	Green Field	Sacramento Co.	5/02	5/04	R	38	13
5	East Altamont	12-mo. AFC	1,100	Green Field	Alameda Co.	3/02	5/04	R	32	2.6
6	Nueva Azalea	12-mo. AFC	[550]	Brown Field	Los Angeles Co.	suspended	suspended	U	85	21
7	Contra Costa	Financing	530	Expansion	Contra Costa	7/01	7/03	U	27	8.7

CALIFORNIA ENERGY COMMISSION - SITING PROJECT STATUS AND DEMOGRAPHICS

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	Six-Month Projects in Review	Status	Capacity (MW)	Project Type	Location	Decision Date	On-line Date*	Urban (U) or Rural (R)	Percent Minority	Percent Low-income
1	Pastoria II	6-mo. AFC	250	Green Field	Kern Co.	1/02	4/04	R	19	9.8
2	Golden Gate	6-mo AFC	570	Brown Field	San Mateo Co.	1/02	11/03	U	42	6
3	Magnolia	6-mo. AFC	310	Expansion	Los Angeles Co.	1/02	11/03	U	46	14
4	Russell City	6-mo. AFC	600	Brown Field	Hayward	12/01	12/03	U		

	Four-Month Projects in Review	Status	Capacity (MW)	Project Type	Location	Decision Date	On-line Date*	Urban (U) or Rural (R)	Percent Minority	Percent Low-income
1	Ocotillo Peaker	4-mo. AFC	450	Green Field	Riverside Co.	10/01	6/02	R		
2	Valero Cogeneration	4-mo. AFC	102	Brown Field	Solano Co.	9/01	4/02	U		
3	Woodland II	SPPE	80	Brown Field	Stanislaus Co	9/01	10/03	U		

	21 Day Projects In Review	Status	Capacity (MW)	Project Type	Location	Decision Date	On-line Date*	Urban (U) or Rural (R)	Percent Minority	Percent Low-income
1	*Ramco Chula Vista*	*Emergency*	*62*	*Brown Field*	*San Diego Co.*	*6/01*	*9/01*	U	49**	13
2	*Baldwin Hills Unit 1*	*Emergency*	*53*	*Brown Field*	*Los Angeles Co.*	*6/01*	*9/01*	U	65.2**	8.9
3	*Lancaster La Jolla*	*Emergency*	*240*	*Brown Field*	*Los Angeles Co.*	*6/01*	*9/01*	R	36.1**	9.5
4	*Evergreen Concord*	*Emergency*	*50*	*Green Field*	*Contra Costa*	*6/01*	*9/01*			
5	*Chino Organic Power*	*Emergency*	*160*	*Brown Field*	*San Bernardino Co*	*6/01*	*9/01*			
6	*Calpeak Border*	*Emergency*	*49*	*Green Field*	*San Diego Co.*	*6/01*	*9/01*	R	72.3	5.11

	45 Day Amendments in Review	Status	Capacity (MW)	Project Type	Location	Decision Date	On-line Date*	Urban (U) or Rural (R)	Percent Minority	Percent Low-income
1	Sunrise Comb. Cycle	Amendment	260	Expansion	Kern Co.	08/01	6/03	R	43	31

CALIFORNIA ENERGY COMMISSION - SITING PROJECT STATUS AND DEMOGRAPHICS

6/19/01

Operating Projects		Capacity (MW)	Date Certified	Location	Filing Date	On-line Date*	Urban (U) or Rural (R)	Percent Minority	Percent Low-income
GEYSERS 17 (PG&E 17)	Operating	110	Sep-79	SONOMA CO.	n/a	n/a	R	19	12
NCPA 2 (NCPA 1)	Operating	110	Mar-80	SONOMA CO.	n/a	n/a	R	15	12
GEYSERS 18 (PG&E 18)	Operating	110	May-80	SONOMA CO.	n/a	n/a	R	19	12
GEYSERS 16 (PG&E 16)	Operating	110	Sep-81	LAKE COUNTY	n/a	n/a	R	7	13
SONOMA (SMUDGEO 1)	Operating	72	Mar-81	SONOMA CO.	n/a	n/a	R	19	12
TEXACO WILMINGTON	Operating	60	Mar-81	CARSON	n/a	n/a	U	72	17
CALISTOGA (Oxy, Santa Fe)	Operating	80	Feb-82	LAKE COUNTY	n/a	n/a	R	6	12
NCPA 3 (NCPA 2)	Operating	110	Dec-82	SONOMA CO.	n/a	n/a	R	16	12
GEYSERS 20 (PG&E 20)	Operating	110	Feb-83	SONOMA CO.	n/a	n/a	R	19	12
KERN RIVER (Omar Hill)	Operating	300	Aug-83	BAKERSFIELD	n/a	n/a	R	5	7
TOSCO MARTINEZ (Tosco cogen, Foster Wheeler Martinez	Operating	100	Nov-83	MARTINEZ	n/a	n/a	U	16	7
CALPINE GILROY	Operating	115	Nov-85	GILROY	n/a	n/a	R	55	21
SYCAMORE	Operating	300	Dec-86	BAKERSFIELD	n/a	n/a	R	7	8
AES PLACERITA	Operating	120	Dec-85	LA COUNTY	n/a	n/a	R	27	8
ARCO WATSON	Operating	385	Sep-86	CARSON	n/a	n/a	U	79	9
MIDWAY-SUNSET	Operating	225	May-87	WEST KERN CO.	n/a	n/a	R	12	5
CALPINE KING CITY	Operating	120	Jul-87	KING CITY	n/a	n/a	U	52	14
EL SEGUNDO	Operating	77	Apr-86	EL SEGUNDO	n/a	n/a	U	15	4
CHAMPLIN	Operating	79	Jun-86	WILMINGTON	n/a	n/a	U	17	42
ACE (ARGUS)	Operating	100	Jan-88	TRONA	n/a	n/a	R	8	17
CHEVRON RICHMOND	Operating	99	Nov-87	RICHMOND	n/a	n/a	U	84	31
SWEPI BELRIDGE	Operating	60	Oct-88	SO. BELRIDGE	n/a	n/a	R	12	13
SEGS III-VII	Operating	150	May-88	KRAMER JCT.	n/a	n/a	R	18	9
SEGS VIII	Operating	80	Mar-89	HARPER LAKE	n/a	n/a	R	18	9
COSO NAVY 2	Operating	80	Dec-88	COSO JUNCTION	n/a	n/a	R	23	13
MOJAVE	Operating	55	Apr-89	BORON	n/a	n/a	R	16	11
SEGS IX	Operating	160	Feb-90	HARPER LAKE	n/a	n/a	R	18	9
IID EL CENTRO UNIT #2	Operating	80	May-91	EL CENTRO	n/a	n/a	R	7	23
CROCKETT	Operating	240	Apr-93	CROCKETT	n/a	n/a	R	14	4
SMUD GAS PIPELINE	Operating	n/a	May-94	YOLO/SACTO CO.	n/a	n/a	R & U	N/A	N/A
CARSON ICE-GEN	Operating	95	Jun-93	SACRAMENTO	n/a	n/a	U	37	6
REDDING PEAKING	Operating	73	May-93	REDDING	n/a	n/a	U	9	11
PROCTER & GAMBLE Phase 1	Operating	171	Nov-94	SACRAMENTO	n/a	n/a	U	37	17
CAMPBELL	Operating	158	Nov-94	SACRAMENTO	n/a	n/a	U	48	29
EQUILON	Operating	99	Mar-94	MARTINEZ	n/a	n/a	U	12	6
TOTAL	**35-PROJECTS**	**5,665**							

CALIFORNIA ENERGY COMMISSION - SITING PROJECT STATUS AND DEMOGRAPHICS

6/19/01

	Coastal Projects	Status	Capacity (MW)	Project Type	Location	Decision Date	On-line Date*	Urban (U) or Rural (R)	Percent Minority	Percent Low-income
1	Huntington Beach	Construction	450	Repower	Orange Co.	5/01	8/01	U	14	6
2	Moss Landing	Construction	1,060	Expansion	Monterey Co.	10/00	6/02	U	58.5	11.5
3	Morro Bay 1/	12-mo. AFC	1,200	Replacement	San Luis Obispo	1/02	1/04	U	7	11
4	Long Beach	12-mo. AFC	500	Green Field	Los Angeles Co.	?		U		
5	Redondo Beach	12-mo. AFC	1,000	Replacement	Los Angeles Co.	?		U		

Notes:

* Estimated on-line date if approved and constructed

** Peaker projects evaluated for 3-mile radius. All others evaluated for 6-mile radius.

Projects in italics are emergency siting projects.

Megawatts in [ ] are not included in totals.

/1 750 MW will be replaced with 1200 MW for a net increase of 450 MW

/2 350 MW will be replaced with 630 MW for a net increase of 280 MW

6 month	
12 month	
45 Day	
4 month	
21 Day	
Operating	
Coastal Project	

Greenfield - undeveloped site

Brownfield - developed site

Expansion - New unit at existing power plant site, no loss of existing generation

