3.5 Energy

This section describes existing energy supply and consumption trends within the SCAG region, identifies the potential impacts of the RTP on energy consumption, includes mitigation measures for the impacts, and evaluates the residual impacts.

Environmental Setting

Energy Types, Sources and Providers

The major sources of energy in the SCAG region include petroleum, electricity, and natural gas. Renewable resources have become a major focus of recent energy policy with increased awareness of petroleum and natural gas constraints and air quality concerns. In addition, electric power generation accounts for approximately 20 percent of the state's greenhouse gas emissions.[1]

Petroleum products represent approximately 40 percent of the energy consumption in the U.S. Natural gas and coal each supply approximately 23 percent of the national energy demand. Nuclear power represents about 8 percent of the energy consumption and renewable energy represents approximately 7 percent of energy use.[2] Current annual consumption in the U.S. is approximately 100.7 quadrillion (10^{15}) British thermal units (Btu)[3], which represents about 22 percent of the world's energy consumption.[4]

Petroleum and natural gas supply most of the energy consumed in California. Petroleum supplies 54 percent and natural gas supplies 33 percent of California's energy.[5] In 2004, Californians consumed about 15.4 billion gallons of gasoline and 2.8 billion gallons of diesel fuel an increase of nearly 50 percent over the last 20 years.[6] Electricity generation requires nearly half of the

1 California Environmental Protection Agency, Climate Action Team Report to Governor Schwarzenegger and the Legislature, March 2006.

2 United States Department of Energy, Energy Information Administration. U.S. Primary Energy Consumption by Source and Sector, 2006. Retrieved October 29, 2007, from http://www.eia.doe.gov/emeu/aer/pdf/pecss_diagram.pdf

3 The units of energy used in this report are British Thermal Units (Btu), kilowatt-hours (kWh), therms, and gallons. A Btu is the quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit at sea level. Since the other units of energy can all be converted into equivalent Btu units, the Btu is used as the basis for comparing energy consumption associated with different resources. A kWh is a unit of electrical energy, and on kWh is equivalent to approximately 10,200 Btu, taking into account initial conversion losses (i.e., from one type of energy, e.g., chemical, to another type of energy, e.g., mechanical) and transmission losses. Natural gas consumption typically is described in terms of cubic feet or therms; one cubic foot of natural gas is equivalent to approximately 1,050 Btu, and one therm represents 100,000 Btu. One gallon of gasoline/diesel is equivalent to approximately 140,000 Btu, taking into account energy consumed in the refining process.

4 United States Department of Energy, Energy Information Administration. (21 September 2007). International Energy Annual 2004, Table E.1 World Total Primary Energy Consumption, 1980-2005. Retrieved October 12, 2007 from http://www.eia.doe.gov/pub/international/iealf/tablee1.xls

5 California Energy Commission, California Energy Demand 2000-2010 Staff Report, (2000 June) page 3, Retrieved December 19, 2006 from http://www.energy.ca.gov/reports/2000-07-14_200-00-002.PDF

6 California Energy Commission, Integrated Energy Policy Report, (2005, November 21) page 20.

natural gas consumed in California.[7] Nearly all of the state's transportation system is fueled currently by fossil fuels.[8]

California consumes more energy than any other state in the U.S. except Texas. However, in terms of energy consumption per person, California ranks 49th among the 51 states, including the District of Columbia.[9] Current annual energy consumption in California (for all purposes including transportation) is approximately 8,364,592 billion Btu, which represents approximately 8.3 percent of the nation's total energy consumption.[10]

Petroleum

The United States consumes approximately 25 percent of the world's oil, while making up 5 percent of the world's population.[11] California consumes approximately 2 million barrels of oil per day or 2 percent of the world's oil consumption.[12] The U.S. imports approximately 60 percent of its oil.[13] Canada provides the largest share of imported petroleum, with 1.8 million barrels/day, followed by Mexico with 1.6 million barrels/day and Saudi Arabia with 1.4 million barrels/day.[14]

California as a state ranks 4th in crude oil reserves and crude oil production in the U.S. California also ranks 1st in gasoline consumption and jet fuel consumption and 3rd in distillate fuel consumption.[15] California relies on oil produced within the state, Alaska, and foreign nations to supply its refineries and produce the petroleum that is used in automobiles and for other purposes. The percentage of oil that is imported from foreign nations has increased dramatically in the past twenty years. For example, in 1994, California imported 49 million barrels of oil from foreign sources and in 2006 California imported 295 million barrels from foreign sources, as shown in **Figure 3.5-1**. Of the total 655 million barrels of oil refined in 2006, 38.8 percent came from in-state oil production, 16.2 percent came from Alaska and 45.0 percent came from foreign sources. As shown in the figure below, foreign sources of oil have surpassed Alaskan supplies and are reaching California supply levels.[16]

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7 California Energy Commission, Integrated Energy Policy Report, (2005, November 21) page 123.

8 California Energy Commission, Alternative Transportation Fuels, Retrieved October 29, 2007 from http://www.energy.ca.gov/afvs/vehicle_fact_sheets/index.html

9 United States Department of Energy, Energy Information Administration. Table R.2 Energy Consumption by Source and Total Consumption per Capita, Ranked by State, 2004. Retrieved October 29, 2007 from http://www.eia.doe.gov/emeu/states/sep_sum/plain_html/rank_use_per_cap.html

10 United States Department of Energy, Energy Information Administration. State Energy Profiles (October 25, 2007). Retrieved October 29, 2007 from http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=CA

11 United States Census Bureau. Retrieved January 31, 2007 from http://www.census.gov/. United Stated Department of Energy, Energy Information Administration (July 2007). Basic Petroleum Statistics. Retrieved October 29, 2007 from http://www.eia.doe.gov/neic/quickfacts/quickoil.html

12 United States Department of Energy, Energy Information Administration. State Energy Consumption, Price and Expenditure Estimates. Total Petroleum Consumption Estimates by Sector, 2005, Retrieved October 29, 2007 from http://www.eia.doe.gov/emeu/states/sep_fuel/html/fuel_use_pa.html

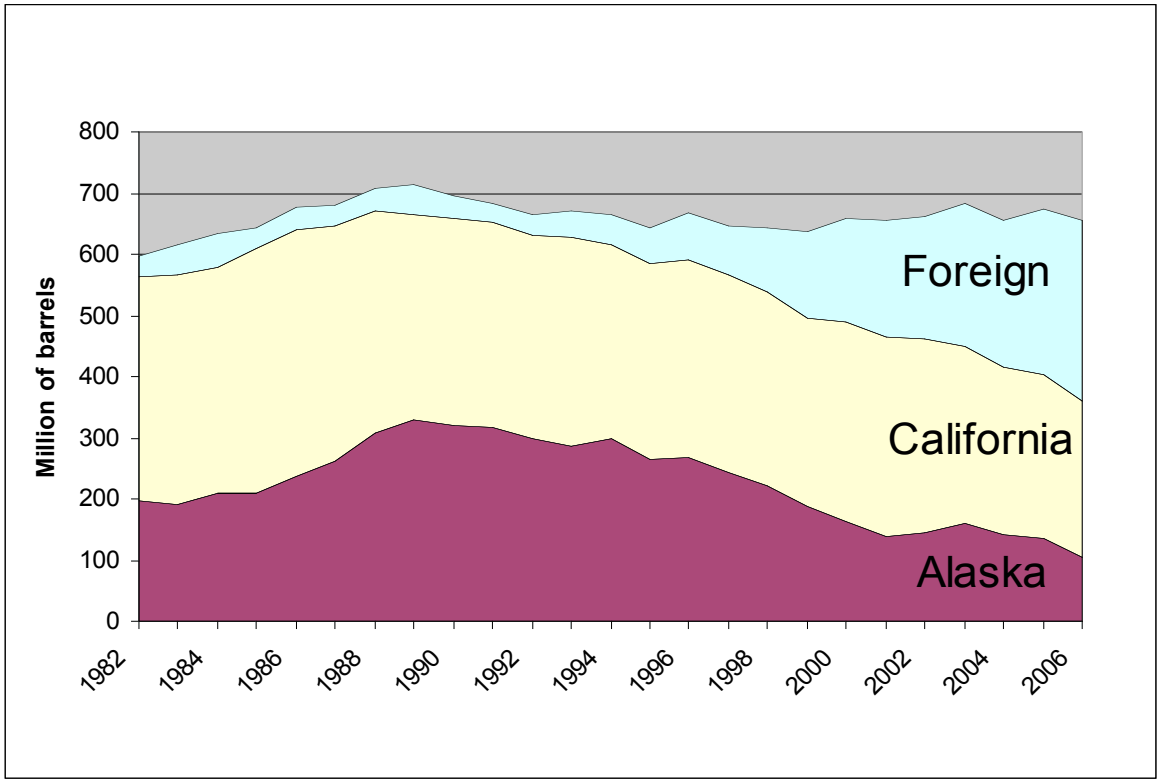
13 United States Department of Energy, Energy Information Administration. (July 2007) Basic Petroleum Statistics. Retrieved October 29, 2007 from http://www.eia.doe.gov/neic/quickfacts/quickoil.html

14 United States Department of Energy, Energy Information Administration. U.S. Crude Oil Imports 2006. Retrieved October 29, 2007 from http://tonto.eia.doe.gov/dnav/pet/pet_move_impcus_a2_nus_epc0_im0_mbblpd_a.htm.

15 United States Department of Energy, Energy Information Administration, Petroleum Profile, California; October 2007 http://tonto.eia.doe.gov/oog/info/state/ca.html, accessed October 29, 2007

16 California Energy Commission, Oil Supply Sources To California Refineries, Retrieved October 29, 2007 from http://www.energy.ca.gov/oil/statistics/crude_oil_receipts.html, Oil Supply Sources To California Refineries

FIGURE 3.5-1
OIL SUPPLY SOURCES IN CALIFORNIA 1982 – 2006



SOURCE: California Energy Commission, Oil Supply Sources to California Refineries. Retrieved October 29, 2007 from http://www.energy.ca.gov/oil/statistics/crude_oil_receipts.html

Oil is a finite and non-renewable resource and it is uncertain how future energy consumption trends will be sustained with the current political, environmental and technological constraints. Our nation's reliance on petroleum for our energy needs is even more problematic because of the global trend toward an inevitable turning point often referred to as "peak oil" the peak and then decline of global oil production. Peak oil is the point of maximum oil production whether from a single well, a country, or the planet as a whole. The maximum point of production is expected to happen when about half or slightly more of the ultimately recoverable oil has been produced. To be clear, peaking does not mean "running out." Rather, it indicates the point where global production can no longer be maintained or increased. Production will begin to decline, year after year. Geophysicist M. King Hubbert correctly predicted the 1971 peak in U.S. oil production and further predicted that sometime between 2005 and 2025, world oil production would reach a peak and begin a sharp decline.[17]

The International Energy Agency reported in July 2007 that the world will face an oil supply "crunch" in the next five years. This is due to faster than expected falls in supply in mature areas

[17] Udall, R. and Andrews, S. (1999, January). When will the joy ride end? A petroleum primer. Hubbert Center Newsletter, 99(1),
1-8.

such as the North Sea and Mexico and new prospects in Russia are experiencing long delays. As a result, oil supply will increase approximately 1 percent annually while demand will grow at an annual rate of 2.2 percent.[18] The world supply crunch will impact California and the SCAG region. A fuel shortage will take a toll on California's economy as consumers are spending more of their household income on gasoline than ever before, particularly with development patterns that create long commutes without access to public transportation. High fuel prices also reduce profit margins for the manufacturing and industrial sectors, which pass the higher cost of their goods and services to consumers. Since September of 2004, the monthly average price of gasoline has increased by more than 35 cents per gallon, costing consumers an additional $6.1 billion for gasoline.[19]

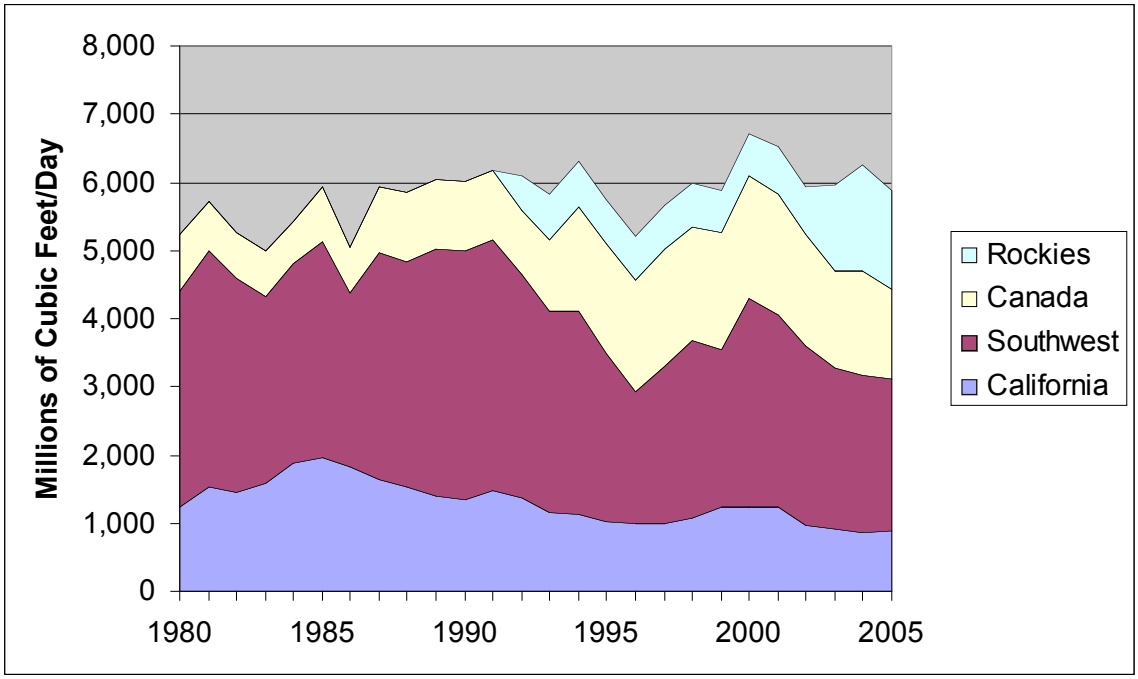
Natural Gas

Natural gas supply and demand data are compiled by the state's natural gas utilities in the annual California Gas Report and in the California Energy Commission's Integrated Energy Policy Report. Since 1994, California began to rely on natural gas from Canada and the Rocky Mountains region and has seen both the physical amount and the percentage produced within California as well as imported from the Southwest decrease. California imports approximately 85 percent of its natural gas supply from the Southwestern U.S., the Rocky Mountains, and Canada. The remainder is produced in California.[20] California's natural gas supply sources are shown in **Figure 3.5-2**.[21]

The SCAG region is served primarily by the investor-owned Southern California Gas Company, a unit of Sempra Energy. A small portion of the region is served by a municipal gas utility, Long Beach Energy (part of the City of Long Beach). The Southern California Gas Company, a privately owned utility company, provides natural gas service throughout the SCAG region, except for the City of Long Beach, the southern portion of Orange County, and portions of San Bernardino County. The service area for Long Beach Energy, a municipal utility and natural gas supplier owned and operated by the City of Long Beach, includes the cities of Long Beach and Signal Hill, and sections of surrounding communities including Lakewood, Bellflower, Compton, Seal Beach, Paramount, and Los Alamitos. Long Beach's customer load profile is 50 percent residential and 50 percent commercial/industrial. The majority of Long Beach supplies are purchased at the California border, primarily from the Southwestern United States. San Diego Gas & Electric Company provides natural gas service to the southern portion of Orange County. In San Bernardino County, Southwest Gas Corporation provides natural gas service to Victorville, Big Bear, Barstow, and Needles. The Los Angeles Department of Water and Power utilizes natural gas for electrical generation in the City of Los Angeles.