Repower - Modification of existing equipment

Replacement - Demolition of old plant and construction of new plant

1996 Electric Consumption by County (in millions of kWh)

County	Residential kWh	Non-Residential kWh	Total kWh	Percent of Statewide Total kWh	Electric Consumption per Sq. Mile	Ranking by Total Consumption	Ranking by Total Consumption per Sq. Mile	Ranking by per Capita Use
Alameda	2,631	6,659	9,290	4.26%	11.31	7	4	50
Alpine	6	5	11	0.01%	0.01	58	56	3
Amador	116	127	243	0.11%	0.40	44	35	13
Butte	597	636	1,233	0.57%	0.74	28	25	19
Calaveras	155	71	226	0.10%	0.22	47	40	4
Colusa	54	164	218	0.10%	0.19	48	41	24
Contra Costa	2,331	3,561	5,892	2.70%	7.34	10	7	28
Del Norte	113	105	218	0.10%	0.18	49	43	6
El Dorado	573	425	998	0.46%	0.56	31	30	7
Fresno	2,028	3,387	5,415	2.48%	0.90	11	22	29
Glenn	82	257	339	0.16%	0.26	43	39	18
Humboldt	281	480	761	0.35%	0.19	34	42	41
Imperial	29	727	756	0.35%	0.17	35	44	57
Inyo	33	54	87	0.04%	0.01	55	58	52
Kern	1,558	5,072	6,630	3.04%	0.81	9	24	33
Kings	262	669	931	0.43%	0.67	32	28	40
Lake	228	186	414	0.19%	0.31	41	38	5
Lassen	75	99	174	0.08%	0.04	50	53	37
Los Angeles	17,147	40,195	57,342	26.28%	12.07	1	3	51
Madera	311	716	1,027	0.47%	0.48	30	34	25
Marin	645	688	1,333	0.61%	1.61	26	15	26
Mariposa	61	57	118	0.05%	0.08	53	49	11
Mendocino	255	337	592	0.27%	0.15	36	48	21
Merced	507	1,594	2,101	0.96%	1.07	22	20	31
Modoc	58	109	167	0.08%	0.04	52	52	2
Mono	81	87	168	0.08%	0.05	51	50	1
Monterey	639	1,594	2,233	1.02%	0.59	21	29	53
Napa	318	470	788	0.36%	1.00	33	21	27
Nevada	341	194	535	0.25%	0.55	37	32	9
Orange	5,466	12,194	17,660	8.09%	18.63	2	2	46
Placer	823	1,022	1,845	0.85%	1.23	23	19	8
Plumas	61	53	114	0.05%	0.04	54	51	20
Riverside	4,641	5,201	9,842	4.51%	1.35	6	17	16
Sacramento	3,821	5,135	8,956	4.10%	8.99	8	6	15
San Benito	86	142	228	0.10%	0.16	45	45	49
San Bernardino	3,537	6,822	10,359	4.75%	0.52	5	33	42
San Diego	5,300	9,599	14,899	6.83%	3.29	3	9	48
San Francisco	1,281	3,740	5,021	2.30%	21.65	12	1	55
San Joaquin	1,317	3,179	4,496	2.06%	3.15	13	10	35
San Luis Obispo	528	692	1,220	0.56%	0.34	29	37	38
San Mateo	1,454	2,714	4,168	1.91%	5.62	15	8	44
Santa Barbara	683	1,867	2,550	1.17%	0.67	19	27	54
Santa Clara	3,405	11,070	14,475	6.63%	11.10	4	5	45
Santa Cruz	532	828	1,360	0.62%	2.24	25	13	43
Shasta	632	793	1,425	0.65%	0.37	24	36	10
Sierra	10	10	20	0.01%	0.02	57	55	22
Siskiyou	0	227	227	0.10%	0.04	46	54	58
Solano	849	1,711	2,560	1.17%	2.82	18	11	39
Sonoma	1,072	1,397	2,469	1.13%	1.40	20	16	32

1996 Electric Consumption by County (in millions of kWh)								
County	Residential kWh	Non-Residential kWh	Total kWh	Percent of Statewide Total kWh	Electric Consumption per Sq. Mile	Ranking by Total Consumption	Ranking by Total Consumption per Sq. Mile	Ranking by per Capita Use
Stanislaus	1,344	2,541	3,885	1.78%	2.56	16	12	17
Statewide	**23**	**44**	**67**					
Statewide Total	**68,380**	**139,706**	**208,086**					
Sutter	221	278	499	0.23%	0.82	38	23	23
Tehama	188	267	455	0.21%	0.15	39	47	14
Trinity	7	33	40	0.02%	0.01	56	57	56
Tulare	879	1,786	2,665	1.22%	0.55	17	31	34
Tuolumne	191	169	360	0.17%	0.16	42	46	12
Ventura	1,429	3,001	4,430	2.03%	2.01	14	14	47
Yolo	398	866	1,264	0.58%	1.24	27	18	30
Yuba	149	299	448	0.21%	0.70	40	26	36

CALIFORNIA
ENERGY
COMMISSION

Appendix V

Environmental Performance Report

July 2001
P700-01-001

Gray Davis, *Governor*

Project Name	Owner	Original Unit(s)					Previous Expansion Unit(s)					NOx and PM10 Emission Projections (tons per year of each criteria pollutant)	Cooling Technology, Source of Water (if water cooled), and New Linear Facilities	Current/Planned Expansion
		Unit	Capacity MW	Fuel Source	Year Online	Year Offline	Unit	Capacity MW	Fuel Source	Year Online	Year Offline			
Moss Landing	Duke Energy *Previously Owned by PG&E	1	116	NG/O	1950	1994						NOx - 771 ton/year PM10 - 223 ton/year	Once-through cooling, using seawater which is discharged into the Pacific Ocean, 92,200 gallons per day (GPD).	The project adds 1,206-megawatt (MW) at a site with 1,478 MW existing generation capacity. Total generating capacity will be 2,684 MW. Duke Energy will replacing the existing electric power generation Units 1-5, (613 MW), which were shut down in 1995, with two 530 MW, natural gas-fired, combined- cycle units. Each combined cycle unit consists of two natural gas fired combustion turbine generators (CTGs), two unfired heat recovery steam generators (HRSGs) and a reheat, condensing steam turbine generator (STG). Units 6 and 7 will be upgraded by 73 MW each. These changes total 1,206 MWs (530 + 530 + 73 + 73 MWs). In addition, Duke Energy plans to dismantle eight of the existing stacks that were previously used for Units 1-5.
		2	115	NG/O	1950	1994								
							3	117	NG/O	1951	1994			
							4	117	NG/O	1952	1994			
							5	117	NG/O	1952	1994			
							6	739	NG/O	1967	active			
							7	739	NG/O	1968	active			
		Original Generating Capacity: 231 MW					Current Generating Capacity: 1,478 MW							
Contra Costa	Mirant (formerly Southern Energy) *Previously owned by PG&E	1	116	NG/O	1951	1994						NOx - 174 ton/year. PM10 - 124 ton/year	Reused San Joaquin River water, used first to cool Units 6 & 7, 7.3 - 7.5 million gallons per day (MGD)	The project adds 530-megawatt (MW) at a site with 680 MW existing generation capacity. Total generating capacity will be 1,210 MW. A new Unit 8 will be a natural gas-fired, combined cycle, combustion turbine power plant. The fuel would be supplied by the existing gas pipeline and no increase in water withdrawal from the San Joaquin River is anticipated, because cooling water would come from re-use of the cooling water from the existing Units 6 and 7.
		2	116	NG/O	1951	1994								
		3	116	NG/O	1951	1994								
							4	117	NG/O	1953	synchs			
							5	115	NG/O	1953	synchs			
							6	340	NG/O	1964	active			
							7	340	NG/O	1964	active			
		Original Generating Capacity: 348 MW					Current Generating Capacity: 680 MW							
Mountainview	Thermo Ecotek *Previously owned by SCE as the San Bernardino Power Plant	1	66	NG/O	1957	active						NOx - 238 ton/year. PM10 - 218 ton/year	Water from either on-site and off-site wells, or secondary effluent from City of Redlands WWTP, 7.15 MGD	The project adds 936-megawatt (MW) at a site with 120 MW existing generation capacity. Total generating capacity will be 1,056 MW. New Units 3 and 4 will be natural gas-fired combined cycle power plants. Natural gas would be supplied via a new 17-mile long pipeline. Cooling water sources include onsite groundwater derived from two new wells and secondary effluent from the City of Redlands Waste Water Treatment Plant (WWTP). No new transmission lines are proposed.
							2	66	NG/O	1958	active			
		Original Generating Capacity: 120 MW					Current Generating Capacity: 120 MW							
Potrero Repwr	Mirant (formerly Southern Energy) *Previously owned by PG&E	1	50	Coal-gas	1901	1983						NOx - 178.4 ton/year. PM10 - 110.5 ton/year	Once-through cooling, using seawater which is discharged into SF Bay, 228 MGD	The project adds 540-MW at a site with 362-MW existing generation capacity. Total generating capacity will be 902 MW. A new Unit 7 would be a 540-megawatt, natural gas-fired, combined-cycle power plant. The unit would moderize and use the existing once-through cooling system. Units 3 and 6 will be retroffitted with emission controls in 2004 and 2003, respectively. This project will permit shut down of the 429-MW Hunters Point power plant, thereby displacing its air emissions and thermal discharge to the San Francisco Bay.
							2	50	Coal-gas	1937	1983			
							3	206	NG/O	1965	active			
							4	52	NG/O	1976	active			
							5	52	NG/O	1976	active			
							6	52	NG/O	1976	active			
		Original Generating Capacity: unknown					Current Generating Capacity: 362 MW							

Project Name	Owner	Original Unit(s)					Previous Expansion Unit(s)					NOx and PM10 Emission Projections (tons per year of each criteria pollutant)	Cooling Technology, Source of Water (if water cooled), and New Linear Facilities	Current/Planned Expansion
		Unit	Capacity MW	Fuel Source	Year Online	Year Offline	Unit	Capacity MW	Fuel Source	Year Online	Year Offline			
Morro Bay Repwr	Duke Energy *Previously owned by SCE	1	163	NG/O	1955	active						NOx - 747 ton/year. PM10 - 24.2 ton/year	Once-through cooling, using seawater which is discharged into Estero Bay, 10,000 GPD	The project will add 170 MW net generating capacity to an existing 1,030 MW facility (comprised of Units 1 through 4), but all existing units will be removed and replaced with a new 1,200 MW facility (1,200 - 1,030 = 170). The new facility will include two, 600-MW natural-gas fired combined cycle units. The new facility will reduce sea-water consumption at the site by 29 percent. Each new unit will have two, 145 foot tall stacks, replacing the existing plant's three 450 foot tall stacks. An oil tank "farm" will be removed from the site as well. Status: In review.
		2	163	NG/O	1956	active								
							3	336	NG/O	1962	active			
							4	340	NG/O	1963	active			
		Original Generating Capacity: 326 MW					Current Generating Capacity: 1,030 MW							
Huntington Beach Repwr	AES *Previously owned by SCE	1	215	NG/O	1958	active						NOx - 134.18 ton/year. PM10 - 14.39 ton/year	Once-through cooling, using seawater which is discharged into the Pacific Ocean, 507 MDG	The project would retool and restore to operation Units 3 and 4, which have been out of service since 1995. These units have a combined generating capacity of 450 MW, so that total generating capacity would become 1,013 MW. The unit's steam turbine generators will be rebuilt with new natural gas burners, a burner management system, new draft fans and SCR. SCR will also be installed on existing Units 1 and 2.
		2	215	NG/O	1958	active								
							3	215	NG/O	1961	1995			
							4	225	NG/O	1961	1995			
							5	133	NG/O	1969	active			
		Original Generating Capacity: 430 MW					Current Generating Capacity: 563 MW							
El Segundo Repwr	NRG & Dynergy *Previously owned by SCE	1	175	NG/O	1955	active						[Existing Boilers] NOx - 536 ton/year. PM10 - 82 ton/year, [New Gas Turbines] NOx - 137 ton/year. PM10 - 105 ton/year	Once-through cooling, using seawater which is discharged into the Pacific Ocean, 605 MGD	The project adds 280-megawatt (MW) at a site with 1,020 MW of existing generation capacity. Total generating capacity will be 1,300 MW. The project will replace existing steam generating Units 1 and 2 (350 MW) with two new combustion turbines (Units 5 and 7) and one new steam turbine (Unit 6), which together constitute a 630-MW natural gas-fired combined cycle electric generation facility. Sanitary waste from the facility is now discharged to the ocean. This project will redirect sanitary wastewater to the local treatment plant.
		2	175	NG/O	1956	active								
							3	335	NG/O	1964	active			
							4	335	NG/O	1965	active			
		Original Generating Capacity: 350 MW					Current Generating Capacity: 1,020 MW							