18 International Energy Agency (July 2007). Medium Term Oil Market Report
19 California Energy Commission. (November 2005). Integrated Energy Policy Report. CEC-100-2005-007CMF. Retrieved September 26, 2007 from http://www.energy.ca.gov/2005publications/CEC-100-2005-007/CEC-100-2005-007-CMF.PDF
20 California Energy Commission, California Natural Gas Supply by Source. Retrieved October 29, 2007 from http://www.energy.ca.gov/naturalgas/statistics/gas_supply_by_source.html
21 California Energy Commission. (2006, August 30). California Natural Gas Supply by Source. Retrieved October 29, 2007 from http://www.energy.ca.gov/naturalgas/statistics/gas_supply_by_source.html

FIGURE 3.5-2
NATURAL GAS SUPPLY SOURCES 1980 – 2005



SOURCE: California Energy Commission, California Natural Gas Supply By Source. Retrieved October 29, 2007 from http://www.energy.ca.gov/naturalgas/statistics/gas_supply_by_source.html

There is also a tightening of natural gas markets due to decreasing supplies and growing demand for natural gas, which makes up 25 percent of the nation's energy use and is by comparison, a relatively clean source of electricity compared to sources such as coal. The U.S. and California will lose a major source of natural gas imports by 2010 due to the decline of Canada's largest producing basin, the Western Sedimentary Basin, coupled with an approximately 2 percent projected average annual growth in Canada's domestic consumption.[22] Although some research has shown a world peak in natural gas occurring a decade after oil, the U.S. and California could experience the effects sooner. For example, natural gas has become the preferred source of electricity generation, supplying over 40 percent of California's power.[23] Also, unlike oil, it is more difficult and expensive to import replacement natural gas from overseas − as it has to be liquefied for transport and then re-gasified for distribution.[24] An increase in natural gas prices would negatively affect the economy, potentially leading to reduced sales and employment.[25]

22 United States Department of Energy, Energy Information Administration. International Energy Outlook 2006 (June 2006) pp. 37 – 49. Retrieved October 29, 2007 from http://www.eia.doe.gov/oiaf/ieo/pdf/0484(2006).pdf

23 California Energy Commission, 2006 Gross System Electricity Production. (April 2007) CEC-300-2007-007. Retrieved October 29, 2007 from http://www.energy.ca.gov/electricity/gross_system_power.html

24 City of Portland Office of Sustainable Development, Bureau of Planning, and Department of Transportation. Peak Oil Task Force Briefing Book (July 25, 2006).

25 Global Insight. (February 2006). The Impacts of Natural Gas Prices on the California Economy: Final Report. Retrieved September 27, 2007 from http://www.globalinsight.com/publicDownload/genericContent/natgasfullstudy.pdf

Electricity

Local electricity distribution service is provided to customers within the SCAG region by both Investor-Owned Utilities (IOUs) and Publicly Owned Utilities (POUs). The two IOUs operating in the region are Southern California Edison Company (SCE) and San Diego Gas and Electric (SDG&E). SCE is the largest electricity utility in Southern California with a service area that covers all or nearly all of Orange, San Bernardino, and Ventura Counties, and most of Los Angeles and Riverside Counties. The SCE territory also includes areas outside of SCAG including Inyo, Tulare, and Mono County as well as portions of Kern, Fresno, and Tolumne Counties. The Southern California Edison Company delivers 78 percent of the retail electricity sales to residents and businesses in the SCAG region.[26] SDG&E provides local distribution service to the southern portion of Orange County.[27] There are also 12 publicly owned utilities in the SCAG region including Anaheim, Azusa, Banning, Burbank, Cerritos, Colton, Glendale, Los Angeles, Pasadena, Riverside, and Vernon, and the Imperial Irrigation District. Together, these municipal utilities deliver electricity to over 2 million customers in the Southern California region that spans an area of 7,000 square miles and has a total population that exceeds 5 million.[28] The Los Angeles Department of Water and Power (LADWP) is the largest of the publicly owned electric utilities in Southern California, providing approximately 20 percent of the region's electricity.[29]

Alternative Energy Sources

Alternative Fuels

Alternative fuels, as defined by the Energy Policy Act of 1992 (EPAct), include ethanol, natural gas, propane, hydrogen, biodiesel, electricity, methanol, and p-series fuels. These fuels are being used worldwide in a variety of vehicle applications.[30] Use of these fuels for transportation can generally reduce air pollutant emissions and can be domestically produced and derived from renewable sources. The Energy Policy Act of 2005 further directed the Department of Energy to carry out a study to plan for the transition from petroleum to hydrogen in a significant percentage of vehicles sold by 2020. The following descriptions of alternative fuels are from the U.S. Department of Energy's Alternative Fuels Data Center website. **Map 3.5-1**, Alternative Fuel Facilities, identifies the location of biodiesel, hydrogen, natural gas and propane facilities in the SCAG region.

26 The California Energy Commission's 2006-2016 Demand Forecast (CEC-400-2005-034-SF-ED2) states that the SCE planning area data includes the following utilities: Anaheim, Anza, Azusa, Banning, Colton, Metropolitan Water District, Riverside, SCE, Southern California Water, USBR-Parker Davis, Valley Electric, Vernon. The municipal utilities including Burbank, Pasadena, and Glendale are combined into one category by CEC.

27 California Energy Commission, Map of Electric Utility Service Areas in California. Retrieved October 29, 2007 from http://www.energy.ca.gov/maps/UTILITY_SERVICE_AREAS.PDF

28 Southern California Public Power Authority. 2005-2006 Annual Report. Retrieved October 29, 2007 from http://www.scppa.org/annualreport.htm

29 California Energy Commission. California Energy Demand 2006-2016, Staff Energy Demand Forecast, Staff Final Report. (September 2005). CEC-400-2005-034-SF-ED2.

30 U.S. Department of Energy, Alternative Fuels Data Center, Retrieved October 29, 2007 from http://www.eere.energy.gov/afdc/fuels/index.html

Ethanol is a clear, colorless liquid. Blends of at least 85 percent ethanol are considered alternative fuels under the EPAct. E85, a blend of 85 percent ethanol and 15 percent gasoline, is used in flexible fuel vehicles (FFVs) that are currently offered by most major auto manufacturers. FFVs can run on gasoline, E85, or any combination of the two and qualify as alternative fuel vehicles under EPAct regulations.

Natural gas is a mixture of hydrocarbons—mainly methane (CH4)—and is produced either from gas wells or in conjunction with crude oil production. The interest in natural gas as an alternative fuel for automobiles stems mainly from its clean burning qualities, its domestic resource base, and its commercial availability to end users. Because of the gaseous nature of this fuel, it must be stored onboard a vehicle in either a compressed gaseous state (CNG) or in a liquefied state (LNG).

Propane is produced as a by-product of natural gas processing and petroleum refining. Propane or liquefied petroleum gas (LPG) is a popular alternative fuel choice for vehicles because there is already an infrastructure of pipelines, processing facilities, and storage for its efficient distribution.

Hydrogen is the simplest and lightest fuel is hydrogen gas (H2). Hydrogen is in a gaseous state at atmospheric pressure and ambient temperatures. Hydrogen is being explored for use in combustion engines and fuel cell electric vehicles. The ability to create hydrogen from a variety of resources and its clean-burning properties make it a desirable alternative fuel. Although there is no significant transportation distribution system currently for hydrogen transportation use, hydrogen could be transported and delivered using the established hydrogen infrastructure; for significant market penetration, the infrastructure will need further development.

Biodiesel is a domestically produced, renewable fuel that can be manufactured from vegetable oils, animal fats, or recycled restaurant greases. Biodiesel is safe, biodegradable, and reduces serious air pollutants such as particulates, carbon monoxide, hydrocarbons, and air toxics. According to the U.S. Department of Energy, pure biodiesel (B100) is considered an alternative fuel under EPAct. Lower-level biodiesel blends are not considered alternative fuels, but covered fleets can earn one EPAct credit for every 450 gallons of B100 purchased for use in blends of 20 percent or higher.

Electricity can be used as a transportation fuel to power battery electric and fuel cell vehicles. When used to power electric vehicles or EVs, electricity is stored in an energy storage device such as a battery. Fuel cell vehicles use electricity produced from an electrochemical reaction that takes place when hydrogen and oxygen are combined in the fuel cell "stack." The production of electricity using fuel cells takes place without combustion or pollution and leaves only two byproducts, heat and water. The U.S. Department of Energy's Advanced Vehicle Testing Activity (AVTA) promotes the use of electric vehicles in commercial fleets in the United States. During 1996, AVTA requested and received proposals from interested groups to become qualified vehicle testers (QVT). SCE headed one QVT. According to SCE, California's approximately 20,000 megawatts of excess off-peak (nighttime) electricity capacity would allow the charging of

millions of electro-drive technologies without the need for new power generation facilities.[31] **Map 3.5-2,** Electric Refueling Stations, identifies the location of planned, private and public refueling stations in the SCAG region.

Methanol, also known as wood alcohol, can be used as an alternative fuel in flexible fuel vehicles that run on M85 (a blend of 85 percent methanol and 15 percent gasoline). However, it is not commonly used because automakers are no longer supplying methanol-powered vehicles. Today most of the world's methanol is produced by a process using natural gas as a feedstock. However, the ability to produce methanol from non-petroleum feedstocks such as coal or biomass is of interest for reducing petroleum imports.

P-Series fuel is a unique blend of natural gas liquids (pentanes plus), ethanol, and the biomass-derived co-solvent methyltetrahydrofuran (MeTHF). P-Series fuels are clear, colorless, 89-93 octane, liquid blends that are formulated to be used in flexible fuel vehicles (FFV's). P-Series are designed to be used alone or freely mixed with gasoline in any proportion inside the FFV's gas tank. These fuels are not currently being produced in large quantities and are not widely used.

Renewable Electricity

Electricity supply reliability depends, in part, on the diversity of energy sources. In 1978, congress passed the Public Utilities Regulatory Policies Act (PURPA). The act defines facilities that use alternative or renewable energy sources as “qualifying facilities.” It provides financial incentives for their installation and requires utilities to sign long-term power purchase contracts with qualifying facilities. The California Public Utilities Commission (CPUC) has adopted contract incentives to assist qualifying facilities.

Qualifying facilities built in the SCAG region include wind and solar installations in Riverside and San Bernardino Counties and a number of cogeneration units around the region. Original provisions of PURPA encouraged the construction of biomass-to-energy facilities, which use materials such as agricultural and wood waste as fuel for energy production.

On or before March 1 of each year, each retail provider who makes a claim of specific purchases during the previous calendar year provides a filing to the Energy Commission, providing certain information about each electricity product for which a claim is made.[32]

Cogeneration provides the most megawatts of energy from qualifying facilities for Southern California Edison with over 2,000 megawatts under contract. Wind is the second largest source for energy from qualifying facilities with over 1,000 megawatts. Southern California Edison’s energy from qualifying facilities and descriptions of each energy source are presented below.

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31 Southern California Edison, Electric Transportation website. Retrieved October 29, 2007 from http://www.sce.com/PowerandEnvironment/ElectricTransportationNew/Energy/

32 Public Utilities Code, Section 398.5 and California Code of Regulations, Section 1394

Cogeneration / Combined Heat and Power

Emissions stacks are synonymous with fossil fuel burning energy plants. Cogeneration captures a portion of the heat energy lost through the stacks to create power. Cogeneration means that the useful thermal energy produced as a by-product is captured at the same time electrical power is produced. This practice can increase the efficiency of energy production.

The most efficient and cost-effective form of distributed generation is cogeneration or combined heat and power. By recycling waste heat, these systems are much more efficient than systems that separately serve thermal and electric loads. They are also considerably more efficient than almost all conventional gas-fired power plants. California has more than 9,000 MW of combined heat and power systems throughout the state, representing approximately 17 percent of statewide generation.[33]

The petroleum refining industry is one of the largest users of cogeneration in the U.S. California refineries have an installed cogeneration capacity of about 1,400 MW and have the potential to increase their use of cogeneration technologies. Therefore, the California Energy Commission's 2005 Integrated Energy Report recommended that the state should work with the petroleum industry and other agencies to identify opportunities for additional cogeneration at refineries.[34]

There are several national and regional partnerships that promote cogeneration. The U.S. Environmental Protection Agency's (EPA) Combined Heat and Power (CHP) Partnership is "a voluntary program that seeks to reduce the environmental impact of power generation by fostering the use of cogeneration."[35] This partnership is designed to foster cost-effective cogeneration projects throughout the country.

Wind

Existing utility-scale wind power generation facilities in the SCAG region can be found in the San Gorgonio Pass near Palm Springs in Riverside County. This area currently has a generating capacity of 359 megawatts (MW). Utility-scale wind power is also generated in the Tehachapi Ranges in Kern County, with a capacity of 710 MW. Orange County has 36 MW of wind generation capacity. Other large resource areas in California include Altamont Pass (562 MW), Solano (165 MW), and Pacheco Pass (16 MW). Three of these primary regions (Altamont, Tehachapi and San Gorgonio) account for approximately 95 percent of all commercial wind power generation in California and approximately 11 percent of the world's wind-generated electricity. With an average California household using 6,500 kilowatt-hours (kWh) of electricity per year, 3.5 billion kWh of annual electricity generation from wind resources in the state provides electricity sufficient to power over 530,000 homes.[36]

33 California Energy Commission, Integrated Energy Policy Report, (2005, November 21) page 3. Retrieved October 29, 2007 from http://www.energy.ca.gov/2005publications/CEC-100-2005-007/CEC-100-2005-007-CMF.PDF.
34 California Energy Commission, Integrated Energy Policy Report, (2005, November 21) page 42.
35 U.S. Environmental Protection Agency. (26 October 2006). Combined Heat and Power Partnership. Retrieved October 29, 2007, from http://www.epa.gov/CHP/index.html
36 California Energy Commission. (April 2005) California Wind Resources. Retrieved October 29, 2007 from http://www.energy.ca.gov/2005publications/CEC-500-2005-071/CEC-500-2005-071-D.PDF.

Geothermal

Southern California Edison has 955 megawatts of geothermal energy under contract. Geothermal energy comes from underground reservoirs of steam, hot water, and hot dry rocks. Hot water or steam extracted from geothermal reservoirs in the Earth's crust is supplied to steam turbines at electric utilities that drive generators to produce electricity.[37] The California Energy Commission's Geothermal Program was created by Assembly Bill 1905 (Bosco) and has been in operation since 1981.[38] The program promotes geothermal research and development of geothermal energy production in California.