Relative Merit Order of West Coast Power Plants (Highest to Lowest Apparent Efficiency)			
Unit Name	Unit #	Max Rating	California Air Basin or Other State, County
Etiwanda GT	5	126	South Coast
Huntin. Beach GT	5	133	South Coast
Alamitos GT	7	133	South Coast
Encina GT	1	16	San Diego County
Steam Plant No. 2	2	38	Washington
Bullock	1-2	12	Colorado
Kearny GT	3	66	San Diego County
Kearny GT	2	66	San Diego County
El Cajon GT	1	16	San Diego County
Kearny GT	1	20	San Diego County
NTC Central GT	1	16	San Diego County
Roseville GT	1	24.9	Sacramento Valle
Lodi	1	24.9	San Joaquin Vall
Anaheim GT	1	46.4	South Coast
Harbor GT	7	19	South Coast
Harbor GT	6	19	South Coast
Division GT	1	16	San Diego County
Miramar GT	1	39	San Diego County
Alameda	2	24.9	San Francisco Ba
Alameda	1	24.9	San Francisco Ba
North Island	2	19	San Diego County
HR Milner	1	153	Canada
Raton	4-5	12	Mexico
Las Animas	1-6	7	Colorado
North Island	1	19	San Diego County
Birdsall	1	16	Colorado
Birdsall	2	17	Colorado
Elwood GT	1	48	South Central Co
Birdsall	3	23	Colorado
Highgrove	3	44	South Coast
Highgrove	4	45	South Coast
Wabamun	4	295	Canada
Neil Simpson	6/2	75	Wyoming
Roseville GT	2	24.9	Sacramento Valle
Naval Station	1	23	San Diego County
Fruita GT	1	17	Colorado
Winnemucca	1	12	Nevada
Mandalay GT	3	140	South Central Co
Olive	4	32	South Coast
Olive GT	3	24	South Coast
Las Vegas GT	1	20	Nevada
Magnolia GT	5	22	South Coast
Alamosa GT	1	15	Colorado
Alamosa GT	2	15	Colorado
Yuma Axis	GT1	20	Salton Sea
Wabamun	1	67	Canada
Ft. Lupton GT	1	40	Colorado
Ft. Lupton GT	2	40	Colorado
Grayson GT	6	19.5	South Coast
Drake	4	11	Colorado
Clark Mount	1	10	Nevada
Holly	1-4	2.5	Colorado
Cherkee Dls	1-2	5	Colorado

Unit Name	Unit #	Max Rating	California Air Basin or Other State, County
Redding GT	1	18	Sacramento Valle
Redding GT	2	24	Sacramento Valle
Redding GT	3	24	Sacramento Valle
Neil Simpson	5/1	15	Wyoming
South Bay GT	1	16	San Diego County
McClellan CT	1	74	Sacramento Valle
Irvington GT	1	24.7	Arizona
Irvington GT	2	24.7	Arizona
North Loop GT	1	24.5	Arizona
North Loop GT	2	24.5	Arizona
North Loop GT	3	24.5	Arizona
Clark Mount	2	10	Nevada
Little Mtn GT	1	13	Utah
Provo City	4	8	Utah
Medicine Hat	8	32	Canada
Medicine Hat	9	32	Canada
Medicine Hat	10	14	Canada
Medicine Hat	11	14	Canada
Medicine Hat	5	15	Canada
Medicine Hat	6	5	Canada
Zuni	1	39	Colorado
Highgrove	1	32	South Coast
Highgrove	2	33	South Coast
Farmington	3	9	Colorado
Potrero GT	5	49	San Francisco Ba
Redding Pwr ST	4	28	Sacramento Valle
Cipres GT	1	27.5	Mexico
Cipres GT	2	27.5	Mexico
Mexicali GT	1	18	Mexico
Mexicali GT	2	18	Mexico
Mexicali GT	3	26	Mexico
PDTE Juarez GT	1	26	Mexico
PDTE Juarez GT	2	26	Mexico
Valmont	6	44	Colorado
Rupert GT	2	23	Idaho
McClure GT	1	61	San Joaquin Vall
McClure GT	2	61	San Joaquin Vall
Farmington	4	16	Colorado
SECC	1	2	Colorado
Trinidad	1-4	10	Colorado
Hunters Pnt GT	1	56	San Francisco Ba
Zuni	2	68	Colorado
South Bay	4	150	San Diego County
Rossdale	8	71	Canada
Potrero GT	4	49	San Francisco Ba
Gianera GT	1	25	San Francisco Ba
Gianera GT	2	25	San Francisco Ba
Coachella GT	1	20	Salton Sea
Coachella GT	2	20	Salton Sea
Coachella GT	3	20	Salton Sea
Coachella GT	4	20	Salton Sea
Rockwood GT	1	21	Salton Sea
Rockwood GT	2	21	Salton Sea
Yuma Axis(Yucca)	ST1	75	Salton Sea
Brawley GT	1	9	Salton Sea

Unit Name	Unit #	Max Rating	California Air Basin or Other State, County
Brawley GT	2	9	Salton Sea
Grayson GT	7	19.5	South Coast
Ben French GT	1	17	Canada
Ben French GT	2	17	Wyoming
Ben French GT	3	17	Wyoming
Ben French GT	4	17	Wyoming
Wabamun	2	67	Canada
Lamar	6	25	Colorado
Ben French PSC	1	22	Wyoming
Valencia	1-3	64	Arizona
Grayson	3	19	South Coast
Humboldt Bay	2	52.5	North Coast
Cameo	1	24	Colorado
So Whidbey GT	1	26	Washington
Walnut	1	24	San Joaquin Vall
Walnut	2	24	San Joaquin Vall
Bethel GT	1	52	Oregon
Bethel GT	2	52	Oregon
Rossdale	9	73	Canada
Rathdrum GT	1	71	Idaho
Rathdrum GT	2	71	Idaho
Glenarm GT	1	26	South Coast
Glenarm GT	2	26	South Coast
Vernon GT	1	10	South Coast
Rossdale	10	72	Canada
Rupert GT	1	23	Idaho
Mobile GT	1	15	San Francisco Ba
Mobile GT	2	15	San Francisco Ba
Mobile GT	3	15	San Francisco Ba
Oakland GT	1	54	San Francisco Ba
Oakland GT	2	54	San Francisco Ba
Potrero GT	6	49	San Francisco Ba
Oakland GT	3	54	San Francisco Ba
Lodi	2	49	San Joaquin Vall
Drake	6	79	Colorado
Clark GT	4	50	Nevada
Keogh GT	2	25	Canada
Ben French BHPL	1	22	Canada
Rosarito GT	1	165	Mexico
Cryst Mt	0	3	Washington
Magnolia	3	21.5	South Coast
Arapahoe	1	45	Colorado
Arapahoe	3	45	Colorado
Sunrise GT	2	69	Nevada
Broadway	1	42	South Coast
Logan City 2-6	2	6	Utah
La Junta	1-9	15	Colorado
Drake	5	47	Colorado
Bountiful City	1-7	15	Utah
Douglas GT	1	16	Arizona
Yucca GT	1	16	Arizona
Yucca GT	2	16	Arizona
Ocotillo GT	1	54	Arizona
Ocotillo GT	2	54	Arizona
W Phox GT	1	47	Arizona

Unit Name	Unit #	Max Rating	California Air Basin or Other State, County
W Phox GT	2	47	Arizona
Wabamun	3	148	Canada
Yucca GT	3	49	Arizona
Kyrene	2	72	Arizona
Apache GT	2-3	89	Arizona
Kyrene	1	34	Arizona
Saguaro GT	1	105	Arizona
Saguaro GT	2	105	Arizona
Battle River	3	156	Canada
Whitehead	1-2	14	Utah
Encina	1	107	San Diego County
Agua Fria GT	5	70	Arizona
Agua Fria GT	6	70	Arizona
Yucca GT	4	47	Arizona
San Bernardino	1	63	South Coast
San Bernardino	2	63	South Coast
Battle River	4	156	Canada
Encina	2	104	San Diego County
Broadway	2	42	South Coast
Grayson	4	43	South Coast
Sun Peak	1	70	Nevada
Sun Peak	2	70	Nevada
Sun Peak	3	70	Nevada
Arapahoe	2	45	Colorado
Gadsby	1	69.5	Utah
Encina	3	110	San Diego County
Tracy WSCC	1	53	Nevada
Kings Beach	1-6	18	Mountain Countie
Magnolia	4	32	South Coast
Saguaro	2	104.5	Arizona
Clark Mount	3	74	Nevada
Clark Mount	4	74	Nevada
Clover Bar	1	165	Canada
Etiwanda	2	132	South Coast
Nucla	1	12	Colorado
Nucla	2	12	Colorado
Nucla	3	12	Colorado
Etiwanda	1	132	South Coast
Agua Fria GT	4	72	Arizona
Reeves	3	51.3	New Mexico
Osage	1	10	Wyoming
Osage	2	10	Wyoming
Osage	3	10	Wyoming
Nucla	4	64	Colorado
Reeves	1	51.3	New Mexico
Reeves	2	51.3	New Mexico
Johnston	1	106	Colorado
Johnston	2	106	Colorado
Olive	1	53	South Coast
Johnston	3	230	Colorado
J E Correte	1	160	Montana
Clover Bar	2	171	Canada
Burlington WSCC	1	50	Colorado
Burlington WSCC	2	50	Colorado
Manchief	1	130	Colorado