Solar

California has set a goal to create 3,000 megawatts of new, solar-produced electricity by 2017. The California Public Utilities Commission, through its California Solar Initiative, provides incentives for existing residential homes and existing and new commercial, industrial, and agricultural properties. The California Energy Commission manages a 10-year, $400 million program to encourage solar in new home construction through its New Solar Homes Partnership.[39] As shown in **Table 3.5-1**, Southern California Edison has 879 megawatts of solar energy under contract, or approximately 3 percent of their power mix.

TABLE 3.5-1
SOUTHERN CALIFORNIA EDISON ENERGY FROM QUALIFYING FACILITIES

Technology	MegaWatts Under Contract
Cogeneration	2,087
Wind	1,220
Geothermal	955
Solar	879
Biomass	249
Small Hydro	94
Total	5,484

SOURCE: Southern California Edison Company. (31 January 2007). *QF Resources: Qualifying Facilities Semi-Annual Status Report to the California Public Utilities Commission.*

Solar thermal electricity is produced from the concentrating sunlight on a relatively small area to create the high temperatures needed to vaporize water or other fluids to drive a turbine for generation of electric power. In California's Mojave desert, there are huge rows of solar mirrors arranged in what's called "solar thermal power plants" that use this idea to make electricity for more than 350,000 homes.

37 U.S. Department of Energy. (August 2005). Geothermal Energy. Retrieved October 29, 2007 from http://www.eia.doe.gov/cneaf/solar.renewables/page/geothermal/geothermal.html.
38 California Energy Commission. (17 September 2007). Energy Commission Geothermal Program. Retrieved October 29, 2007, from http://www.energy.ca.gov/geothermal/.
39 The California Solar Initiative. Retrieved October 29, 2007 from http://www.gosolarcalifornia.ca.gov/csi/index.html

Solar cells (or photovoltaic energy) are small, square-shaped panel semiconductors made from silicon and other conductive materials. They are manufactured in thin film layers. When sunlight strikes a solar cell, chemical reactions release electrons, generating electric current. Solar cells are also called photovoltaic cells - or PV cells for short - and can be found on many small appliances, like calculators, toys and even hats. Individual PV cells are arranged together in a PV module and the modules are grouped together in an array. Some of the arrays are set on special tracking devices to follow sunlight all day long.

The electrical energy from solar cells can then be used directly. It can be used in a home for lights and appliances. It can be used in a business. Solar energy can be stored in batteries to light a roadside billboard at night. Or the energy can be stored in a battery for an emergency roadside cellular telephone when no telephone wires are around.

There are two primary PV markets. Off-grid systems are used where the cost of a PV system is cheaper than stringing electrical power lines long distances from the local utility. Grid-connected PV systems usually cannot compete directly with the cost of utility-produced power. Because of state incentives and federal tax credits, many people are considering grid-connected PV systems. If the PV system provides more power than the home or business uses, additional electricity is fed back into the grid for other people to use. This effectively spins an electricity meter backward in what is known as "net metering."

Incentives offered to homeowners and small businesses are helping develop a more robust PV industry in the United States. Additional, growing demand for PV cells, along with competition, can help drive down the per watt price of PV cells while, at the same time, create new jobs.

Photovoltaics or solar cells can be purchased in two formats: as a stand-alone module that is attached to your roof or on a separate system, or using integrated roofing materials with dual functions - that as a regular roofing shingle and as a solar cell making electricity.

Because they do not produce polluting air emissions or water effluents, solar PV systems are prime candidates for supplying electricity at locations where such environmental impacts are unacceptable (for example, in parks and places where preserving high levels of environmental quality is important).[40]

Biomass / Biofuels

As discussed under qualifying facilities, biofuels and biomass are alternative energy sources that can be developed to reduce the dependence on energy from fossil fuels. The U.S. Department of Energy's Biomass Program promotes biomass and biofuels because biomass use "strengthens rural economies, decreases America's dependence on imported oil, avoids use of MTBE or other highly toxic fuel additives, reduces air and water pollution, and reduces greenhouse gas

40 California Solar Initiative, Solar 101. Retrieved October 29, 2007 from http://www.gosolarcalifornia.ca.gov/solar101/what_is.html

emissions."[41] Nationwide in 2003, biomass was the leading source of renewable energy, accounting for 47 percent of the renewable energy produced in the United States and 4 percent of the total energy produced within the U.S.[42] There are 26 biomass-to-energy plants operating in California, with a total generating capacity of 550 MW.[43] Southern California Edison has 254 MW of biomass under contract within the SCAG region.

Small Hydroelectric

Small hydroelectric facilities provide 94 megawatts of energy to Southern California Edison under their qualifying facilities contract. Large hydroelectric facilities provide a major source of power in California. These large facilities are operated by the federal government's Bureau of Reclamation and the state government's Department of Water Resources and are located on dams in the state.[44] Power utilities such as Southern California Edison operate the smaller hydroelectric facilities in the state. Hydroelectric projects larger than 30 MW are not considered eligible under the Renewable Portfolio Standard program for Investor Owned Utilities (IOUs). However, most Publicly Owned Utilities (POUs) still count generation from these projects toward their renewable energy targets.[45]

Conversion Technologies

Conversion technologies (CTs) refer to a diverse set of processes used to convert post-recycled, municipal solid waste to intermediate liquid, gas, or solid fuel products. The fuel products can then be combusted to produce energy. Conversion technology processes include (but are not limited to) the following:

- Gasification – the thermal conversion of solid organic material that takes place at elevated temperatures and pressures in the presence of oxygen to yield a gaseous product or solid char.
- Pyrolysis – similar to gasification but occurs in the absence of air and optimized for the production of fuel liquids.
- Catalytic Cracking – uses catalysts to accelerate the breakdown of polymers – such as plastics – into its basic unit which can be further processed to produce fuels (low-sulfur diesel and gasoline).
- Acid Hydrolysis – biomass is treated with an acid to break the plant matter down into its component sugars for subsequent fermentation to ethanol.
- Anaerobic Digestion – a bacterial fermentation process that produces a gas (biogas) from organic waste such as livestock manure, food waste, wastewater sludge, etc.

41 U.S. Department of Energy. (7 June 2007). Biomass Program. Accessed October 29, 2007, from http://www.eere.energy.gov/biomass/.
42 U.S. Department of Energy. (15 March 2007). Biomass Today. Accessed October 30, 2007, from http://www1.eere.energy.gov/biomass/biomass_today.html.
43 California Integrated Waste Management Board. (17 October 2007). Biomass to Energy. Accessed October 30, 2007 from http://www.ciwmb.ca.gov/Organics/Conversion/BioEnergy/.
44 California Energy Commission. (22 May 2001). Hydroelectric Power in California. Accessed October 30, 2007, from http://www.energy.ca.gov/electricity/hydro.html.
45 California Energy Commission (21 November 2005). 2005 Integrated Energy Policy Report. Adopted November 21, 2005.

CT systems often utilize a combination of two or more processes. Direct combustion (incineration) does not fall under the conversion technology category.[46]

The public health impacts of conversion technologies are still being assessed, but CTs with appropriate controls and emissions technology produce lower emissions of criteria air pollutants (NOx and SOx) than either landfills or direct combustion incinerators. The environmental benefits of CT scenarios are dependent on their ability to achieve high conversion efficiencies and high materials recycling rates.

Distributed Generation

An important alternative to new central station fossil-fueled generation is distributed generation (DG), which includes both cogeneration and self-generation. DG is broadly defined as electricity produced on-site or close to a load center that is also interconnected with a utility distribution system. California has approximately 2,500 MW of small scale renewable and non-renewable DG and has added an average of 100 MW of new small scale DG capacity every year since 2001.[47]

A small portion of the SCAG region's electrical power is currently provided by distributed energy resources. The LADWP Draft 2006 Power System Integrated Resource Plan has a goal to increase the commitment and funding to customer energy efficiency, demand side management and distributed generation programs and to aggressively pursue the goal of achieving 20 percent renewable energy by the year 2010. This policy, known as the Renewable Portfolio Standard (RPS), calls for diversifying renewables by location and technology, and pursuing both owned renewable power projects and purchase power agreements.[48] SCE also has a program to encourage distributed generation and meet the RPS.[49]

The limited use of distributed generation in the SCAG region reflects a number of barriers that have slowed adoption. According to the National Renewable Energy Laboratory, barriers include the following:

- Relatively small projects may face high fees, long approval processes, or burdensome insurance requirements. An example is high backup or standby charges, which a utility collects to cover the cost of providing power when the DG system is not operating. Another is an exit fee, which is levied on customers leaving the grid to compensate the utilities for the stranded cost of generating facilities.
- There is no national consensus on standard interconnection practices, so each project must go through a unique process, pay different charges, and meet different technical and safety standards. This may partly reflect utilities' lack of experience with DG

46 California Integrated Waste Management Board website. Retrieved October 23, 2007 from http://ciwmb.ca.gov/Organics/Conversion/
47 California Energy Commission (21 November 2005). 2005 Integrated Energy Policy Report. Adopted November 21, 2005.
48 Los Angeles Department of Water and Power. (2 May 2006) Draft Integrated Resource Plan. Retrieved October 29, 2007 from http://www.ladwp.com/ladwp/cms/ladwp008065.pdf
49 Southern California Edison, Self Generation website. Retrieved October 29, 2007 from http://www.sce.com/RebatesandSavings/GeneratingYourOwnPower.

projects, but could also stem from an understandable reluctance to lose part of their customer base.

- Local codes, standards, and environmental regulations that are not structured to recognize the attributes of distributed power.[50]

Nuclear Energy

California receives approximately 15 percent of its energy from nuclear sources. The three plants that supply this energy include the Diablo Canyon Power Plan located near San Luis Obispo, the San Onofre Nuclear Generating Station located near San Clemente, and the Palo Verde Nuclear Generation Station located near Phoenix, Arizona. The San Onofre Nuclear Generating station provides power to the Southern California Edison service area and has a capacity of 2,254 megawatts.[51] The San Onofre Nuclear Generating Station (SONGS) is jointly owned by Southern California Edison (SCE) (75 percent ownership), San Diego Gas & Electric (20 percent), and the cities of Riverside and Anaheim. Today, SONGS provides nearly 20 percent of the power to more than 15 million people in Southern California -- enough power to serve 2.75 million households.[52]

The increasing demand for energy and concerns about global warming has resulted in increased interest in nuclear energy. Many U.S. nuclear power plant operators are seeking approval from the U.S. Nuclear Regulatory Commission for license renewals. These extensions could keep the aging fleet of U.S. nuclear power plants operating for an additional 20 years, with uncertain economic, environmental, and reliability implications. In light of California's moratorium on nuclear power development, until progress is made in disposing of or reprocessing spent fuel, the Energy Commission could not provide land use permits or certification for such a power plant at this time. It is unlikely that the Energy Commission will be able to provide land use permits or certification for a new nuclear power plant in California in the near future.[53]

Consumptive Uses

Travel Fuel Consumption

The California Department of Transportation (Caltrans) forecasts the annual statewide and countywide number of vehicles, vehicle miles of travel (VMT), vehicle fuel consumption (VFC), and vehicle fuel economy (VFE).[54] Caltrans reports that vehicles in the SCAG region consumed over 23 million gallons of fuel per day in 2005 (the most recent data available). The 422 million

50 U.S. Dept. of Energy, Energy Efficiency and Renewable Energy. Retrieved October 29, 2007http://www.eere.energy.gov/de/overcoming_obstacles.html,.

51 California Energy Commission. Nuclear Power in California: 2007 Status Report. (June 2007). Retrieved from http://energy.ca.gov/2007publications/CEC-100-2007-005/CEC-100-2007-005-D.PDF on July 27, 2007.

52 Southern California Edison, San Onofre Nuclear Generating Station. Retrieved from http://www.sce.com/PowerandEnvironment/PowerGeneration/SanOnofreNuclearGeneratingStation/ on July 30, 2007.

53 California Energy Commission. Nuclear Power in California: 2007 Status Report. (June 2007). Retrieved from http://energy.ca.gov/2007publications/CEC-100-2007-005/CEC-100-2007-005-D.PDF on December 11, 2007.

54 Caltrans' Motor Vehicle Stock, Travel and Fuel Forecast Motor provides forecasts of Vehicle Miles Traveled (VMT), Vehicle Fuel Consumption (VFC), registered vehicles, and vehicle fuel economy on a statewide basis. The forecasts are disaggregated by county, road system, vehicle body type, and vehicle fuel type. The travel fuel consumption data from Caltrans provides the 2005 on-road fuel consumption estimate from the Board of Equalization's sales data.

vehicle miles traveled daily in the SCAG region in 2005 represented 47 percent of all vehicle miles traveled in the state.

California currently imports 61 percent of its petroleum from out-of-state sources, including 45 percent from foreign sources.[55] However, California's refining capacity has not been able to keep up with the demand for transportation fuels.[56] Because of that, the gasoline market is increasingly unstable as refinery accidents or scheduled maintenance create shortages and price fluctuations.[57]

The California Energy Commission has studied clean fuels infrastructure on a state level, and provides some insight into the SCAG region's infrastructure levels. For example, the CEC's 2003 market assessment of clean fuels infrastructure reveals that the Los Angeles Metropolitan Transit Authority (Metro) has the largest fleet of natural gas buses in California—over 2,000 in operation or on order at that time—and the Orange County Transportation Authority operated 232 liquid natural gas buses at that time. These numbers suggest that the region leads the State in alternate fuel vehicle use by public agencies.[58]

Transportation

Transportation, i.e., the movement of people and goods from place to place, is an important end use of energy in California, accounting for approximately 40 percent of total statewide energy consumption in 2004 and 12 percent of total U.S. transportation energy consumption.[59] **Table 3.5-2** shows annual transportation consumption in the SCAG region. Nonrenewable energy products derived from crude oil; including gasoline, diesel, kerosene, and residual fuel, provide most of the energy consumed for transportation purposes by on-road motor vehicles (i.e., automobiles and trucks), locomotives, aircraft, and ships. In addition, energy is consumed in connection with construction and maintenance of transportation infrastructure, such as highways, locomotives, runways, and berths. Trends in transportation-related technology foretell increased use of electricity and natural gas for transportation purposes.

Transportation energy is derived from a wide variety of petroleum products. Automobiles and trucks consume gasoline and diesel fuel. Turbine aircraft consume kerosene fuel; locomotives consume diesel fuel; and ships consume residual fuel oil. The transportation sector consumes relatively minor amounts of natural gas or electricity, but, propelled mainly by air quality laws and

55 California Energy Commission, Oil Supply Sources to California Refineries. Retrieved October 29, 2007 from http://www.energy.ca.gov/oil/statistics/crude_oil_receipts.html
56 California Energy Commission/California Air Resources Board: Reducing California's Petroleum Dependence, August 14, 2003 Final, Adopted Joint Agency AB 2076 Report, publication # 600-03-006F.
57 California Energy Commission (CEC)/California Air Resources Board: Reducing California's Petroleum Dependence, August 14, 2003 Final, Adopted Joint Agency AB 2076 Report, publication # 600-03-006F.
58 Burr Consulting, Regional Infrastructure Evaluation: A Report to the Southern California Association of Governments, September 18, 2006. Page 90.
59 Energy Information Administration, State Energy Profiles, California. (October 2007). Retrieved October 29, 2007 from http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=CA

TABLE 3.5-2
ANNUAL TRANSPORTATION ENERGY CONSUMPTION IN THE SCAG REGION

Category	Fuel Type	Year	Consumption	Units
Motor Vehicles	Gasoline/Diesel (1)	2005	8,524,639	(SCAG) thousand gallons
	Natural Gas (Compressed and Liquefied) (2)	2004	22,630	(CA) million cubic feet
	Hydrogen (3)	2006	0.02	(CA) million kilograms
	Ethanol (4)	2006	23	(CA) million barrels
Aircraft	Aviation Gasoline, Kerosene-type jet fuel (5)	2006	14,599,670	(SCAG) thousand gallons
Locomotives	Distillate Fuel Oil (6)	2005	324,496	(CA) thousand gallons
Ships (Vessel Bunkering)	Residual and Distillate Fuel Oil (7)	2005	677,949	(CA) thousand gallons

NOTE: California's transportation sector is more than 95 percent dependent on petroleum. Therefore, additional alternative fuels are not shown in this table.

(1) Source: California Department of Transportation, Division of Transportation System Information. (December 2006). California Motor Vehicle Stock, Travel and Fuel Forecast.
(2) Source :California Energy Commission, Natural Gas Statistics. Retrieved September 27, 2007 from http://www.energy.ca.gov/naturalgas/natural_gas_facts.html. and United States Department of Energy Alternative Fuels and Advanced Vehicles Data Center, Energy Efficiency and Renewable Energy, Estimated Consumption of Alternative Fuel by AFVs (in thousand GGEs), http://www.eere.energy.gov/afdc/data/docs/alternative_fuel_consumption.xls
(3) Source: South Coast Air Quality Management District, 2007 Final Program Environmental Impact Report for the Air Quality Management Plan, Energy Chapter, Retrieved October 5, 2007 from http://www.aqmd.gov/ceqa/documents/2007/aqmd/finalEA/07aqmp/ch4.2_FPEIR.pdf
(4) California Energy Commission, 2007 Integrated Energy Policy Report Staff Draft. (October 2007). Retrieved on October 5, 2007 from http://energy.ca.gov/2007publications/CEC-100-2007-008/CEC-100-2007-008-CTD.PDF
(5) United States Department of Energy, Table 5.13c Estimated Petroleum Consumption: Transportation Sector, 1949-2006. Retrieved October 5, 2007 from http://www.eia.doe.gov/emeu/aer/txt/ptb0513c.html; Source" Federal Aviation Administration, Passenger Boarding and All Cargo Data for U.S. Airports 2006. Retrieved November 2, 2007 from http://www.faa.gov/airports_airtraffic/airports/planning_capacity/passenger_allcargo_stats/passenger/index.cfm?year=2006
(6) United States Department of Energy, Energy Information Administration. Table 13: Adjusted sales of distillate fuel oil by energy use in the United States: 2001-2005. Retrieved September 27, 2007, from 2005
(7) United States Department of Energy, Energy Information Administration. Table 13: Adjusted sales of distillate fuel oil by energy use in the United States: 2001-2005. Retrieved September 27, 2007, from http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/fuel_oil_and_kerosene_sales/current/pdf/table23.pdf

regulations, technological innovations in transportation are expected to increasingly rely on compressed natural gas and electricity as energy sources. Biodiesel, derived from plant sources such as used vegetable oils, is a small but growing source of transportation fuel. Vehicles powered by fuels other than gasoline or diesel are referred to as "alternative fuel vehicles."

Roadways

Energy consumption by on-road motor vehicles reflects the types and numbers of vehicles, the extent of their use (typically described in terms of VMT), and their fuel economy (typically described in terms of miles per gallon). Trends in energy consumption by on-road motor vehicles generally follow trends in population and per capita income as well as trends in land use development patterns. For example, diffuse land use development patterns can result in an

imbalance between jobs and housing, which can lead to longer average commute trips. For example, a smart growth development plan that increases density by 30 percent, emphasizes infill and mixes land use to a high degree would be expected to reduce regional VMT by about 15 percent per capita over 30 years.[60]

Airports

As shown in **Table 3.5-2**, jet fuels consumption in California represents approximately 14,599,670 thousand gallons in 2006. The SCAG region has 57 public use airports, including six established commercial service airports, 45 general aviation, two recently closed military air bases (one certified as a commercial service airport), two commuter airports, and two joint-use facilities. Six established commercial service airports handle the majority of passenger air traffic: Bob Hope, John Wayne/Orange County, Long Beach, Los Angeles International, Ontario International and Palm Springs. Limited commercial service exists at Oxnard and Imperial County airports. In 2006, passenger activity at these airports was approximately 43 million boardings.[61] Airports also play an important role in goods movement, as air cargo is transported in either passenger aircraft belly-holds or in dedicated freight aircraft used primarily for high value, time sensitive shipments. In 2006, 5 million tons of air cargo were handled by the region's airports.[62] The most recent data available for the SCAG region's consumption of aviation fuel was derived from the United States Department of Energy's estimated petroleum consumption for the transportation sector and the percentage of boardings at airports in the SCAG region.

Ports

Table 3.5-2 also includes energy consumption estimates for locomotives and ships. Locomotive consumption of diesel fuel in California was 324,496 thousand gallons in 2005, the most recent year available. Vessel bunkering fuel use was approximately 678,000 thousand gallons in 2005. Residual fuel and distillate fuel oil consumption by ships in the SCAG region was estimated by applying the ratio of waterborne traffic (in millions of short tons) associated with Long Beach and Los Angeles Ports over total national waterborne traffic to nation-wide estimates of residual fuel consumption for vessel bunkering.[63] The Port of Los Angeles employs an Alternative Maritime Power (AMP) program that allows ships to plug in to shore side electrical power and the Port of Long Beach initiated a voluntary project to install shore-side electrical power, which could provide reductions the estimated vessel bunkering fuel use.

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60 California Energy Commission. (August 2007). The Role of Land Use in Meeting California's Energy and Climate Change Goals. Final Staff Report. CEC-600-2007-008-SF.

61 Federal Aviation Administration.CY 2006 Passenger Boarding and All-Cargo Data. (October 18, 2007). Retrieved October 29, 2007 from http://www.faa.gov/airports_airtraffic/airports/planning_capacity/passenger_allcargo_stats/passenger/index.cfm?year=2006

62 Federal Aviation Administration, All Cargo Data. Qualifying Cargo Airports, Rank Order, and Percent Change from 2006. Retrieved October 29, 2007 from http://www.faa.gov/airports_airtraffic/airports/planning_capacity/passenger_allcargo_stats/passenger/media/cy06_cargo.pdf

63 Southern California Association of Governments (September 2005). Goods Movement in Southern California: The Challenge, The Opportunity, and The Solution. Retrieved October 5, 2007 from http://scag.ca.gov/goodsmove/pdf/GoodsmovePaper0905.pdf

Electricity

Electricity is produced in several different ways. Natural gas is used to supply the largest percentage of electricity in California. Combined with natural gas, the energy sources of coal, large hydrologic systems, and nuclear power provide approximately 90 percent of the energy to make electricity in the state. Only 10 percent of electricity in the state comes from renewable energy sources such as geothermal, biomass, small hydrologic projects, wind, and solar sources. Power generation by type can be seen in **Table 3.5-3**, below:

TABLE 3.5-3
CALIFORNIA GROSS SYSTEM POWER GENERATION FOR 2006 (GIGAWATT-HOURS)

Fuel Type	In-State	Northwest Imports	Southwest Imports	Gross System Power (GSP)	GSP Percentage
Coal {1}	17,573	5,467	23,195	46,235	15.7%
Large Hydro	43,088	10,608	2,343	56,039	19.0%
Natural Gas	106,968	2,051	13,207	122,226	41.5%
Nuclear	31,959	556	5,635	38,150	12.9%
Renewables	30,514	1,122	579	32,215	10.9%
Biomass	5,735	430	120	6,285	2.1%
Geothermal	13,448	0	260	13,708	4.7%
Small Hydro	5,788	448	0	6,236	2.1%
Solar {2}	616	0	0	616	0.2%
Wind	4,927	244	199	5,370	1.8%
TOTAL	**230,102**	**19,804**	**44,959**	**294,865**	**100.0%**

Notes:

{1} The in-state coal-fired generation includes electricity generated from several out-of-state coal-fired power plants that are owned by and reported by California utilities. There are other out-of-state generation facilities that are owned by California utilities, which are reported as imports.

{2} This number only includes generator-reported electricity, not electricity produced by many small-scale photovoltaic installations throughout the state. Based on the the Energy Commission's Renewable Energy Program records, the state has financed approximately 135,517 kilowatts (kW) of solar photovoltaic capacity. Assuming that each installed kW of PV-generated 1,500 kWh in 2005, then the combined output of these PV systems would add another 203.3 gigawatt-hours to the gross system power totals.

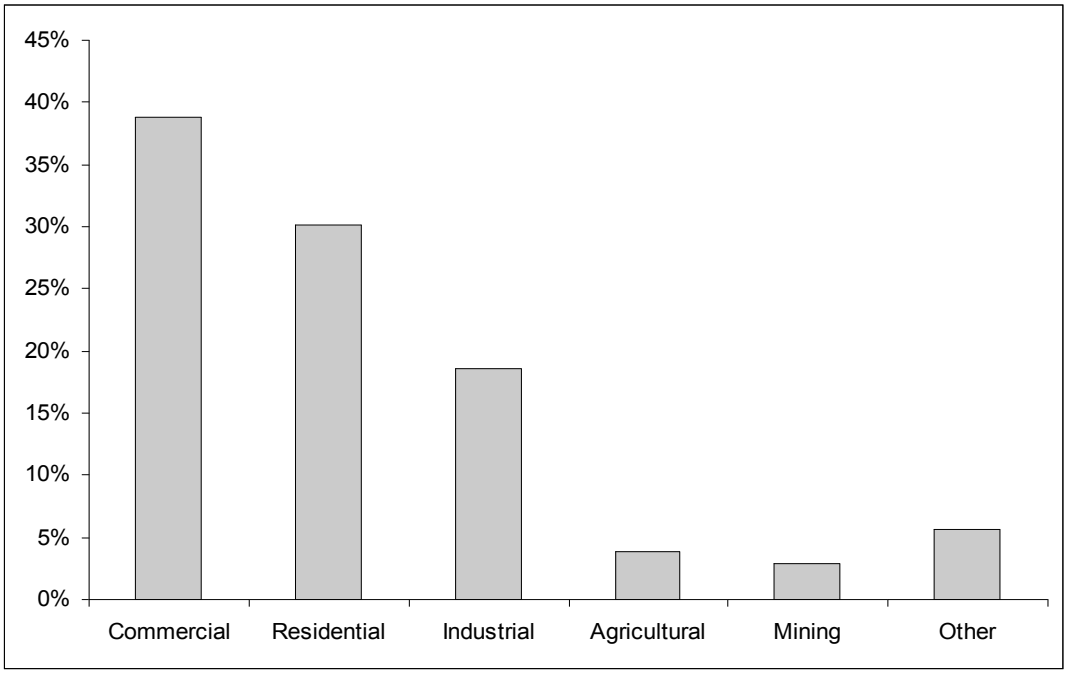
SOURCE: California Energy Commission. 2006 Net System Power Report, Energy Commission Publication # CEC-300-2007-007. Accessed October 5, 2007, from http://www.energy.ca.gov/electricity/gross_system_power.html

Different sectors of the economy use different amounts of electricity. Based on 2004 demand, the commercial sector uses the most electricity in California (37 percent), followed by the residential (31 percent) and then the industrial sector (16 percent). Agricultural, mining, and other users account for 16 percent of the electricity consumed in the state.[64]

64 California Energy Commission. (September 2005). California Energy Demand 2006-2016 Staff Energy Demand Forecast. Retrieved October 22, 2007 from http://www.energy.ca.gov/2005publications/CEC-400-2005-034/CEC-400-2005-034-SF-ED2.PDF

The SCAG region consumed approximately 46 percent of the electricity in the state in 2004. The percentage of consumption by individual sectors follows the same pattern as the state. Commercial, residential, and industrial users consume 88 percent of the electricity in the region, with the remaining 14 percent consumed by agricultural, mining, or other uses.[65] **Figure 3.5-3** shows the distribution of electricity consumption, by sector, for the SCAG region in 2004, which is the most recent data year available. The California Energy Commission's Demand Forecast indicates that the SCE planning area data includes the following utilities: Anaheim, Anza, Azusa, Banning, Colton, Metropolitan Water District, Riverside, SCE, Southern California Water, USBR-Parker Davis, Valley Electric, and Vernon.[66]

FIGURE 3.5-3
SCAG REGION PERCENTAGE OF ELECTRICITY CONSUMPTION BY SECTOR



SOURCE: California Energy Commission, California Energy Demand 2006-2016, Staff Energy Demand Forecast, Revised September 2005, Staff Final Report, CEC-400-2005-034-SF-ED2.

Natural Gas

Californians consumed approximately 6 billion cubic feet per day of natural gas in 2004.[67] The Energy Commission expects residential natural gas use to increase by 1.3 percent per year and commercial natural gas use to increase by 1.8 percent per year. Industrial natural gas demand,

65 California Energy Commission. (September 2005). California Energy Demand 2006-2016 Staff Energy Demand Forecast. Retrieved October 22, 2007 from http://www.energy.ca.gov/2005publications/CEC-400-2005-034/CEC-400-2005-034-SF-ED2.PDF

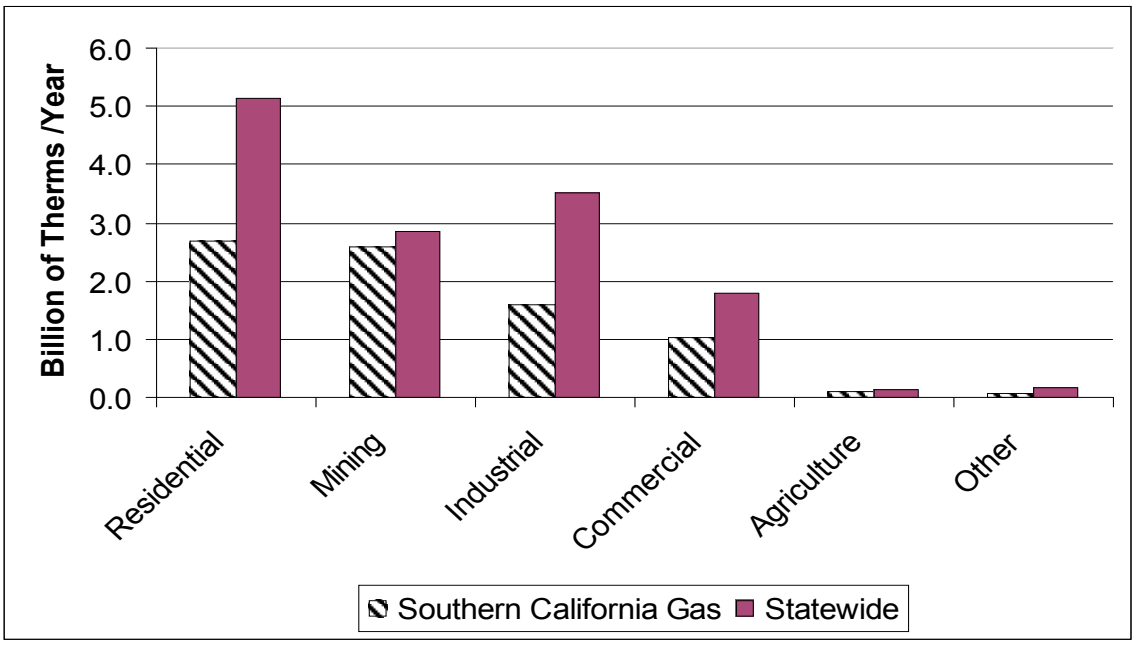
66 California Energy Commission. (September 2005). California Energy Demand 2006-2016 Staff Energy Demand Forecast. Retrieved October 22, 2007 from http://www.energy.ca.gov/2005publications/CEC-400-2005-034/CEC-400-2005-034-SF-ED2.PDF, page 1-5

67 California Energy Commission, Natural Gas Facts. Retrieved October 23, 2007 from http://www.energy.ca.gov/naturalgas/natural_gas_facts.html.

however, is expected to be flat or decline in nearly all of the western states because industrial customers are the most likely to respond to currently rising natural gas prices. [68]

The most recent data from the California Energy Commission show that the residential sector uses the largest amount of natural gas, both across the state and in the SCAG region as shown in **Figure 3.5-4**. In 2004, the mining sector was second in the amount of natural gas consumed in the SCAG region. Statewide, the industrial sector was second in the amount of natural gas consumed. The commercial sector falls behind residential, mining, and industrial uses in natural gas consumption in the SCAG region and statewide. The agricultural sector accounts for only 1 percent of the natural gas use statewide and in the SCAG region.[69]

FIGURE 3.5-4
NATURAL GAS DEMAND BY SECTOR SOUTHERN CALIFORNIA GAS VS. STATEWIDE



SOURCE: California Energy Commission, (Revised September 2005) California Energy Demand 2006-2016 Staff Energy Demand Forecast 2005, CEC-400-2005-034-SF-ED2.