Unit Name	Unit #	Max Rating	California Air Basin or Other State, County
Manchief	2	130	Colorado
MEAN	1	19.6	Colorado
WPE Diesel IC	2	20	Colorado
Cobisa-Person	1	132	New Mexico
Cheynne Dies	1-5	10	Wyoming
Encina	4	300	San Diego County
Grayson	5	43	South Coast
Alamitos	1	175	South Coast
Apache CC	1	81	Arizona
Valley WSCC	3	163	South Coast
Sundance	3	374	Canada
Sundance	4	374	Canada
Gabbs	0	5	Nevada
Cameo	2	49	Colorado
Clover Bar	3	165	Canada
Northeast GT	1	58	Washington
Whitehorn	1	58	Washington
Carbon	1	73	Utah
Valley WSCC	4	160	South Coast
El Segundo	1	175	South Coast
Rocky	1	8	Washington
Medicine Hat	7	28	Canada
Medicine Hat	12	28	Canada
Medicine Hat	3-4	16	Canada
NW Energy	1	55	Canada
Pueblo	6	20	Colorado
Los Alamos	1	6	New Mexico
Los Alamos	2	6	New Mexico
Los Alamos	3	6	New Mexico
El Segundo	2	175	South Coast
Clover Bar	4	176	Canada
Sundance	1	292	Canada
Sundance	2	294	Canada
Johnston	4	330	Colorado
Redondo.Beach	5	175	South Coast
Redondo.Beach	6	175	South Coast
Alamitos	2	175	South Coast
Clark ST	3	67	Nevada
W.N. Clark	1	17	Colorado
W.N. Clark	2	24	Colorado
Burrard	1	157	Canada
Burrard	2	0	Canada
Burrard	3	0	Canada
Gadsby	2	69.5	Utah
Broadway	3	66	South Coast
Burrard	4	157	Canada
Burrard	5	158	Canada
Coyote Springs	1	203	Oregon
Burrard	6	163	Canada
Apache ST	2	175	Arizona
Apache ST	3	175	Arizona
Fredrickson GT	2	79	Washington
Whitehorn	2	79	Washington
Whitehorn	3	79	Washington
Fredrickson GT	1	79	Washington

Unit Name	Unit #	Max Rating	California Air Basin or Other State, County
South Bay	3	171	San Diego County
Carson Ice GT	1	41	Sacramento Valle
Pawnee	1	511	Colorado
Coolwater CC	3	241	Mojave Desert
Coolwater CC	4	241	Mojave Desert
Old Faithful	1	2	Montana
Comanche	1	325	Colorado
Portola	1	5	Mountain Countie
Morro Bay	1	163	South Central Co
Arapahoe	4	111	Colorado
St. George	1-2	14	Utah
PEGS	1	235	New Mexico
Coolwater	1	65	Mojave Desert
Coolwater	2	81	Mojave Desert
Morro Bay	2	163	South Central Co
Springfield 1-2, 4-5	1	4	Oregon
Gadsby	3	100	Utah
Ocotillo	1	113	Arizona
Ocotillo	2	113	Arizona
Clark ST	1	42	Nevada
Naughton	1	160	Wyoming
Naughton	2	210	Wyoming
Craig	3	408	Colorado
Naughton	3	330	Wyoming
Carbon	2	105	Utah
Nixon	1	208	Colorado
Kyrene GT	4	57	Arizona
Olive	2	53	South Coast
Keephills	1	392	Canada
Keephills	2	393	Canada
Sundance	5	374	Canada
Cherokee	3	158	Colorado
Long Beach CC	8	265	South Coast
Long Beach CC	9	265	South Coast
Alamitos	3	320	South Coast
Tracy WSCC	2	83	Nevada
Rawhide	1	269	Colorado
Magnolia	2	10	South Coast
Wheelabrator	1	3.8	Sacramento Valle
Yolo Power	1	2.3	Sacramento Valle
Tulare Energy	1	1.78	San Joaquin Vall
Woodville Energy	1	0.56	San Joaquin Vall
West Covina	1	5.69	South Coast
Allen CT	1	72	Nevada
EP Genesee	1	407	Canada
EP Genesee	2	407	Canada
Fredonia GT	1	108	Washington
Fredonia GT	2	108	Washington
Drake	7	133	Colorado
Cherokee	2	106	Colorado
Comanche	2	335	Colorado
Weyerhauser	1	11	Canada
Whitecourt	1	21	Canada
Arapahoe New	2	31	Colorado
Arapahoe New	1	31	Colorado

Unit Name	Unit #	Max Rating	California Air Basin or Other State, County
Valmont New	1	31	Colorado
Lake	1	1	Montana
El Segundo	4	335	South Coast
Cherokee	1	106.5	Colorado
Battle River	5	390	Canada
Sundance	6	385	Canada
Irvington	3	105	Arizona
Beaver CC	1	495	Oregon
Scattergood	2	179	South Coast
Etiwanda	4	320	South Coast
Cholla	2	245	Arizona
Cholla	3	260	Arizona
Cholla	1	110	Arizona
Scattergood	1	179	South Coast
Mandalay	1	215	South Central Co
Delta 1-7	0	8	Colorado
Morro Bay	3	338	South Central Co
Hunter	3	395	Utah
Huntington Beach	1	215	South Coast
Alamitos	6	480	South Coast
Clark ST	2	66	Nevada
El Segundo	3	335	South Coast
J.R.C. Wauna	1	27	Oregon
Haynes	2	222	South Coast
Drywoods 1-2	0	6	Canada
Fort Nelson	1	45	Canada
Ray D Nixon	2	32	Colorado
Ray D Nixon	1	32	Colorado
Haynes	5	341	South Coast
Morro Bay	4	338	South Central Co
Alamitos	5	480	South Coast
Redondo.Beach	7	480	South Coast
Redondo.Beach	8	480	South Coast
Haynes	3	222	South Coast
Murry City	1-4	7	Utah
Brunswick IC	1	5	Nevada
Tracy WSCC	3	108	Nevada
Payson	1-2	6	Utah
Valmont	5	189	Colorado
Ormond.Beach	2	750	South Central Co
Sunrise	1	80	Nevada
Haynes	1	222	South Coast
Saguaro	1	104.5	Arizona
Ormond.Beach	1	750	South Central Co
Fort Churchill	2	113	Nevada
Heber City IC	1-6	7	Utah
J.R.C. Camus	1	52	Utah
Provo City Peaking 1	1	12	Utah
Kyrene GT	5	51	Arizona
Kyrene GT	6	50	Arizona
Irvington	4	156	Arizona
Valleyroad	1	5	Nevada
Irvington	2	81	Arizona
Battle Mountain	2	8	Nevada
Cholla	4	380	Arizona

Unit Name	Unit #	Max Rating	California Air Basin or Other State, County
AES Placerita	1	120	South Coast
Cherokee	4	352	Colorado
Huntington	1	420	Utah
Fort Churchill	1	113	Nevada
Ben French IC	1-5	10	Wyoming
W Phoenix CC	1	80	Arizona
W Phoenix CC	2	80	Arizona
W Phoenix CC	3	80	Arizona
APS Gen Cogen	1	1	Arizona
APS Gen Cogen	2	4	Arizona
APS Solar	1-5	10	Arizona
Bonneville	1	85	Nevada
Bonneville	2	85	Nevada
LV Cogen	1	45	Nevada
Saguaro Cogen	1	90	Nevada
Huntington	2	425	Utah
Haynes	4	222	South Coast
Scattergood	3	445	South Coast
Agua Fria	1	113	Arizona
Agua Fria	2	113	Arizona
Almond Power CC	1	49	San Joaquin Vall
Irvington	1	81	Arizona
Moss Landing	7	739	North Central Co
Citizens	1-4	4	Arizona
Fallon	1	2	Nevada
Grayson CC	8	95	South Coast
Haynes	6	341	South Coast
Agua Fria	3	181	Arizona
Ft St Vrain CC	1	229	Colorado
Ft St Vrain CC	2	238	Colorado
Springerville	1	400	Arizona
Greeley Energy	1	69	Colorado
Springerville	2	400	Arizona
Animas CC	1	26	New Mexico
Simplot Cogen	1	7	Idaho
Santan CC	2	74	Arizona
Santan CC	1	76	Arizona
Santan CC	4	77	Arizona
Santan CC	3	80	Arizona
Woodland	1	46	San Joaquin Vall
Harbor CC	10	240	South Coast
River Road	1	248	Washington
Joffre	1	208	Canada
Joffre	2	208	Canada
Fountain	1	215	Colorado
Hermiston Cogen	1	469	Oregon
Clark CC	9	233	Nevada
Clark CC	10	233	Nevada
El Dorado Energy	1A	246	Nevada
El Dorado Energy	1B	246	Nevada