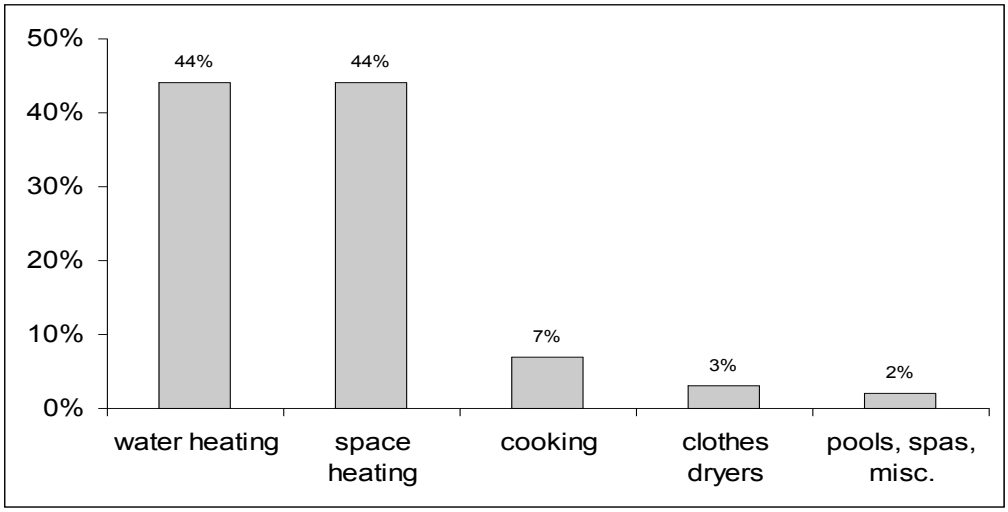
Figure 3.5-5 illustrates the residential uses of natural gas in California. The two residential uses that consume the largest percentage of natural gas are space heat and hot water. Natural gas is also used to heat the water for washing machines, dishwashers, and swimming pools. Natural gas used for cooking purposes ranks fourth in terms of residential uses for natural gas.[70]

68 California Energy Commission, 2005 Integrated Energy Policy Report (2005, November), page 125. Retrieved October 23, 2007 from http://www.energy.ca.gov/2005publications/CEC-100-2005-007/CEC-100-2005-007-CMF.PDF

69 California Energy Commission, California Energy Demand 2006-2016 Staff Energy Demand Forecast, Revised September 2005, CEC-400-2005-034-SF-ED2. Retrieved October 23, 2007 from http://www.energy.ca.gov/2005publications/CEC-400-2005-034/CEC-400-2005-034-SF-ED2.PDF

70 California Energy Commission. (Adopted November 21, 2005) 2005 Integrated Energy Policy Report, page 127. Retrieved October 23, 2007 from http://www.energy.ca.gov/2005publications/CEC-100-2005-007/CEC-100-2005-007-CTF.PDF

FIGURE 3.5-5
RESIDENTIAL NATURAL GAS USE IN CALIFORNIA



Source: California Energy Commission. (Adopted November 21, 2005) 2005 Integrated Energy Policy Report.

Major energy consumption sectors (i.e., in addition to transportation) include residential, commercial, industrial uses as well as street lighting, mining, and agriculture. Unlike transportation, these sectors primarily consume electricity and natural gas. Total annual electricity consumption in the SCAG region is approximately 123,678 million kWh (39,432 kWh for residential uses and 84,246 kWh for nonresidential uses). The residential, commercial, and industrial sectors account for approximately 30, 39, and 19 percent, respectively, of total regional electricity consumption. The agricultural sector accounts for another 4 percent.[71]

Electricity use by households varies depending on the local climate and on the housing type (i.e., single-family vs. multi-family). **Table 3.5-4** summarizes residential and nonresidential electricity use by county in the SCAG region.

TABLE 3.5-4
AVERAGE ANNUAL ELECTRICITY USAGE BY COUNTY

County	Residential kWh (billions)	Nonresidential kWh (billions)
Imperial	0.61	1.00
Los Angeles	20.34	50.42
Orange	6.90	14.21
Riverside	6.04	8.03
San Bernardino	5.54	10.42
Ventura	1.85	3.98
SCAG TOTAL	41.27	88.06
California	86.35	186.11

SOURCES: California Energy Commission, California Electricity Consumption by County in 2005. Retrieved October 23, 2007 from http://www.energy.ca.gov/electricity/electricity_by_county_2005.html and Terry Hayes and Associates

71 California Energy Commission, California Energy Demand 2006-2016, Staff Energy Demand Forecast, Revised September 2005, Staff Final Report, CEC-400-2005-034-SF-ED2

Total annual natural gas (end use) consumption in the SCAG region is approximately 2,197 million cubic feet. The residential, commercial, and industrial sectors account for approximately 31, 13, and 19 percent, respectively, of total regional natural gas (end use) consumption. Electrical generation accounts for 35 percent of regional natural gas consumption.[72]

Consumption Reduction Efforts

There are various policies and initiatives to reduce non-petroleum vehicle fuel consumption and increase the share of renewable energy generation and use in the region. These strategies include energy efficient building practices, smarter land use with access to public transportation, increasing automobile fuel efficiency, and participating in energy efficiency incentive program. All publicly owned utilities and most municipal owned utilities that provide electric and natural gas service also administer energy conservation programs. These programs typically include home energy audits; incentives for replacement of existing appliances with new, energy-efficient models; provision of resources to inform businesses on development and operation of energy-efficient buildings; and construction of infrastructure to accommodate increased use of motor vehicles powered by natural gas or electricity.

Cities in the SCAG region are voluntarily taking steps to reduce their energy consumption. For example, Azusa Light & Water has ensured that energy efficiency is part of integrated resource planning by determining and implementing the most cost-effective, reliable, and feasible energy efficiency measures. They have expended over $4,250,000 toward providing energy conservation information to the Azusa community and rewarding the businesses and residents for upgrading inefficient energy consuming equipment with more energy efficient equipment. Azusa Light & Water is continuing to explore addition supplies of renewable energy to meet the year 2010 requirements of 20 percent renewable energy in the power portfolio.[73]

In June 2006, the City of Ventura installed a 110-kilowatt solar electric system at its maintenance yard. Each year the system produces about 180,000 kWh of electricity (45 percent of the facility's needs) and saves the City around $25,000. Nearly 75 percent of the project costs were funded through a renewable energy rebate from California Edison and from a low-interest loan from the California Energy Commission. In addition, over the past year the City has replaced over 2,700 lights at 5 major facilities with the latest energy efficient lights. The City also installed energy efficient motors and pumps on the HVAC systems at City Hall and Police Fire Headquarters. These efforts will reduce electricity use by an estimated 1.9 million kWh and save over $100,000 each year. No general fund money was used to fund these projects. The Ventura County Regional Energy Alliance provided about 40 percent of the project costs, while the remainder was financed through the California Energy Commission's low-interest loan program. The loan is repaid using money saved from reduced electricity costs.[74]

72 California Gas Utilities, California Gas Report 2007 Supplement. Retrieved October 23, 2007, from Southern California Gas Company Web site: http://www.socalgas.com/regulatory/docs/2007_CGR.pdf
73 Personal communication, Joe Hsu, Azusa Light & Water, November 28, 2006.
74 Personal communication, Carl Morehouse, Mayor, City of San Buenaventura, November 16, 2006.

Regulatory Setting

Federal Regulations

Public Utility Regulatory Policies Act of 1978 (PURPA) (Public Law 95-617)

PURPA was passed in response to the unstable energy climate of the late 1970s. PURPA sought to promote conservation of electric energy. Additionally, PURPA created a new class of nonutility generators, small power producers, from which, along with qualified cogenerators, utilities are required to buy power.

PURPA was in part intended to augment electric utility generation with more efficiently produced electricity and to provide equitable rates to electric consumers. Utility companies are required to buy all electricity from "Qfs" (qualifying facilities) at avoided cost (avoided costs are the incremental savings associated with not having to produce additional units of electricity). PURPA expanded participation of nonutility generators in the electricity market, and demonstrated that electricity from nonutility generators could successfully be integrated with a utility's own supply. PURPA requires utilities to buy whatever power is produced by Qfs (usually cogeneration or renewable energy). Utilities want these provisions repealed, critics argue that it will decrease competition and impede development of the renewable energy industry. The Fuel Use Act (FUA) of 1978 (repealed in 1987) also helped Qfs become established. Under FUA, utilities were not allowed to use natural gas to fuel new generating technologies but Qfs which were by definition not utilities, were able to take advantage of abundant natural gas and abundant new technologies (such as combined-cycle). The technologies lowered the financial threshold for entrance into the electricity generation business as well as shortened the lead time for constructing new plants.

Energy Policy Act of 2005

On August 8, 2005, President George W. Bush signed the National Energy Policy Act of 2005 into law. This comprehensive energy legislation contains several electricity-related provisions that aim to:

- Help ensure that consumers receive electricity over a dependable, modern infrastructure;
- Remove outdated obstacles to investment in electricity transmission lines;
- Make electric reliability standards mandatory instead of optional; and
- Give Federal officials the authority to site new power lines in DOE-designated national corridors in certain limited circumstances.

Clean Air Act

Section 211(o) of the Clean Air Act (the Act), as amended by the Energy Policy Act of 2005, requires the Administrator of the Environmental Protection Agency (EPA) to annually determine a renewable fuel standard (RFS) which is applicable to refiners, importers and certain blenders of gasoline, and publish the standard in the Federal Register by November 30 of each year. On the basis of this standard, each obligated party determines the volume of renewable fuel that it must

ensure is consumed as motor vehicle fuel. This standard is calculated as a percentage, by dividing the amount of renewable fuel that the Act requires to be blended into gasoline for a given year by the amount of gasoline expected to be used during that year, including certain adjustments specified by the Act. The notice, published on November 27, 2007, included an RFS of 4.66 percent for 2008.

State Regulations

The California Energy Commission and California Public Utilities Commission have jurisdiction over the IOUs in California. The California Energy Commission also collects information for the Los Angeles Department of Water and Power (LADWP) and the Burbank, Glendale and Pasadena Municipal Utilities.

California Building Energy Efficiency Standards: Title 24

As mentioned above, California established statewide building energy efficiency standards following legislative action. The legislation required the standards to:

- be cost-effective,
- be based on the building life cycle, and to
- include both prescriptive and performance-based approaches.[75]

California's building efficiency standards (along with those for energy efficient appliances) have saved more than $56 billion in electricity and natural gas costs since 1978. It is estimated the standards will save an additional $23 billion by 2013.[76]

The standards have been periodically updated as technology and design have evolved. Generally, the standards are updated every three years. As a result of AB 970, passed in the fall of 2000 in response to the state's electricity crisis, an emergency update of the Standards went into effect in June 2001. The Commission then initiated an immediate follow-on proceeding to consider and adopt updated Standards that could not be completed during the emergency proceeding. The 2005 Building Energy Efficiency Standards were adopted in November 2003, took effect October 1, 2005. The Energy Commission has begun development of the 2008 update to the Building Energy Efficiency Standards.

Title 24 of the California Code of Regulations comprises the state Building Standards Code. Part 6 of Title 24 is the California Energy Code, which includes the building energy efficiency standards. The standards include provisions applicable to all buildings, residential and non-residential, which describe requirements for documentation and certificates that the building

75 California Energy Commission. Initial Study/Proposed Negative Declaration for the 2005 Building Energy Efficiency Standards for Residential and Nonresidential Buildings, Staff Report, September 2003, P400-03-018, p. 7.

76 California Energy Commission. Title 24, Part 6 website, Retrieved October 30, 2007 from http://www.energy.ca.gov/title24/.

meets the standards. These provisions include mandatory requirements for efficiency and design of the following types of systems, equipment, and appliances:

- Air conditioning systems
- Heat pumps
- Water chillers
- Gas- and oil-fired boilers
- Cooling equipment
- Water heaters and equipment
- Pool and spa heaters and equipment
- Gas-fired equipment including furnaces and stoves/ovens
- Windows and exterior doors
- Joints and other building structure openings ("envelope")
- Insulation and cool roofs
- Lighting control devices.

The standards include additional mandatory requirements for space conditioning (cooling and heating), water heating, and indoor and outdoor lighting systems and equipment in non-residential, high-rise residential, and hotel or motel buildings.

Mandatory requirements for low-rise residential buildings cover indoor and outdoor lighting, fireplaces, space cooling and heating equipment (including ducts and fans), and insulation of the structure, foundation, and water piping.

In addition to the mandatory requirements, the Standards call for further energy efficiency that can be provided through a choice between performance and prescriptive compliance approaches. (Separate sections apply to low-rise residential and to non-residential, high-rise residential, and hotel or motel buildings.) In buildings designed for mixed use (e.g., commercial and residential), each section must meet the standards applicable to that type of occupancy.[77]

The performance approach provides for the calculation of an energy budget for each building and allows flexibility in building systems and features to meet the budget. The energy budget addresses space-conditioning (cooling and heating), lighting, and water heating. Compliance with the budget is determined by the use of a CEC-approved computer software energy model. The alternative prescriptive standards require demonstrating compliance with specific minimum efficiency for components of the building such as building envelope insulation R-values, fenestration (areas, U-factor and solar heat gain coefficients of windows and doors) and heating and cooling, water heating and lighting system design requirements. These requirements vary depending on the building's location in the state's 16 climate zones.

The 2005 standards that became effective statewide October 1, 2005, include the following major changes:

- Updated energy budgets that recognize the time dependence of energy usage by season and time of day.

77 California Energy Commission, 2005 Building Energy Efficiency Standards for Residential and Nonresidential Buildings, P400-03-001F, Effective Date October 1, 2005, Section 100(f).

- Incorporation of new federal appliance standards and other advances in technology emerging from the state's Public Interest Energy Research program.
- Incorporation of new state standards for outdoor lighting and for indoor and outdoor signs.
- Changes to improve the quality of construction and verification of reliable energy savings.

Executive Order S-3-05

On June 1, 2005, Governor Arnold Schwarzenegger signed Executive Order S-3-05, which establishes greenhouse gas (GHG) emission reduction targets for California, and directs the California Environmental Protection Agency Secretary to coordinate the oversight of efforts to achieve them.

The targets established by Governor Schwarzenegger call for a reduction of GHG emissions to 2000 levels by 2010; a reduction of GHG emissions to 1990 levels by 2020; and a reduction of GHG emissions to 80 percent below 1990 levels by 2050.

AB 32: Global Warming Solutions Act

Governor Arnold Schwarzenegger signed AB 32 (Global Warming Solutions Act) into law on September 27, 2006, requiring that the California Air Resources Board (ARB) reduce GHG emissions by 25 percent by 2020. In the interim, ARB will begin to measure the GHG emissions of the industries it determines to be significant emitters. The bill also provides the Governor the ability to invoke a safety valve and suspend the emissions caps for up to one year in the case of an emergency or significant economic harm.

AB 32 requires ARB to:

- Establish a statewide GHG emissions cap for 2020, based on 1990 emissions by January 1, 2008.
- Adopt mandatory reporting rules for significant sources of GHG by January 1, 2008.
- Adopt a plan by January 1, 2009 indicating how emission reductions will be achieved from significant GHG sources.
- Adopt a list of early actions by July 1, 2007 that can be implemented before January 1, 2010.

Executive Order S-20-06

This Executive Order directs ARB to collaborate with the Secretary for Environmental Protection and the Climate Action Team to develop a comprehensive market-based compliance program with the goal of creating a program that permits trading with the European Union, the Regional Greenhouse Gas Initiative and other jurisdictions. ARB shall consider the recommendations of the Market Advisory Committee in the development of the market-based compliance program

AB 1007, Alternative Fuels Plan

Assembly Bill (AB) 1007, (Pavley, Chapter 371, Statutes of 2005) requires the California Energy Commission (Energy Commission) to prepare a state plan to increase the use of alternative fuels in California (Alternative Fuels Plan). The Energy Commission must prepare the plan in partnership with the California Air Resources Board, and in consultation with the other state, federal and local agencies. In preparing the Alternative Fuels Plan, the Committee will incorporate and build on the work currently underway within the Bio-Energy Interagency Working Group, the work of other agencies, and also will examine the broader suite of alternative fuels that could benefit California's transportation market.

The State Alternative Fuels Plan approved by the Energy Commission on November 2, 2007 was mandated by AB 1007 (Pavley) aimed at cleaning the state's air, diversifying fuel sources and protecting the state from oil spikes that affect prices, the economy and jobs. The plan supports Governor Arnold Schwarzenegger's goal of reducing statewide greenhouse gases to 80 percent below 1990 levels by 2050.

To achieve this objective, the Alternative Fuels Plan, recommends that the Governor set targets on a gasoline gallon equivalent basis for use of 10 different alternative motor fuels in the on-road and off-road sectors by nine percent by 2012, 11 percent by 2017 and 26 percent by 2022. These targets do not apply to air, rail or marine fuel uses. These goals will require a dramatic expansion in the use of such fuels as electricity, compressed natural gas, hydrogen, renewable diesel, bio-diesel and ethanol in motor vehicles.

Also built into the Alternative Fuels Plan is a multi-part strategy to develop hybrid and electric vehicle technologies; build the infrastructure to deliver the alternative fuels; increase the blending of more biofuels into gasoline and diesel; improve the fuel efficiency of vehicles; and reduce miles traveled by California motorists with more effective land use planning.

Low Carbon Fuel Standard

On January 9 2007, Governor Schwarzenegger signed Executive Order S-01-07 to establish a Low Carbon Fuel Standard (LCFS) for transportation fuels sold in California. By 2020 the standard will reduce the carbon intensity of California’s passenger vehicle fuels by at least 10 percent. The LCFS will support AB 32 emissions targets as part of California’s overall strategy to fight global warming.

AB 1493, Vehicle Climate Change Standards

AB 1493 required the State to develop and adopt regulations that achieve the maximum feasible and cost-effective reduction of climate change emissions emitted by passenger vehicles and light-duty trucks. Regulations were adopted by ARB in September 2004.

SB 1368, Greenhouse Gas Emissions Performance Standard for Major Power Plant Investments

This law requires the California Energy Commission to develop and adopt by regulation a greenhouse gas emissions performance standard for long-term procurement of electricity by local publicly owned utilities. The California Energy Commission must adopt the standard on or before June 30, 2007 and must be consistent with the standard adopted by the CPUC for load-serving entities under their jurisdiction on or before February 1, 2007.

SB 107, Renewable Energy Procurement

This law, written by Senator Joseph Simitian (D-Palo Alto) requires investor owned utilities such as Pacific Gas and Electric, SCE and San Diego Gas and Electric, to have 20 percent of its electricity come from renewable sources by 2010. Previously, state law required that this target be achieved by 2017.

California Solar Initiative

On January 12, 2006, the CPUC approved the California Solar Initiative (R.04-03-017), which provides $2.9 billion in incentives between 2007 and 2017. The CPUC will oversee a $2.5 billion program for commercial and existing residential customers, funded through revenues and collected from gas and electric utility distribution rates. Furthermore, the California Energy Commission (CEC) will manage $350 million targeted for new residential building construction, utilizing funds already allocated to the CEC to foster renewable projects between 2007 and 2011.

On March 2, 2006, the CPUC opened a proceeding to develop rules and procedures for the California Solar Initiative and to continue consideration of policies for the development of cost-effective, clean and reliable distributed generation (DG). On August 21, 2006, the Governor signed Senate Bill 1 (SB1), which directs the CPUC and the Energy Commission to implement the CSI program consistent with specific requirements and budget limits set forth in the legislation and directs the CPUC and the Energy Commission to create 3,000 megawatts of new, solar-produced electricity by 2017.

The PUC has a rulemaking in progress to reconcile its decisions with SB1, and it also continues to hold public workshops to continue designing program elements.

Current incentives provide an upfront, capacity-based payment for a new system. The CSI incentive system will change in 2007 when it moves to performance-based payments. In its August 24, 2006, decision, the CPUC shifted the program from volume-based to performance-based incentives and clarified many elements of the program's design and administration.[78]

78 California Solar Initiative. Retrieved October 31, 2007 from http://www.gosolarcalifornia.ca.gov/csi/index.html

AB 2075, Reducing Dependence on Petroleum

The CEC and ARB are directed by law (2000 AB 2075) to develop and adopt recommendations for reducing dependence on petroleum. A performance based goal is to reduce petroleum demand to 15 percent below 2003 demand. The options include:[79]

- Near-Term Options (could be fully implemented by 2010)
    - Use more fuel efficient replacement tires with proper inflation
    - Improve fuel economy in government fleets
    - Improve private vehicle maintenance
- Mid-Term Options (could be fully implemented in the 2010-2020 time frame)
    - Double fuel efficiency of current model light duty vehicles to 40 miles/gallon
    - Use natural gas-derived Fischer-Tropsch fuel as a 33 percent blending agent in diesel
- Long-Term Options
    - Introduce fuel cell light duty vehicles in 2012, increasing to 10 percent of new vehicle sales by 2020, and 20 percent by 2030.

Recommendations include:[80]

- The Governor and Legislature should adopt the recommended statewide goal of reducing demand for on-road gasoline and diesel to 15 percent below the 2003 demand level by 2020 and maintaining that level for the foreseeable future.
- The Governor and Legislature should work with the California delegation and other states to establish national fuel economy standards that double the fuel efficiency of new cars, light trucks and SUVs.
- The Governor and Legislature should establish a goal to increase the use of non-petroleum fuels to 20 percent of on-road fuel consumption by 2020 and 30 percent by 2030.

SB 97, CEQA Guidelines for Greenhouse Gas Emissions:

SB 97 requires the Governor's Office of Planning and Research ("OPR") to prepare CEQA guidelines for the mitigation of GHG emissions, including, but not limited to, effects associated with transportation or energy consumption. OPR must prepare these guidelines and transmit them to the Resources Agency by July 1, 2009. The Resources Agency must then certify and adopt the guidelines by January 1, 2010. OPR and the Resources Agency are required to periodically review the guidelines to incorporate new information or criteria adopted by ARB pursuant to the Global Warming Solutions Act, scheduled for 2012.

79 CEC/California Air Resources Board: Reducing California's Petroleum Dependence, August 14, 2003 Final, Adopted Joint Agency AB 2076 Report, publication # 600-03-006F.

80 CEC/California Air Resources Board: Reducing California's Petroleum Dependence, August 14, 2003 Final, Adopted Joint Agency AB 2076 Report, publication # 600-03-006F.

Clean Cities Program

The U.S. Department of Energy's Clean Cities Program promotes voluntary, locally based government/industry partnerships for the purpose of expanding the use of alternatives to gasoline and diesel fuel by accelerating the deployment of AFVs and building a local AFV refueling infrastructure. The mission of the Clean Cities Program is to advance the nation's economic, environmental and energy security by supporting local decisions to adopt practices that contribute to the reduction of petroleum consumption. Clean Cities carries out this mission through a network of more than 80 volunteer coalitions, which develop public/private partnerships to promote alternative fuels and vehicles, fuel blends, fuel economy, hybrid vehicles, and idle reduction.

San Gabriel Valley Energy Efficiency Partnership

In April 2006, the SCAG's Regional Council authorized SCAG's Executive Director to enter into a partnership with SCE to incentivize energy efficiency programs in the San Gabriel Valley Subregion. The partnership program agreement was fully executed on October 20, 2006 and the program will run through 2008. The main goal of the San Gabriel Valley Energy Wise Program (SGVEWP) is to save a combined 3,000,000 kWh by providing technical assistance and incentive packages to cities. The program is funded by California utility customers and administered by SCE under the auspices of the CPUC.

Methodology

This section summarizes the methodology used to evaluate the expected impacts of implementation of the proposed Plan on energy consumption and associated environmental effects. Estimated energy consumption in 2035 is expected to represent the most conservative (i.e., highest energy consumption) because population and employment are projected to be higher in this year than in any earlier year. Also, no estimate is made of the impact of energy efficiency and conservation measures which are likely to be adopted, resulting in energy consumption lower than that projected in this chapter.

Expected future travel fuel consumption was estimated for 2035 using SCAG's regional transportation demand model and the EMFAC/BURDEN air quality model, which provides estimated gasoline and diesel fuel consumption for the 2008 RTP. Energy consumption for the other elements of the transportation plan was also estimated and evaluated.

The electricity use rate for each county was based on the existing electricity consumption for residential and non-residential uses obtained from the California Energy Commission (CEC).[81] Existing dwelling units and employees in each county were used to obtain an electricity usage rate per dwelling unit and employee.[82] Then, the electricity usage rate was multiplied by the

[81] California Energy Commission, California Electricity Consumption by County in 2005. Retrieved October 23, 2007 from http://www.energy.ca.gov/electricity/electricity_by_county_2005.html

[82] According to the latest CEC Energy Demand Forecast (2008-2018), the statewide electricity demand per capita is expected to remain constant between 2008 and 2018. Therefore, the electricity use rate was assumed to be constant for each of the analyzed years.

correlating dwelling units and employees for each of the analyzed alternatives to obtain the total electricity consumption in kilowatt-hours for each county.

Natural gas consumption was obtained from the CEC, which provides data by utility planning area and not by county.[83] Therefore, a natural gas use rate applicable to the entire SCAG region was developed to forecast future natural gas consumption. Existing dwelling units and employees in each county were used to obtain a natural gas usage rate per dwelling unit and employee.[84] The natural gas use rate was multiplied by the correlating numbers for each of the analyzed alternatives to obtain the total natural gas use in standard cubic feet per year each county.

Comparison with the No Project

The analysis of energy resources includes a comparison between the expected future conditions with the proposed Plan and the expected future conditions if no Plan were adopted. This evaluation is not included in the determination of the significance of impacts (which is based on a comparison to existing conditions); however, it provides a meaningful perspective on the expected effects of the 2008 RTP.

Determination of Significance

The methodology for determining the significance of energy impacts compares existing conditions to the expected future energy consumption with the Plan, as required in *CEQA Guidelines §* 15126.2(a). Criteria below were applied to compare current energy usage to expected future (2035) Plan conditions.

Significance Criteria

A *significant impact* is defined as "a substantial or potentially substantial, adverse change in the environment" (CEQA §21068). The proposed Plan would have a significant impact if implementation would potentially:

- Substantially increase the consumption of electricity, natural gas, gasoline, diesel, or other non-renewable energy types between the current conditions and 2035;
- Use substantial amounts of electricity and natural gas, thereby requiring the construction of new facilities and sources of energy or major improvements to local infrastructure;
- Cause the use of large amounts of electricity and natural gas in a wasteful manner;

83 California Energy Commission, (September 2005) California Energy Demand 2006-2016 Staff Energy Demand Forecast 2005, CEC-400-2005-034-SF-ED2.

84 According to the latest CEC Energy Demand Forecast (2008-2018), the statewide per capita consumption shows a steady decline between 2008 and 2018. The forecast for the 2008 RTP PEIR assumed a constant the natural gas use rate for each of the analyzed years, which results in a conservative estimate of future use.

- Be inconsistent with adopted plans or policies, including greenhouse gas reduction levels identified in AB 32 (1990 levels by 2020)[85]; or

- Cause a cumulatively considerable increase in energy consumption and associated environmental effects.

Impacts and Mitigation Measures

Implementation of the 2008 RTP would affect the use of energy resources in the SCAG region. The analysis of these impacts is at the regional level and is therefore by its nature an analysis of cumulative impacts. Three main areas of impact have been identified: energy demands for construction and expansion of the regional transportation system; energy demands for operation of the regional transportation system as of 2035; and the cumulative impacts of growing energy demand from growth associated with implementation of the 2008 RTP.

All mitigation measures should be included in project-level analysis as appropriate. The project proponent or local jurisdiction shall be responsible for ensuring adherence to the mitigation measures prior to construction. For regionally significant projects SCAG shall be provided with documentation of compliance with mitigation measures through its Intergovernmental Review Process in which all regionally significant projects, plans, and programs must be consistent with regional plans and policies.

Impact 3.5-1: The implementation of the 2008 RTP is likely to use electricity, natural gas, gasoline, diesel, and other non-renewable energy types in the construction and expansion of the regional transportation system and development in the region between the current conditions and 2035.