Project Name	Developer	Type, Fuel Source and Size	Location	Estimated Construction Cost	Estimated Cost per MW	Nature and Size of Site	Intended Grid Tie-In and Need for New Transmission Lines	Reliability Must Run Status	Natural Gas Use, Supplier and Need for New Gas Lines
Sutter Power	Calpine Corporation	Natural Gas Combined Cycle 500MW	Yuba City area, Sutter Co.	$275 million	$570,000	16 acres of green field, adjacent to cogeneration power plant	Western Area Power Administration transmission system (not ISO operated), need new 4-mile 230 kV line	No	PG&E, 14.9 mile pipeline
Los Medanos	Calpine Corporation	Natural Gas Combined Cycle Cogeneration (steam to USS-POSCO) 559MW	Pittsburg Contra Costa Co.	$300 million	$600,000	12 acres of an existing industrial site (USS-Posco Industries)	PG&E switchyard at the Pittsburg Power Plant, need 2-mile 115kV line	Yes, starting in 2001	PG&E, 3.6 mile pipeline
La Paloma	La Paloma Generating Company LLC (formed by PG&E National Energy Group)	Natural Gas Combined Cycle 1,048MW	McKittrick Kern Co.	$500 million	$477,099	Green Field, 23 acres in an oil field production area	PG&E Midway Substation, 14.2 mile 230kV line	No	Interstate pipeline owned jointly by Kern River National Gas Transmission Company and Mojave Pipeline Company, 370 feet
Delta Energy Center	Calpine & Bechtel	Natural Gas Combined Cycle Cogeneration (steam to Dow Chemical) 880MW	Pittsburg Contra Costa Co.	$350-$450 million	$511,364	20 acres of existing industrial site (Dow Chemical)	PG&E Pittsburg Substation, 3.3 mile 230kV line	Yes, Not until 2002	PG&E, 5.3 mile pipeline
Moss Landing	Moss Landing LLC (Duke Energy)	Natural Gas Combined Cycle 1,060 MW	Moss Landing Monterey Co.	$475 million	$435,780	Existing 239-acre power plant site. The project will not use additional acres.	PG&E substation on site	Yes, Units 6 and 7 only	PG&E pipeline on site

Project Name	Developer	Type, Fuel Source and Size	Location	Estimated Construction Cost	Estimated Cost per MW	Nature and Size of Site	Intended Grid Tie-In and Need for New Transmission Lines	Reliability Must Run Status	Natural Gas Use, Supplier and Need for New Gas Lines
High Desert	High Desert Power Plant LLC (Inland & Constellation)	Natural Gas Combined Cycle, 720MW. May develop steam, hot water or chilled water to industrial operations at project site in the future	Victorville San Bernardino Co.	$350 million	$486,111	25 acres at former Air Force base site	SCE Victor Substation, 7.2 mile 230kV line	No	Southwest Gas Co. will build 2.75-mile pipeline to project, but additional connections being considered as well
Sunrise Cogen	Sunrise Cogeneration and Power Company (subsidiary of Texaco, Inc.)	Natural Gas-Fired Cogeneration (for thermally enhanced oil recovery) 320MW	Fellows Kern Co.	$200 million	$609,375	16 acres at an oil reserve site	PG&E and DWR (new) Valley Acres substation, 15 mile 230 kV line	No	Texaco No. American Production, 60 ft. pipeline
Elk Hills	Elk Hills Power LLC (Sempra & Occidental)	Natural Gas Combined Cycle 500MW	Taft/ Buttonwillow Kern Co.	$300 million	$400,000	12 acres within the Elk Hills Oil and Gas Field	Either new Tupman substation or Midway substation, 9 miles	No	Developer will produce gas from Occidential Elk Hills via 2,500 ft. pipeline
Pastoria	Pastoria Energy Facility LLP (Enron)	Natural Gas Combined Cycle 750 MW	Tejon Ranch Kern Co.	$300 million	$400,000	30 acres of land rezoned from Williamson Act prime-agricultural land designation to allow for this power plant development	SCE Pastoria substation, via 1.35 mile 230 kV	No	Up to 126 billion Btu/day LHV From a new 11.65 mile pipeline that connects to an existing Kern River-Mojave interstate pipeline

Project Name	Developer	Type, Fuel Source and Size	Location	Estimated Construction Cost	Estimated Cost per MW	Nature and Size of Site	Intended Grid Tie-In and Need for New Transmission Lines	Reliability Must Run Status	Natural Gas Use, Supplier and Need for New Gas Lines
Blythe Energy	Caithness Enegy	Natural Gas Combined Cycle 520MW	Blythe Riverside Co.	$250 million	$480,769	15 acres of land zoned for industrial use	Western Area Power Admin., 600 ft. to Blythe Substation	No	Up to 84 billion Btu/day LHV From either or both of an 11.5 mile pipeline connecting with the El Paso Natural Gas interstate pipeline east of the Colorado River near Ehrenberg, AZ or an 0.8 mile pipeline connecting with the So Cal Gas line south of Interstate 10.
Hanford Energy Park SPPE	GWF Power Systems Company	Natural gas-fired, combined cycle. 99MW	Hanford Kings Co.	$70 million	$709,220	Green field adjacent to existing cogeneration facility site. The project will occupy an additional 5-acres.	PG&E, 1.2 miles of new 115 kV t-line to existing line	No	Up to 24.1 billion Btu/day LHV A new 2.8 mile-long 16-inch pipeline connecting to the existing So Cal Gas Line 400 pipeline
Western Midway Sunset	ARCO Western Energy Company	Natural Gas Combined Cycle 500MW	McKittrick Kern Co.	$250 million	$600,000	Expansion, 10 acres near an existing power plant facility	PG&E, 19 mile 230 kV line to Midway substation	No	Up to 94 billion Btu/day LHV From an existing 3.8 million pipeline connected to existing Kern-Mojave and So Cal Gas pipelines which serve the existing Midway Sunset power plant.
Mountainview	Mountainview Power Co., LLC (subsidiary of Thermo ECOtek)	Natural Gas Combined Cycle, 1,056MW	Redlands San Bernardino Co.	$550 million	$520,833	Expansion, 16.3 acres at existing power plant site (formerly San Bernardino Power Plant)	SCE's San Bernardino substation, no new t. lines needed	No	Up to 88 billion Btu/day LHV A new 17-mile long 24- to 30 inch peopline conntecting with the existing SoCalGas Line 4000/4002 near Etiwanda Avenue in Rancho Cucamonga
Indigo Energy Facility	Wildflower Energy, LP	Natural Gas or Low-Sulfur Diesel Fuel Oil, Simple Cycle, 135 MW	Palm Springs, Riverside Co.			10 acres of desert open space	Will interconnect to 115 V line between Garnet and Devers substations.		Up to 30.9 million cubic feet per day (HHV) New gas line to So. Cal. Gas.

Project Name	Developer	Type, Fuel Source and Size	Location	Estimated Construction Cost	Estimated Cost per MW	Nature and Size of Site	Intended Grid Tie-In and Need for New Transmission Lines	Reliability Must Run Status	Natural Gas Use, Supplier and Need for New Gas Lines
Larkspur Energy Facility	Wildflower Energy, LP	Natural Gas, Simple Cycle, 90 MW	San Diego San Diego Co.			8 acres of unused agricultural land, zoned for industrial use.	Will interconnect to SDG&E Border substation via new 500 foot 69 V line.		Up to 20.6 MMCF/day (HHV) SDG&E supply from new 500 ft. pipeline
United Golden Gate Phase I	El Paso Merchant Energy Company	Natural Gas, Simple Cycle, 51 MW	So. San Francisco, City and County of San Francisco			2 acres adjacent to United Airlines Maintenance and Operations Center and to United Cogeneration, Inc. (UCI) facility	Will interconnect at UCI facility		Will interconnect to UCI facility
Otay Mesa	Otay Mesa Generating Company (Ownership will transfer to Calpine upon Energy Commission approval.)	Natural Gas Combined Cycle 510MW	Otay Mesa San Diego Co.	$500 million	$980,392	15 acres of green field	SDG&E, .1 mile 230 kV line to Miguel-Tijuana substation	No	Up to 84.6 billion Btu/day LHV From either a 2 mile pipeline from SDG&E's Pipeline 2000 or a 1.6 mile pipeline from SDG&E's metering station near the Mexican border.
Three Mountain	Three Mountain Power LLC (Ogden Power Pacific)	Natural Gas Combined Cycle 500MW	Burney Shasta Co.	$250 million	$500,000	40-acres at an existing industrial site adjacent to an existing 10 MW wood-burning power plant	PG&E, 1,800 ft. 230 kV line to McCloud River Railway lie, plus 60 miles of reconductoring	No	More than 78 billion Btu/day Will buy gas from domestic and Canadian sources through a gas marketer or by contract with producers or supply aggregators. Will receive gas via a new 2,900 ft. pipeline, connected to a PG&E instate pipeline SE of Highway 299.
Metcalf	Calpine & Bechtel	Natural Gas Combined Cycle 600 MW	San Jose and Santa Clara County Santa Clara Co.	$300-400 million	$666,667	14 acres of land zoned agricultural/ campus industrial develoment	PG&E, 200 ft. 230 kV to Metcalf substation	No	More than 80 billion Btu/day New 1-mile pipeline to PG&E backbone pipeline that lies to the east of Hwy 101

Project Name	Developer	Type, Fuel Source and Size	Location	Estimated Construction Cost	Estimated Cost per MW	Nature and Size of Site	Intended Grid Tie-In and Need for New Transmission Lines	Reliability Must Run Status	Natural Gas Use, Supplier and Need for New Gas Lines
United Golden Gate Phase II	El Paso Merchant Energy Company	Natural gas-fired, 50 MW simple cycle power plant This is Phase One of a two-phase project.	San Francisco	$50 million (?)		Existing urbanized site - the project will occupy about 2 acres.	Tie into existing UCI (cogeneration power plant) infrastructure for transmission grid interconnection. No off-site linear facilities are proposed. 115 kV.	No	Up to 450 million Btu/hour LHV From existing PG&E pipeline near South Airport Blvd. that already serves United Cogen, Inc. cogeneration plant.
Contra Costa Modernization	Southern Energy Delta, LLC	Natural Gas Combined Cycle 530MW (Total generating capacity at facility: 1,210 MW)	Antioch Contra Costa Co.	$250-$300 million	$247,934	Expansion, 20 acres on existing 200-acre power plant site	PG&E's Contract Costa Switchyard, located on site at 230 KV	Yes, Units 4-7 only	Unit 8 will burn natural gas at a nominal rate of up to 95.3 billion Btus/day LHV Will build a new 12- to 16 inch pipeline to receive natural gas from PG&E Line 400 that passes through the site on its way from Canada to the Antioch terminal.
Potrero Unit 7	Southern Company	Natural Gas Combined Cycle, 540MW	San Francisco	$260-320 million	$592,593	Expansion at existing 20-acre power plant site, 6.5 acres	PG&E substation at Hunters Point via 1.8 mile t-line underground	Yes	PG&E pipeline on site

Project Name	Developer	Type, Fuel Source and Size	Location	Estimated Construction Cost	Estimated Cost per MW	Nature and Size of Site	Intended Grid Tie-In and Need for New Transmission Lines	Reliability Must Run Status	Natural Gas Use, Supplier and Need for New Gas Lines
Morro Bay	Duke Energy	600MW Gas-fired combined cycle	Morro Bay San Luis Obispo Co.	$250 million	$247,934	Replacement, at an existing power plant site - an existing 107-acre industrial complex.	Existing 107-acre industrial complex zoned for industrial use. Situated near Morro Bay Harbor and east of Estero Bay.	No	Natural Gas is delivered by an existing PG&E pipeline.
Huntington Beach Repwr	AES	1000MW	Huntington Beach Orange Co.	$135-140 million	$140,000	Repower, 12-acre at an existing power plant site	Transmission connection with an adjacent 230 kilovolt (kV) switchyard owned by SCE	Yes, Unit 2 only	Up to 6.3 billion Btu/year (based on 2,500 operating hours/year) HHV Will use existing So Cal Gas, 18-inch pipeline that serves the existing power plant.
El Segundo Repower	El Segundo Power II LLC (NRG Energy and Destec)	Gas-fired combined cycle. 630MW	El Segundo Los Angeles Co.	$350-$400 million	$634,921	Replacement, at an existing power plant site, 33 acres	Repower, No new linear facilities will be required	No	Natural gas is supplied by SoCalGas. It's provided by existing pipelines and there is no new offsite gas pipeline proposed.
Pastoria Energy Facility Expansion Project	Pastoria Energy Facility LLC (Enron)	Gas-fired combined cycle. 250MW	Tejon Ranch Kern Co.			30 acres of land rezoned from Williamson Act prime-agricultural land designation to allow for this power plant development, per recently approved Pastoria project.	SCE Pastoria substation, via 1.35 mile 230 kV, per recently approved Pastoria project.	No	From new 11.65 mile pipeline that connects to an existing Kern River-Mojave interstate pipeline, per recently approved Pastoria project.
East Altamont Energy Center	East Altamont Energy Center LLC (Calpine)	Gas-fired combined cycle. 1,100 MW	Alameda Co.						

Project Name	Turbine Specs and Projected Thermal Efficiency (in Lower Heating Value)	Air District and Emission Control Technology	NOx and PM10 Emission Projections	Cooling Technology, Source of Water, and Need for New Water Lines	Wildlife Habitat Loss and Mitigation Measures	Status
Sutter Power	2 - 170MW Westinghouse 501 FC gas turbine/generators, 2 heat recovery steam generators (HRSG), 1 - 160 MW steam turbine/generator 54 percent thermal efficiency	Feather River AQMD SCR, dry low NOx burners and an oxidation catalyst	NOx - 205.86 tons/year PM10 - 32 tons/year	Dry air condenser. No water needed for cooling.	Impacted habitats are: 5.83 acres of wetlands, 19.11 acres of Swainson's Hawk habitat, and 4.9 Giant Garter Snake habitat. Will purchase 38.5 acres land (total cost $616,700) to compensate.	Approved and in construction.
Los Medanos	2 "F" class gas turbine/generators, heat recovery steam generator units, 1 steam turbine generator. 56.5 percent thermal efficiency.	Bay Area AQMD SCR, dry low NOx burners and an oxidation catalyst	NOx - 153.2 tons/year PM10 - 123.55 tons/year	Delta Diablo Sanitation District - disinfected tertiary reclaimed water (128,000 gpm), 2 mile pipeline	Existing industrial site, no major environmental impacts. No proposed mitigation measures.	Approved and in construction.
La Paloma	4 - 262 MW "power islands," each with 1 gas turbine generator (ABB Model GT 24) , 1 HRSG and 1 steam turbine 57.3 percent thermal efficiency	San Joaquin Valley Unified APCD SCR on 3 units, "SCONOx" on 1 CTSCR, dry low NOx burners and an oxidation catalyst	NOx - 288.7 tons/year PM10 - 284.1 tons/year	Fresh water cooled, Water from CA Aqueduct supplied from West Kern Water Dist., need 8 mile pipeline 5,500 AF/yr	27.4-acres will be permanently impacted. La Paloma intends to purchase at least 246.5-acres in the immediate vicinity of the Lokern Preserve within the Lokern Natural Area of western Kern County for compenstaion.	Approved and in construction.
Delta Energy Center	3 - 200MW CTGs, 3 HRSG, 1 SG. F-class Turbine Siemens-Westing house 55.8 percent thermal efficiency	Bay Area AQMD SCR, dry low NOx burners and an oxidation catalyst	NOx - 289 tons/year PM10 - 162 tons/year	2ndary-treated wastewater from Delta Diablo Sanitation District, need 500 ft. pipeline	Will be constructed on 20 acres of moderately disturbed vacant annual grassland. Mitigation measures: The project owner should provide 1.0 acre of upland habitat in addition to the 0.48 acres of wetland habitat to compensate for the loss of foraging habitat of white-tailed kite.	Approved and in construction.
Moss Landing	Replacing shut-down units 1-5 with 2-530 MW units: each with 2 CTG's, 2 HRSG's and 1 SG. Expanding Units 6&7 by 15 MW each 56.5 percent thermal efficiency	Monterey Bay Unified APCD SCR, dry low NOx burners and an oxidation catalyst, plus SCR for Units 6&7	NOx - 771 tons/year PM10 - 223 tons/year	Seawater, once-through cooling with "best available technology" (fish) traveling screens 92,200 GPD	The site and laydown areas are in a highly disturbed industrialized area. To mitigate potential impacts of long-toed salamanders, a perimeter fence should be provided to exclude salamanders venturing into the site.	Approved and in construction.

Project Name	Turbine Specs and Projected Thermal Efficiency (in Lower Heating Value)	Air District and Emission Control Technology	NOx and PM10 Emission Projections	Cooling Technology, Source of Water, and Need for New Water Lines	Wildlife Habitat Loss and Mitigation Measures	Status
High Desert	3 Class F CT's (160MW each) and 3 steam turbines (86.5MW each)	Mojave Desert APCD SCR, dry low NOx burners and an oxidation catalyst Dry Low NOx burners, SCR, and oxidation catalyst. 58.0 percent efficiency.	NOx - 189 tons/year PM10 - 205 tons/year	Fresh water cooled, Water from CA Aqueduct supplied from Mojave Water Agency- 71 mile pipeline. Groundwater from Victor Valley Water District when CA Aqueduct water is unavailable. 3,597 AF/yr	281.9 acres impacted including certain aspects of the appurtenant facilities . Habitat compensation 269.8 acres and habitat compensation for desert tortoise and Mohave ground squirrel is 1,402.2 acres.	Approved
Sunrise Cogen	2 165 MW General Electric 7FA CTG's, 2 HRSG's 36.2 percent thermal efficiency	San Joaquin Valley Unified APCD, Dry Low NOx burners, SCR, and oxidation catalyst	NOx - 137 tons/year PM10 - 158 tons/year	From adjacent oil field operations	27.5 acres impacted, 155.1 acres purchased ($196,977) in Lokern Natural Preserve as compensation.	Approved and in construction.
Elk Hills	2 153-166 MW CTG's, 1 HRSG, 1 171MW SG 55.8 percent thermal efficiency	San Joaquin Unified Valley APCD SCR, dry low NOx burners and an oxidation catalyst	NOx - 143 tons/year PM10 - 163 tons/year	Fresh water from State Water Project, provided by Western Kern Water Dist, 9.8 mile pipeline 3.1 MGD	Transmission Line Route 1a: 16.25 acres impacted, 51.81 acres in compensation required. Route 1b: 14.62 acres impacted, 46.94 acres in compensation required. Route 1c: 14.60 acres impacted, 46.88 acres in compensation required.	Approved
Pastoria	3-170 MW CT's, 2 HRSG, and 1-185 MW SG 56.5 percent thermal efficiency	San Joaquin Valley Unified APCD SCONOx or SCR, dry low NOx burners and an oxidation catalyst	NOx - 206 tons/year PM10 - 6.2 tons/year	Wheeler Ridge-Maricopa Water Storage District. Water will be supplied to the plant via an interconnection to an existing 24-inch water pipeline approximately 0.2 miles north of the plant site, up to 7.2 MGD.	36.1-acres are impacted. 108.3 acres are required for compensation.	Approved

Project Name	Turbine Specs and Projected Thermal Efficiency (in Lower Heating Value)	Air District and Emission Control Technology	NOx and PM10 Emission Projections	Cooling Technology, Source of Water, and Need for New Water Lines	Wildlife Habitat Loss and Mitigation Measures	Status
Blythe Energy	2-170 MW CTs, 2 HRSG and 1-180 MW SG 57.7 percent thermal efficiency	Mojave Desert APCD SCR, dry low NOx burners and an oxidation catalyst	NOx - 219 tons/year PM10 - 286 tons/year	Groundwater wells at project site 3,000 AF/yr.	76-acres are impacted. 77.15 acres required compensation for wildlife habitat.	Approved
Hanford Energy Park SPPE	1, GE Frame 6FA CTG, 1 heat recovery steam generator, 1 steam turbine generator 49.5 percent thermal efficiency	San Joaquin Valley Unified APCD SCR, dry low NOx burners and an oxidation catalyst	NOx - 40.48 tons/year PM10 - 23.41 tons/year	621 GPM from existing on-site well	6.1 acres impacted. Will purchase habitat credits from the existing Kern Water Bank mitigation bank. Mitigation credits will cost about $2,375 per acre, including endowment costs, plus a $5,000 transaction fee.	Approved
Western Midway Sunset	2 -170 MW CTs, 2 HRSG and 1-180 MW SG 56.5 percent thermal efficiency	San Joaquin Valley Unified APCD SCR, dry low NOx burners and an oxidation catalyst	NOx - 145 tons/year PM10 - 152 tons/year	West Kern Water District to provide water supply. Water will be delivered to the site via a new, 1.8-mile, 16-inch supply pipeline. 3,260 AF/yr	10.2 acres will be impacted. Mitigation: 99.2-acres of compensation habitat in the immediate vicinity of the Lokern Preserve within the Lokern Natural Area of western Kern County.	Approved
Mountainview	Adding Units 3&4 to existing 132-MW power plant site (Units 1&2 @ 66 MW), 4-167 MW GE Model 7FA class CGT's, 4 HRSG's, 2-209 MW STG's, plus diesel engines 56.5 percent thermal efficiency	South Coast AQMD SCR, dry low NOx burners and an oxidation catalyst	NOx - 238 tons/year PM10 - 218 tons/year	Water from either on-site and off-site wells, or secondary effluent from City of Redlands WWTP (if reclaimed water is used, will need 2.3 mi. water supply pipeline, 1,100 ft. wastewater discharge pipeline, 7.15 MGD	No on-site biological resource impacts. If burrowing owls are found on the site, compensation at 6.5 acres per owl will be required.	Approved
Indigo Energy Facility	3 GE LM6000 gas turbines	SCR and CO catalyst		Water from Mission Springs Water District, 240 gallons per minute	Will impact 10 acres of creosote scrub wildlife habitate. To compensate, will pay $600 per acre to non-profit wildlife group.	Approved