Construction of the new elements of the regional transportation system included in the 2008 RTP would likely involve the use of diesel-powered heavy equipment, portable diesel generators, and other battery-operated support equipment, as well as electricity from the existing grid. There would be an irreversible impact from the consumption of diesel fuel (and other fuels) related to these construction activities. The 2008 RTP does not contemplate an increase in the amount of regional transportation system construction beyond what is normally under way and thus, it is unlikely that the energy demands of construction of the new elements of the regional transportation system would create a noticeable impact to regional energy systems. However, it should be noted that the International Energy Agency has forecasted a world oil supply "crunch" in the next five years due to demand outpacing supply, global fuel prices are expected to escalate. As such, many transportation projects could experience unprecedented construction cost increases. Use of energy for construction purposes is anticipated to be **significant**.

85 This threshold is only applicable to the Southern California Association of Governments 2008 RTP PEIR pending future guidance from the Governor's Office of Planning and Research (OPR). SB 97 requires that OPR prepare, develop and transmit guidelines for the feasible mitigation of greenhouse gas emissions or the effects of greenhouse gas emissions as required by CEQA. The Resources Agency would be required to certify or adopt the guidelines by January 1, 2010.

Mitigation Measures

MM-EN.1: In reviewing projects, lead and implementing agencies shall consider energy implications of construction processes. In general the most energy efficient construction process and long-term operational design shall be selected unless there's an overriding reason why not.

Significance after Mitigation

Given the large amount of construction anticipated for the region, the energy that would be consumed by construction is anticipated to be **significant**.

Impact 3.5-2: The implementation of the 2008 RTP is likely to substantially increase the consumption of electricity, natural gas, gasoline, diesel, and other non-renewable energy in the operation of the transportation system and operation of associated growth in the region between the current conditions and 2035.

Operation of the transportation system as described in the 2008 RTP would involve a substantial increase in the use of petroleum fuels between the current conditions and 2035. **Table 3.5-5** summarizes the expected operational increases in fuel usage, as predicted by SCAG's transportation and air quality model, between 2008 and 2035 with the investments in the RTP and without (the No Project Alternative).

TABLE 3.5-5
PROJECTED SCAG REGION TRANSPORTATION FUEL CONSUMPTION (THOUSAND GALLONS PER DAY)

Alternative	Gasoline (1000 gal/day)	Percent Increase over Base Year 2008	Diesel (1000 gal/day)	Percent Increase over Base Year 2008	Total (1000 gal/day)	Percent Increase over Base Year 2008
Existing 2008	19,434.4	--	3,345.6	--	22,780.0	--
2035 No Project	27,732.1	43%	6,614.6	95%	34,246.7	50%
2035 with RTP	26,660.3	37%	6,282.8	88%	32,943.1	45%

SOURCE: SCAG EMFAC Analysis, 2007.

As mentioned in the environmental setting above, there is a potential for a significant dropoff in the amount of economically recoverable petroleum within the next ten years. If this decrease occurs, fuel prices could increase dramatically, and the cost of owning and maintaining a conventional vehicle could also increase dramatically. To help reduce the possible effects of this situation, greater use of alternative fuels, public transit, and non-motorized transportation options must be undertaken.

In addition to increased use of petroleum fuels, projects in the 2008 RTP would be expected to consume natural gas and electricity. As shown in **Table 3.5-6** the region would increase electricity consumption by over 38 billion kWh per year between 2008 and 2035 and increase natural gas

Table 3.5-6
Electricity and Natural Gas Consumption for 2008, 2035 No Project and 2035 w/ Project

	Electricity (Billion kWh/year)			Natural Gas (Billion cubic feet/year)		
County	**Base Year 2008**	**2035 No Project**	**2035 w/ RTP**	**Base Year 2008**	**2035 No Project**	**2035 w/ RTP**
Ventura	5.82	7.35	7.41	37.93	47.84	48.24
Riverside	14.10	26.09	25.43	82.94	154.42	150.60
Imperial	1.61	3.20	3.16	7.12	14.13	13.97
Orange	21.10	24.16	24.35	166.30	190.81	192.19
Los Angeles	70.76	81.28	82.36	468.68	540.34	547.81
San Bernardino	15.96	25.82	24.82	82.47	133.40	128.17
SCAG TOTAL	**129.33**	**167.91**	**167.52**	**845.44**	**1,080.95**	**1,080.97**

Electricity usage rates obtained from the California Energy Commission, California Electricity Consumption by County in 2005. Based on CEC data, electricity usage per capita will remained relatively constant.
Natural gas usage rates from the California Energy Commission, California Energy Demand 2006-2016 Staff Energy Demand Forecast. Based on CEC data, natural gas usage per capita will remain relatively constant.
SOURCE: California Energy Commission and Terry Hayes and Associates.

consumption by 235 billion cubic feet per year during the planning horizon of the RTP. Street lighting for new highways and arterials and nighttime lighting for rail projects would consume electricity. New rail would also require electricity and natural gas during project operation. The energy impacts of rail are dependent on the energy source. If the rail system is powered by electricity generated from renewable sources, the energy impacts would be lessened. In 2006, 15 percent of the electricity consumed in the SCAG was generated from eligible renewables. California currently imports about 31 percent of its annual electricity supply from out-of-state generating units, and about 75 percent of this power (4,744 MW) comes from coal.[86] In response to air quality concerns, particularly efforts to reduce greenhouse gas emissions, it is likely that in the future more buses would use natural gas or alternative, less carbon intense, energy sources instead of petroleum-based fuels for daily operations. In addition, the implementation of mitigation measures identified below would further reduce the significance of these impacts.

Mitigation Measures

In addition to the mitigation measures specified below, mitigation measures identified in the Transportation Section for the impacts of transportation system usage would serve to mitigate the impacts of growing transportation energy demand.

Mitigation Measures for State and Federal Government

MM-EN.2: State and federal lawmakers and regulatory agencies should pursue the design of programs to either require or incentivize the expanded availability and use of alternative-fuel vehicles to reduce the impact of shifts in petroleum fuel supply and price.

86 California Energy Commission, Gross System Power 2006. Retrieved on October 22, 2007 from http://energy.ca.gov/electricity/gross_system_power.html

Mitigation Measures for SCAG

MM-EN.3: SCAG shall continue to consider energy uncertainty impacts prior to the development of the next Regional Transportation Plan. Topics that should be considered include:

- How the price and availability of transportation fuels affects revenues and demand;
- How increases in fuel efficiency could affect revenues and emissions;
- How the cost of commuting and personal travel affects mode choice and growth patterns;
- How the cost of goods movement affects international trade and employment; or
- How the escalation of fuel prices affects the cost of infrastructure construction, maintenance and operation.

This work will help SCAG better understand the relationship between transportation, land use and energy uncertainty.

MM-EN.4: SCAG shall convene key stakeholders to evaluate and where feasible, recommend transportation measures such as congestion pricing, a refined regional goods movement system and technologies that reduce fossil fuel consumption.

MM-EN.5: SCAG shall encourage clean post recycle conversion technologies to produce energy or technologies that offset energy use or air emissions.

MM-EN.6: SCAG shall continue to develop energy efficiency and green building guidance to provide direction on specific approaches and models and to specify levels of performance for regionally significant projects to be consistent with regional plans.

MM-EN.7: SCAG shall encourage the Federal and State Government to increase clean, cost-effective, reliable, domestic renewable energy generation, such as solar and wind turbines.

MM-EN.8: SCAG shall encourage the Federal Government to increase the Corporate Average Fuel Economy (CAFE) to a level that will reduce our dependence on petroleum and reduce greenhouse gas emissions.

MM-EN-9: SCAG shall continue to pursue partnerships with Southern California Edison, municipal utilities, and the California Public Utilities Commission to promote energy efficiency and reduce greenhouse gas emissions in the region.

MM-EN-10: SCAG shall continue to develop, in coordination with the California Air Resourcs Board, a data and information collection and analysis system that provides an

understanding of energy demand and greenhouse gas emissions in the SCAG region.

MM-EN.11: SCAG shall continue to work with local jurisdictions and energy providers, through its Energy and Environment Committee and other means, to encourage regional-scale planning for improved energy management. Future impacts to energy shall be minimized through cooperative planning, and information sharing within the SCAG region.

MM-EN.12: SCAG shall continue to develop, in coordination with the California Air Resources Board, a data and information collection and analysis system that provides an understanding of the energy demand and greenhouse gas emissions in the SCAG Region.

Mitigation Measures for Local Agencies

MM-EN.13: Local agencies should consider various best practices and technological improvements that can reduce the consumption of fossil fuels such as:

- Expanding light-duty vehicle retirement programs
- Increasing commercial vehicle fleet modernization
- Implementing driver training module on fuel consumption
- Replacing gasoline powered mowers with electric mowers
- Reducing idling from construction equipment
- Incentivizing alternative fuel vehicles and equipment
- Developing infrastructure for alternative fueled vehicles
- Increasing use and mileage of High Occupancy Vehicle (HOV), High Occupancy Toll (HOT) and dedicated Bus Rapid Transit (BRT) lanes
- Implementing truck idling rule, devices, and truck-stop electrification
- Requiring electric truck refrigerator units
- Reducing locomotives fuel use
- Modernizing older off-road engines and equipment
- Implementing cold ironing at ports
- Encouraging freight mode shift
- Limit use and develop fleet rules for construction equipment
- Requiring zero-emission forklifts
- Developing landside port strategy with alternative fuels, clean engines, and electrification

MM-EN.14: Local agencies should include energy analyses in environmental documentation and general plans with the goal of conserving energy through the wise and efficient use of energy. For any identified energy impacts, appropriate mitigation measures should be developed and monitored. SCAG recommends the use of Appendix F, Energy Conservation, of the *CEQA Guidelines.*

MM-EN.15: Local agencies should streamline permitting and provide public information to facilitate accelerated construction of solar and wind power.

MM-EN.16: Local agencies should adopt a "Green Building Program" to promote green building standards. Green buildings can reduce local environmental impacts, regional air pollutant emissions and global greenhouse gas emissions. Green building standards involve everything from energy efficiency, usage of renewable resources and reduced waste generation and water usage. For example, water-related energy use consumes 19 percent of the state's electricity. The residential sector accounts for 48 percent of both the electricity and natural gas consumption associated with urban water use.[87] While interest in green buildings has been growing for some time, cost has been a main consideration as it may cost more up front to provide energy-efficient building components and systems. Initial costs can be a hurdle even when the installed systems will save money over the life of the building. Energy efficiency measures can reduce initial costs, for example, by reducing the need for over-sized air conditioners to keep buildings comfortable. Undertaking a more comprehensive design approach to building sustainability can also save initial costs through reuse of building materials and other means.

A comprehensive study of the value of green building savings is the 2003 report to California's Sustainable Building Task Force. In the words of the report: "While the environmental and human health benefits of green building have been widely recognized, this comprehensive report confirms that minimal increases in upfront costs of about 2% to support green design would, on average, result in life cycle savings of 20% of total construction costs -- more than ten times the initial investment. For example, an initial upfront investment of up to $100,000 to incorporate green building features into a $5 million project would result in a savings of $1 million in today's dollars over the life of the building."[88]

MM-EN.17: Local governments should alter zoning to improve jobs/housing balance and creating communities where people live closer to work, bike, walk, and take transit as a substitute for personal auto travel. Creating walkable, transit oriented nodes would generally reduce energy use and greenhouse gas emissions. Residential energy use (electricity and natural gas) accounts for 14 percent of California's greenhouse gas emissions. It is estimated that households in transit-oriented

87 California Energy Commission, (November 2005) California's Water-Energy Relationship Final Staff Report. Retrieved September 26, 2007 from http://www.energy.ca.gov/2005publications/CEC-700-2005-011/CEC-700-2005-011-SF.PDF

88 Greg Kats, Capital E, The Costs and Financial Benefits of Green Buildings, A Report to California's Sustainable Building Task Force, October 2003, http://www.ciwmb.ca.gov/greenbuilding/Design/CostBenefit/Report.pdf, last accessed September 17, 2007.

developments drive 45 percent less than residents in auto-dependent neighborhoods. In addition, mixed land uses (i.e., residential developments near work places, restaurants, and shopping centers) with access to public transportation have been shown to save consumers up to 512 gallons of gasoline per year.[89] Furthermore, studies have shown that the type of housing (such as multi-family) and the size of a house have strong relationships to residential energy use. Residents of single-family detached housing consume over 20 percent more primary energy than those of multifamily housing and 9 percent more than those of single-family attached housing.[90]

Mitigation Measures for Utilities

MM-EN.18: Utilities should install and maintain California Best Available Control Technologies on all power plants at the US-Mexico border.

MM-EN.19: Utilities should consider increasing capacity of existing transmission lines, where feasible.

Mitigation Measures for Project Implementing Agencies/Developers

MM-EN.20: Project sponsors should support programs to reduce single occupancy vehicle trips such as telecommuting, ridesharing, alternative work schedules, and parking cash-outs.

MM-EN.21: Project sponsors should support only the use of the best available technology including monitoring, air, and water impacts for locating any nuclear waste facility.

MM-EN.22: Project sponsors should submit projected electricity and natural gas demand calculations to the local electricity or natural gas provider, for any project anticipated to require substantial utility consumption. Any infrastructure improvements necessary for project construction shall be completed according to the specifications of the energy provider.

MM-EN.23: Project sponsors should consider the most cost-effective alternative and renewable energy generation facilities.

MM-EN.24: Project sponsors should ensure that new buildings incorporate solar panels in roofing and tap other renewable energy sources to offset new demand on conventional power sources.

MM-EN.25: Project sponsors should require energy efficient design for buildings. This may include strengthening local building codes for new construction and renovation to require a higher level of energy efficiency.

89 Transportation Demand Management Encyclopedia. “Transit Oriented Development.” Victoria Transport Policy Institute.

90 Rong, Fang. (2006) Impact of Urban Sprawl on U.S. Residential Energy Use. University of Maryland. Retrieved from http://hdl.handle.net/1903/3848 on September 14, 2007.

MM-EN.26: Project sponsors should fund and schedule energy efficiency "tune-ups" of existing buildings by checking, repairing, and readjusting heating, ventilation, air conditioning, lighting, hot water equipment, insulation and weatherization. (Facilitating or funding the improvement of energy efficiency in existing buildings could offset in part the global warming impacts of new development.)

MM-EN.27: Project sponsors should provide individualized energy management services for large energy users.

MM-EN.28: Project sponsors should require the use of energy efficient appliances and office equipment.

MM-EN.29: Project sponsors should pursue incentives and technical assistance for lighting efficiency.

MM-EN.30: Project sponsors should require that projects use efficient lighting. (Fluorescent lighting uses approximately 75% less energy than incandescent lighting to deliver the same amount of light.)

MM-EN.31: Project sponsors should require measures that reduce the amount of water sent to the sewer system. (Reduction in water volume sent to the sewer system means less water has to be treated and pumped to the end user, thereby saving energy.)

MM-EN.32: Project sponsors should incorporate on-site renewable energy production (through, e.g., participation in the California Energy Commission's New Solar Homes Partnership). Require project proponents to install solar panels, water reuse systems, and/or other systems to capture energy sources that would otherwise be wasted.

MM-EN.33: Project sponsors should pursue incentives to encourage the use of energy efficient equipment and vehicles.

MM-EN.34: Project sponsors should provide public education and publicity about energy efficiency programs and incentives.