Project Name	Turbine Specs and Projected Thermal Efficiency (in Lower Heating Value)	Air District and Emission Control Technology	NOx and PM10 Emission Projections	Cooling Technology, Source of Water, and Need for New Water Lines	Wildlife Habitat Loss and Mitigation Measures	Status
Larkspur Energy Facility	2 GE LM6000 gas turbines	SCR	NOx - 5 ppm (natural gas), or 42 ppm (diesel fuel oil)	Water from Otay Water District 320 GPM	No biological impacts.	Approved
United Golden Gate Phase I	1 GE LM6000 gas turbine	SCR		Wastewater from United Airlines Metal Removal Plant, <100 GPD	No biological impacts.	Approved
Otay Mesa	2-170 MW CTs, 2 HRSG and 1 (180 MW) or 2 (90 MW) SG's 56.5 percent thermal efficiency	San Diego APCD SCONOx, dry low NOx burners and an oxidation catalyst	NOx - 112 tons/year PM10 - 158 tons/year	Dry air condenser, 2 mile pipeline to dispose wastewater to San Diego Co. 370,000 GPD	64.6 acres are impacted. The total habitat compensation will be approximately 35.9 acres at an existing mitigation bank such as the O'Neal Canyon Land Bank.	Approved
Three Mountain	2 170-MW CTs, 2 HRSG, 1 SG up to 230MW 55.8 percent thermal efficiency	Shasta County AQMD SCR, dry low NOx burners and an oxidation catalyst	NOx - 153 tons/year PM10 - 82 tons/year	Groundwater from Burney Water District or own wells via 4,700 ft. pipeline 3,500 AF/yr.	18.78 acres of ponderosa pine habitat directly impacted but not significant. Mitigaton measures: $500,000 will be provided for mitigation fund in the study of Shasta Crayfish as plant operations will contribute to the reduced spring flow in the area.	In review
Metcalf	2 - 200MW CTCs, 2 HRSG, 1-235 MW SG 55.8 percent thermal efficiency	Bay Area AQMD SCR, dry low NOx burners and an oxidation catalyst	NOx - 211 tons/year PM10 - 109 tons/year	Recycled water from San Jose/Santa Clara Water Pollution Control Plant, 7.3 mile pipeline. Estimated water needs: 5 MGD at peak flow.	Loss of 80 significant trees. Mitigation Measures: Plant a total of 320 significant trees to replace the trees lost.	In review

Project Name	Turbine Specs and Projected Thermal Efficiency (in Lower Heating Value)	Air District and Emission Control Technology	NOx and PM10 Emission Projections	Cooling Technology, Source of Water, and Need for New Water Lines	Wildlife Habitat Loss and Mitigation Measures	Status
United Golden Gate Phase II	General Electric LM6000 Sprint combustion turbine generator with inlet air spray misting producing up to 50.4 MW. In the future two Frame 7F gas turbine generators and a steam turbine generator will be added 41.4 percent thermal efficiency	Bay Area AQMD SCR, dry low NOx burners and an oxidation catalyst	NOx - 13.1 tons/year PM10 - 228 tons/year	El Paso plans to use wastewater from the United Airline Metal Removal Plant (MRP). Water requirements for the project is 65 gallons per minute, peak flow.	Project site is predominantly paved with asphalt, there is no habitat for plants or sensitive plant or animal species.	Approval pending
Contra Costa Modernization	Adding new "Unit 8" to existing plant: 2-175 MW GE Frame 7FA CGTs, 2 HRSG, 1-190 MW STG 56.5 percent thermal efficiency	Bay Area AQMD SCR, dry low NOx burners and an oxidation catalyst	NOx - 174 tons/year PM10 - 124 tons/year	Reused San Joaquin River water, used first to cool Units 6 & 7, no new water lines needed 7.3 - 7.5 MGD	Project will occupy 20 acres of previously disturbed land. No impacts are expected to wetlands or non-degraded uplands from this project, therefore, no cumulative impacts associated with habitat loss and degradation are expected.	In review
Potrero Unit 7	2, GE Frame 7s with 2 heat recover steam generators to 1 steam turbine generator 56 percent thermal efficiency	Bay Area AQMD SCR, dry low NOx burners and an oxidation catalyst	NOx - 178.4 tons/year PM10 - 110.5 tons/year	SF Bay direct cooling with thermal impacts mitigated by shutdown of Hunters Point and modification of existing Potrero unit 228 MGD	Due to the developed setting of the proposed project area, no significant cumulative impacts to terrestrial wildlife & plant species, terrestrial unique habitats, or other terrestrial biological resources are expected as a result of this project.	In review

Project Name	Turbine Specs and Projected Thermal Efficiency (in Lower Heating Value)	Air District and Emission Control Technology	NOx and PM10 Emission Projections	Cooling Technology, Source of Water, and Need for New Water Lines	Wildlife Habitat Loss and Mitigation Measures	Status
Morro Bay	Four Steam Turbine generators (Units 1 - 4). Duke Energy proposes to replace Units 1 & 2 with high efficiency combined-cycle natural gas fired units 52.8 percent thermal efficiency	San Luis Obispo County APCD SCR, dry low NOx burners and an oxidation catalyst	NOx - 747 tons/year PM10 - 24.2 tons/year	Cooling Water System: The once-through colling system pumps water from the harbor through the power plant and discharges the water into Estero Bay. 10,000 GPD	This is an existing industrial facility that has been in operation since the early 1950's. No significant impacts to biological resources or to beneficial uses are expected.	In review
Huntington Beach Repwr	The steam turbine generators will be rebuilt with new natural gas burners, a burner management system, and new draft fans 40.7 percent thermal efficiency	South Coast AQMD SCR, dry low NOx burners and an oxidation catalyst	NOx - 134.18 tons/year PM10 - 14.39 tons/year	The project will use once through, circulating ocean water cooling technology, with cooling water discharge into the Pacific Ocean 507 MGD	Only small isolated patches of natural vegetation and associated wildlife remain at the project site as a result of previous heavy industrial development.	In review
El Segundo Repower	Units 5 & 7 (HRSGs) 171.7 MW each. Unit 6 - STG 280MW 49.4 percent thermal efficiency	South Coast AQMD SCR, dry low NOx burners and an oxidation catalyst	NOx - 137 ton/year PM10 - 105 ton/year	Existing sea water cooling and new pipelines include two water supply lines occupying a single trench in El Segundo city streets 605 MGD	Only small isolated patches of natural vegetation and associated wildlife remain at the project site as a result of previous heavy industrial development.	In review
Pastoria Energy Facility Expansion Project	1-168 MW, 1-90 MW HRSG	San Joaquin Valley Unified APCD XONON or SCR, dry low NOx burners and an oxidation catalyst		Wheeler Ridge-Maricopa Water Storage District. Water will be supplied to the plant via an interconnection to an existing 24-inch water pipeline approximately 0.2 miles north of the plant site. Up to 7.2 MGD. Zero discharge water elimination system	See Pastoria, above.	In review
East Altamont Energy Center	3 - F Class gas turbines and 3 HRSG	Bay Area AQMD				In review

Retired and Inactive Power Plants in California

Status	Plant Name	Generator Code	Name-plate Capacity (kW)	Primary Fuel	Fuel Type Group	Unit Type	Unit Type Group	Retire-Ment Year	Owner or Utility Name
OS	AES Huntington Beach	3	217,600	Natural Gas (NG)	Gas	Steam Turbine (ST)	Fossil		AES Enterprises - CA
OS	AES Huntington Beach	4	217,600	NG	Gas	ST	Fossil		AES Enterprises - CA
OS	AES Redondo Beach	1	66,000	NG	Gas	ST	Fossil		AES Enterprises - CA
OS	AES Redondo Beach	2	69,000	NG	Gas	ST	Fossil		AES Enterprises - CA
OS	AES Redondo Beach	3	66,000	NG	Gas	ST	Fossil		AES Enterprises - CA
OS	AES Redondo Beach	4	69,000	NG	Gas	ST	Fossil		AES Enterprises - CA
OS	Tosco	1	8,000	RefineryGas	Gas	ST	Fossil		LA DWP
OS	El Dorado	1	10,000	Water (WAT)	Hydro/PS	Hydro-electric (HY)	Hydro		PG&E
OS	El Dorado	2	10,000	WAT	Hydro/PS	HY	Hydro		PG&E
OS	Gerber Compr Sta	1	4,000	Waste Heat	Misc.	Cogen-eration	Fossil		PG&E

Status	Plant Name	Gen Code	Name-plate Capacity (kW)	Primary	Fuel Type Group	Unit Type	Unit Type Group	Retire-Ment Year	Owner or Utility Name
OS	Slab Creek	1	482	WAT	Hydro/PS	HY	Hydro		Sacramento Municipal Utility District - CA
OS	Black Butte	1	6,190	WAT	Hydro/PS	HY	Hydro		City of Santa Clara – CA
RE	Magnolia	1	10,000	Fuel Oil No.2 (FO2)	Oil	ST	Fossil	1982	Burbank Public Service Dept. - CA
RE	Magnolia	2	10,000	NG	Gas	ST	Fossil	1983	Burbank Public Service Dept. - CA
RE	Bottlerock	1	55,000	Geother-mal Steam (GST)	Misc.	Geother-mal (GE)	Other	1999	Ca. Dept. of Water Resources
RE	Bear Valley	1	350	WAT	Hydro/PS	HY	Hydro	1928	City of Escondido – CA
RE	Bear Valley	2	150	WAT	Hydro/PS	HY	Hydro	1915	City of Escondido – CA
RE	Bear Valley	3	150	WAT	Hydro/PS	HY	Hydro	1980	City of Escondido – CA
RE	Scampp	IC1	600	REF	Misc.	Internal Combus-tion	Fossil	1987	City of Glendale Public Service - CA
RE	Scampp	IC2	600	REF	Misc.	IC	Fossil	1987	City of Glendale Public Service - CA
RE	Scampp	IC3	600	REF	Misc.	IC	Fossil	1987	City of Glendale Public Service - CA
RE	Brawley	3	750	FO2	Oil	IC	Fossil	1991	Imperial Irrigation District – CA (IID)

Status	Plant Name	Gen Code	Name-plate Capacity (kW)	Primary	Fuel Type Group	Unit Type	Unit Type Group	Retire-Ment Year	Owner or Utility Name
RE	Brawley	4	1,750	FO2	Oil	IC	Fossil	1991	IID
RE	Brawley	5	1,750	FO2	Oil	IC	Fossil	1991	IID
RE	Brawley	6	1,750	FO2	Oil	IC	Fossil	1991	IID
RE	Brawley	7	2,888	FO2	Oil	IC	Fossil	1991	IID
RE	Brawley	8	2,888	FO2	Oil	IC	Fossil	1991	IID
RE	Brawley	IC1	750	FO2	Oil	IC	Fossil	1991	IID
RE	Brawley	IC2	750	FO2	Oil	IC	Fossil	1991	IID
RE	El Centro	1	23,000	NG	Gas	ST	Fossil	1995	IID
RE	Harbor	1	65,000	NG	Gas	ST	Fossil	1988	LA DWP
RE	Harbor	2	65,000	NG	Gas	ST	Fossil	1988	LA DWP
RE	Harbor	3	86,400	NG	Gas	ST	Fossil	1991	LA DWP
RE	Harbor	4	86,250	NG	Gas	ST	Fossil	1997	LA DWP
RE	Harbor	GT8	23,580	NG	Gas	Gas Turbine (GT)	Fossil	1997	LA DWP
RE	Harbor	GT9	23,580	NG	Gas	GT	Fossil	1997	LA DWP
RE	San Francisquito 1	1	9,400	WAT	Hydro/PS	HY	Hydro	1981	LA DWP
RE	San Francisquito 1	2	9,400	WAT	Hydro/PS	HY	Hydro	1981	LA DWP
RE	San Francisquito 1	5	25,000	WAT	Hydro/PS	HY	Hydro	1984	LA DWP

Status	Plant Name	Gen Code	Name-plate Capacity (kW)	Primary	Fuel Type Group	Unit Type	Unit Type Group	Retire-Ment Year	Owner or Utility Name
RE	Avon	1	40,000	NG	Gas	ST	Fossil	1987	PG&E
RE	Contra Costa	1	118,800	NG	Gas	ST	Fossil	1994	PG&E
RE	Contra Costa	2	103,500	NG	Gas	ST	Fossil	1994	PG&E
RE	Contra Costa	3	103,500	NG	Gas	ST	Fossil	1994	PG&E
RE	Contra Costa	4	112,500	NG	Gas	ST	Fossil	1994	PG&E
RE	Contra Costa	5	112,500	NG	Gas	ST	Fossil	1994	PG&E
RE	Geysers	1	12,500	GST	Misc.	GE	Other	1991	PG&E
RE	Geysers	15	63,500	GST	Misc.	GE	Other	1989	PG&E
RE	Geysers	2	14,100	GST	Misc.	GE	Other	1992	PG&E
RE	Geysers	3	28,800	GST	Misc.	GE	Other	1992	PG&E
RE	Geysers	4	28,800	GST	Misc.	GE	Other	1992	PG&E
RE	Humboldt Bay	3	65,000	Uranium (UR)	Nuclear	NB	Nuclear	1985	PG&E
RE	Kern	1	66,000	NG	Gas	ST	Fossil	1994	PG&E
RE	Kern	2	99,500	FO6	Oil	ST	Fossil	1994	PG&E
RE	Martinez	1	40,000	NG	Gas	ST	Fossil	1986	PG&E
RE	Melones	1	12,000	WAT	Hydro/PS	HY	Hydro	1976	PG&E
RE	Melones	2	12,000	WAT	Hydro/PS	HY	Hydro	1976	PG&E
RE	Moss Landing	1	107,550	NG	Gas	ST	Fossil	1994	PG&E
RE	Moss Landing	2	111,000	NG	Gas	ST	Fossil	1994	PG&E
RE	Moss Landing	3	107,550	NG	Gas	ST	Fossil	1994	PG&E
RE	Moss Landing	4	112,500	NG	Gas	ST	Fossil	1994	PG&E
RE	Oleum	1	40,000	FO6	Oil	ST	Fossil	1988	PG&E
RE	Oleum	2	40,000	FO6	Oil	ST	Fossil	1988	PG&E
RE	Potrero	1	50,000	FO6	Oil	ST	Fossil	1983	PG&E
RE	Potrero	2	50,000	FO6	Oil	ST	Fossil	1983	PG&E
RE	Solano Wind	1	2,500	WND	Misc.	WT	Other	1988	PG&E

Status	Plant Name	Gen Code	Name plate Capacity (kW)	Primary	Fuel Type Group	Unit Type	Unit Type Group	Retire-Ment Year	Owner or Utility Name
RE	Glenarm	G9	45,000	FO2	Oil	ST	Fossil	1983	City of Pasadena
RE	Glenarm	ST8	25,000	FO2	Oil	ST	Fossil	1983	City of Pasadena
RE	Glenarm	ST9	35,000	FO2	Oil	ST	Fossil	1983	City of Pasadena
RE	Coldwater Creek	GE1	65,000	GST	Misc.	GE	Other	1996	SMUD
RE	Coldwater Creek	GE2	65,000	GST	Misc.	GE	Other	1996	SMUD
RE	PVUSA	1	1,000	SUN	Misc.	Photovol-taic (PV)	Other	1999	City of Davis
RE	Rancho Seco	1	963,000	UR	Nuclear	NP	Nuclear	1990	SMUD
RE	Heber	1	70,000	GST	Misc.	GE	Other	1991	San Diego Gas and Electric Co. (SDG&E)
RE	Station B	21	15,000	FO2	Oil	ST	Fossil	1983	SDG&E
RE	Station B	22	15,000	FO2	Oil	ST	Fossil	1983	SDG&E
RE	Station B	24	28,000	FO2	Oil	ST	Fossil	1983	SDG&E
RE	Station B	25	35,000	FO2	Oil	ST	Fossil	1983	SDG&E
RE	Station B	HT	3,000	NG	Gas	ST	Fossil	1993	SDG&E
RE	SCDP Fuel Cell	1	2,000	NG	Gas	FC	Other	1997	City of Santa Clara
RE	Big Creek 8	A1	100	WAT	Hydro/PS	HY	Hydro		Southern California Edison (SCE)
RE	Big Creek 8	A2	200	WAT	Hydro/PS	HY	Hydro		SCE
RE	Chino Battery	1	10,000	OT	Misc.	OT	Other	1997	SCE
RE	DAF 50 Wind Turbine	1	1,300	WND	Misc.	WT	Other	1985	SCE
RE	DAF 50 Wind Turbine	2	500	WND	Misc.	WT	Other	1986	SCE
RE	DAF 50 Wind Turbine	WT3	50	WND	Misc.	WT	Other	1990	SCE
RE	DAF 50 Wind Turbine	WT4	100	WND	Misc.	WT	Other	1986	SCE

Status	Plant Name	Gen Code	Name-plate Capacity (kW)	Primary	Fuel Type Group	Unit Type	Unit Type Group	Retire-Ment Year	Owner or Utility Name
RE	DAF 50 Wind Turbine	WT5	330	WND	Misc.	WT	Other	1987	SCE
RE	Long Beach	10	90,000	FO2	Oil	ST	Fossil		SCE
RE	Long Beach	11	106,000	FO2	Oil	ST	Fossil	1983	SCE
RE	Pebbly Beach	11	1,000	FO2	Oil	IC	Fossil	1995	SCE
RE	Pebbly Beach	2	500	FO2	Oil	IC	Fossil	1995	SCE
RE	Pebbly Beach	4	200	FO2	Oil	IC	Fossil	1995	SCE
RE	San Onofre	1	456,000	UR	Nuclear	NP	Nuclear	1992	SCE
RE	Santa Ana 2	1	400	WAT	Hydro/PS	HY	Hydro	1998	SCE
RE	Santa Ana 2	2	400	WAT	Hydro/PS	HY	Hydro	1998	SCE
RE	Solar	1	12,500	SUN	Misc.	SS	Other	1988	SCE
RE	Yosemite	1	1,000	WAT	Hydro/PS	HY	Hydro	1985	U.S. Department of the Interior
RE	Yosemite	2	1,000	WAT	Hydro/PS	HY	Hydro	1985	U.S. Department of the Interior
SB	Magnolia	M2	10,000	WH	Misc.	CW	Fossil		Burbank PSD
SB	Magnolia	M3	20,000	NG	Gas	SG	Fossil		Burbank PSD
SB	Magnolia	M4	34,500	NG	Gas	SG	Fossil		Burbank PSD
SB	Silver Gate	1	40,000	FO2	Oil	ST	Fossil		SDG&E
SB	Silver Gate	2	69,000	FO2	Oil	ST	Fossil		SDG&E
SB	Silver Gate	3	69,000	FO2	Oil	ST	Fossil		SDG&E
SB	Silver Gate	4	69,000	FO2	Oil	ST	Fossil		SDG&E
SB	Valley	1	100,000	NG	Gas	ST	Fossil		LA DWP
SB	Valley	2	100,000	NG	Gas	ST	Fossil		LA DWP

KEY: OS – On long-term schedule maintenance or forced outage, not available to operate (>3 months); RE – Retired (no longer in service and not expected to be returned to services; and SB – Cold Standby (Reserve): deactivated (mothballed), in long-term storage and cannot be made available for service in a short period of time, usually requires 3 – 6 months to reactivate.