MM-EN.35: In some instances, a project sponsor may find that measures that will directly reduce a project's greenhouse gas emissions are insufficient. A lead agency may consider whether carbon offsets would be appropriate. The project proponent could, for example, fund off-site projects (e.g., alternative energy projects) that will reduce carbon emissions, or could purchase "credits" from another entity that will fund such projects. The lead agency should ensure that any mitigation taking the form of carbon offsets is specifically identified and that such mitigation will in fact occur.

MM-EN.36: Project sponsors should incorporate and local governments should include the following land use principles that use resources efficiently, eliminate pollution and

significantly reduce waste into their projects, zoning codes and other implementation mechanisms:

- Mixed-use residential and commercial development that is connected with public transportation and utilizes existing infrastructure.
- Land use and planning strategies to increase biking and walking trips

MM-EN.37: Project sponsors and local governments should integrate green building measures into project design and zoning such as those identified in the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED), Energy Star Homes, Green Point Rated Homes, and the California Green Builder Program. Energy saving measures that should be explored for new and remodeled buildings include:

- Using energy efficient materials in building design, construction, rehabilitation, and retrofit
- Encouraging new development to exceed Title 24 energy efficiency requirements
- Developing Cool Communities measures including tree planting and light-colored roofs. These measures focus on reducing ambient heat, which reduces energy consumption related to air conditioning and other cooling equipment.
- Utilizing efficient commercial/residential space and water heaters: This could include the advertisement of existing and/or development of additional incentives for energy efficient appliance purchases to reduce excess energy use and save money. Federal tax incentives are provided online at http://www.energystar.gov/index.cfm?c=Products.pr_tax_credits
- Encouraging landscaping that requires no additional irrigation: utilizing native, drought tolerant plants can reduce water usage up to 60 percent compared to traditional lawns.
- Encouraging combined heating and cooling (CHP), also known as cogeneration, in all buildings.
- Encouraging neighborhood energy systems, which allow communities to generate their own electricity
- Orienting streets and buildings for best solar access
- Encouraging buildings to obtain at least 20% of their electric load from renewable energy

Significance after Mitigation

The regional increase in transportation-related energy demand as a result of implementing the 2008 RTP would remain a **significant** impact, even with the above mitigation.

Impact 3.5-3: Implementation of the 2008 RTP has the potential to not fully address the greenhouse gas reduction levels identified in AB 32 (1990 levels by 2020).

As described in Chapter 3.2, Air Quality, the 2008 RTP will increase the amount of greenhouse gases. Although the Plan will produce fewer greenhouse gas emissions than the No Project Alternative, this reduced amount will not fully address the levels identified in AB 32, contributing to the potential threats summarized below.

California is the second largest emitter of GHG emissions in the United States, next to Texas. Only nine nations have greater total emissions than the state of California. In 2004, California produced 492 million gross metric tons of carbon dioxide -equivalent GHG emissions, including imported electricity and excluding combustion of international fuels and carbon sinks or storage.[91]

Global warming scenarios predict a 3 to 10.5˚F rise in temperature for California by 2100. Although many models that attempt to predict future climate scenarios at a smaller scale are still being refined, there is a general consensus that the following impacts due to warming will occur.[92]

Threats to Local Economy

- Although increased CO_2 concentration will have little impact on direct biomass production, the corresponding temperature changes will affect crops that depend on a certain number of winter chill hours to bear fruit. Many types of fruit and nut trees are sensitive to changes in temperature patterns. A decreasing trend in winter chill hours is evident in many parts of the state. Conversely, extended hot periods can cause leaf desiccation and premature ripening of fruits, such as wine grapes.

- Warm temperatures are predicted to expand the range of many agricultural pests, weeds, and pathogens currently held in check by cold temperatures. Many pests are prevented from spreading by their intolerance to winter frosts.

- The lack of snowfall will lead to loss of winter recreation (seen in 2006).

Degrading Air Quality

- Warmer weather will increase the number of days conducive to ozone formation by 25-85 percent, especially in the Los Angeles and San Joaquin Valley. Volatile Organic Compound (VOC) emissions from fuels, solvents, and coatings; NOx emissions from

91 California Energy Commission, Inventory of Greenhouse Gas Emissions and Sinks: 1990-2004 Final Staff Report. (December 2006) CEC-600-2006-013-SF. Retrieved March 26, 2007 from http://www.energy.ca.gov/2006publications/CEC-600-2006-013/CEC-600-2006-013-SF.PDF

92 California Energy Commission. Our Changing Climate Assessing the Risks to California (July 2006) CEC-500-2006-077. Retrieved March 26, 2007 from http://www.energy.ca.gov/2006publications/CEC-500-2006-077/CEC-500-2006-077.PDF

amplified cooling demands; and enhanced biogenic VOCs from vegetation will also increase as temperatures rise.

- As warming occurs and precipitation patterns change, the fire regime for California will also change. For example, under a warmer, wetter scenario a 30 percent increase in Southern California fires is predicted while a 90 percent increase in Northern California fires is predicted if California climate becomes hotter and drier. The onset and duration of fire season will be earlier and longer. GHG emissions and emissions of fine, particulate matter from fires will add to the overall decrease in air quality.

- It will become even more difficult to meet air quality standards, jeopardizing federal transportation funds.

Water Supply at Risk

- The uncertainty of localized climate models makes it difficult to predict exact rainfall amounts, however many climate scenarios predict a shorter rainy season. Coupled with hotter weather, the overall water consumption for the area (including agricultural consumption) is expected to increase.

- Current climate models predict more precipitation falling as rain and less precipitation falling as snow. Lack of winter snow and a resulting decrease in the Sierra Nevada snow pack, which acts as a natural reservoir, will directly impact water supplies. With much of the summer water supply for the region coming from spring snowmelt, warmer temperatures will cause a later snow season and earlier melting, leaving less water available during the dry summer season. An estimated 30 percent reduction of spring stream flow is predicted under a medium global warming scenario.

- Rising sea levels due to thermal expansion of warmer ocean waters and melting glaciers would degrade estuaries, wetlands, and groundwater aquifers. The contamination of fresh groundwater due to saltwater intrusion is a major concern as sea levels rise. Water pumped from the southern edge of the Sacramento/San Joaquin River Delta is one such water supply at risk of saltwater intrusion.

Threats to Biodiversity and the Environment

- Loss or shift of certain types of ecosystems due to changing temperatures. Increased fire frequency in inland areas is expected to expand grasslands into current shrub and woodland areas. Plants suited to alpine and subalpine regions are expected to decrease 60 to 80 percent.

- A change in the timing of seasonal activities such as breeding and migration will cause chaos for many plant and animal species as earlier plant flowering, insect emergence, and breeding throws off their life cycle. Many species will be driven to extinction as suitable habitat declines.

Threats to Human Health

- As the number of hot days increase, the number of heat-related deaths will increase. This includes death by heat stroke, dehydration, heart attack, stroke, and respiratory distress caused by extreme heat. Those most affected would be the sick, the elderly, young children, and the poor. California averages 36 days of extreme temperatures a year. This average is expected to increase 1.5 to 2.5 times by mid-century.

- The distribution of disease carrying organisms is expected to increase as temperatures warm. For example, Lyme Disease, a common tick-borne disease may spread to areas that were previously uninhabitable for the vector (and disappear from areas it presently inhabits). Other tropical diseases and disease vectors will spread as their habitable range increases due to warmer climate.

- Many California cities are concentrated along the coast and will be put at risk of storm surges, flooding, and coastal erosion as warmer waters fuel more intense winter storms. Flooding also increases the risk of transmission of water-borne diseases.

Given the potentially severe consequences of climate change, the California Climate Action Team (CAT) developed a summary of actions. The report included a list of strategies by responsible agency and estimated their climate change emission reduction potential. The report concluded that the reduction targets identified in Executive Order S-3-05 and AB 32 are achievable. **Table 3.5-7** contains CAT Measures directly related to the long-term transportation system and describes the 2008 RTP's consistency with the measures. The table also identifies the statewide CO_2 reduction potential as summarized in the CAT report. This report also includes a detailed list of potential greenhouse gas emissions mitigation measures recommended by the State's Attorney General. This list, including the location of specific measures and their feasibility is located in **Appendix B**, NOP Comments Regarding Measures to Reduce the Greenhouse Gas Emissions of the Proposed 2008 RTP.

Mitigation Measures

See Mitigation Measures under Impact 3.5-2.

Significance after Mitigation

The impact is **significant** even after mitigation.

TABLE 3.5-7
GREENHOUSE GAS EMISSION REDUCTION STRATEGY CONSISTENCY ANALYSIS

Reduction Strategy	Description	2020 GHG Emission Reductions (Million Tons CO_2 Equivalent)	Consistency Analysis
CARB Reduction Strategy			
Vehicle Climate Change Standards	Reduce GHG emissions emitted by passenger vehicles and light duty trucks	30	Does not address: The energy mitigation program includes best practices and technological improvements that can reduce the consumption of fossil fuels and GHG emissions such as modernizing older engines and equipment. However, using todays emission rates the 2008 RTP could result in an increase in GHG emissions resulting in an inconsistency with the State's plan.
Diesel Anti-idling	Limit diesel fueled commercial motor vehicle idling to 5 minutes or less	1.2	Does not address: While the 2008 RTP will increase investments in non-motorized transportation and maximize the benefit of land use-transportation connections, it will also provide goods movement capacity enhancements which could increase the occurrences of diesel truck idling.
Hydrofluorocarbon Reduction	Low emitting refrigerants used in new vehicles/commercial refrigeration	8.5	Consistent: This measure applies to consumer products. When CARB adopts regulations for these reduction measures, any products that the regulations apply to will comply with the measures.
Public Utilities Commission			
Renewable Portfolio Standard	Accelerate standard to 33% by 2020	11	Does not fully address: The mitigation program includes a provision to increase clean, cost-effective, reliable, domestic renewable energy generation, such as solar and wind turbines. However, the 2008 RTP would increase the demand for electricity in the region. This increase in demand could prohibit the state from reaching its RPS goals by 2020.
California Solar Initiative	Million solar roofs by 2017 on homes/businesses	3	See RPS discussion above.
Investor Owned Utility Energy Efficiency Programs	Energy efficiency incentives	8.8	Consistent: The mitigation program includes a provision to pursue partnerships with Southern California Edison, municipal utilities, and the California Public Utilities Commission to promote energy efficiency and reduce greenhouse gas emissions in the region.
Business Transportation and Housing			
Transportation Energy Efficiency	Framework for expanded incentives, tools and information	9	Does not fully address: The PEIR includes a measure to encourage the Federal Government to increase the Corporate Average Fuel Economy (CAFE) to a level that will reduce our dependence on petroleum and reduce greenhouse gas emissions. However, vehicle miles traveled will increase over the plan horizon, resulting in a potential inconsistency with this measure.
Smart Land Use/Intelligent Transportation System (ITS)	Mixed use, jobs/housing proximity, ITS management	18	Does not fully address: SCAG's Compass Blueprint Program has become a model for turning regional vision into local reality by encouraging efficient land use and growth patterns that complement our transportation investments. These policies have shown to reduce vehicle miles traveled and improved air quality. As a voluntary program, SCAG provides cutting edge tools, analyses and comprehensive planning services to cities that seek help. Services have been sought for over 50 sites in jurisdictions all over the region. Subsequent implementation efforts are in the hands of local governments. The Plan also recommends that SCAG and Transit operators analyze and assess the use of ITS technologies to track, report and improve on-time performance of transit systems. Nonetheless, although these efforts will generally reduce the rate of increase in GHG emissions, the data show an overall increase in GHG in the horizon year 2035, resulting in a potential inconsistency with this measure.

TABLE 3.5-7 (Continued)
GREENHOUSE GAS EMISSION REDUCTION STRATEGY CONSISTENCY ANALYSIS

Reduction Strategy	Description	2020 GHG Emission Reductions (Million Tons CO_2 Equivalent)	Consistency Analysis
State and Consumer Services Agency			
Green Buildings Initiative	Reduce building energy use 20% by 2015	1.8	Does not fully address: The mitigation program includes a measure to develop energy efficiency and green building guidance. Nonetheless, population and households will increase by 2035, and unless energy types change, increasing the demand for energy in buildings.
Environmental Protection Agency			
Alternative Fuels	Biodiesel Blends	Less than 1	Does not fully address: The mitigation program includes a provision for regulatory agencies to pursue the design of programs to either require or incentivize the expanded availability and use of alternative-fuel vehicles to reduce the impact of shifts in petroleum fuel supply and price. However, the 2008 RTP is expected to result in an increase in gasoline (unless fuel efficiency changes dramatically) and diesel usage, inconsistent with the State's plan.
Alternative Fuels	Ethanol	3.2	See Alternative Fuels discussion above.

SOURCE: California Environmental Protection Agency, Climate Action Team Report to Governor Schwarzenegger and the Legislature, March 2006, SCAG 2007

Cumulative Impact 3.5-4: Implementation of the investments and policies in the 2008 RTP would contribute to a cumulatively considerable increase in the amount of total energy consumed in the SCAG region between 2008 and 2035.

The 2035 transportation model includes the population, households, and employment projected for 2035, and therefore the largest demand on the transportation system expected during the lifetime of the 2008 RTP. In accounting for the effects of regional population growth, the model output provides a regional, long-term and cumulative level of analysis for the impacts of the 2008 RTP on transportation resources. Forecast urban development and growth that would be accommodated by the transportation investments in the 2008 RTP, together with the increased mobility provided by the 2008 RTP, would contribute to the significant impacts described in Impact 3.5-2 above.

As indicated in Impact 3.5-2, forecast urban development and growth that would be accommodated by the transportation investments in the 2008 RTP would entail greater use of energy resources in 2035 than in 2008 for purposes indirectly related to transportation, such as housing and employment. Unless per capita energy consumption rates change, the estimated increase in residential energy consumption is projected to be proportional to the overall increase in regional population.

It is beyond the scope of this analysis to project how increased energy demand will be met, but public and private energy providers should continue their current long-range planning processes

to assure that there is no shortfall. A variety of energy sources are available, and recent state actions (see Regulatory Setting) should help to meet the growth in energy demand while minimizing associated environmental impact and reducing dependence on fossil fuels.

The RTP includes a more compact growth pattern than the No Project Alternative and is thus anticipated to result in less energy consumption.

Mitigation Measures

See mitigation measures above.

Significance after Mitigation

Even with mitigation, this cumulative impact would remain **significant**.

Comparison With The No Project

In the No Project Alternative, the regional population is projected to be the same as the Plan Alternative, but no regional transportation investments would be made beyond the existing programmed projects. The population distribution is assumed to follow past trends, uninfluenced by additional transportation investments, resulting in a less compact growth pattern.

Direct Impacts

The No Project Alternative would result in the construction of only about 66,000 new lane miles, compared with over 72,000 new lane miles in the Plan Alternative. As shown in Table 3.5-6, the total projected use of transportation fuels would increase in the SCAG region even more in 2035 under the No Project conditions than under the Plan Alternative (an increase of 50% for the No Project vs. 45% for the Plan). This difference would result from the additional travel necessary without the Plan improvements to the regional transportation system. Thus, the No Project Alternative would have an even greater significant impact on regional transportation energy usage (Impact 3.5-2) than would the Plan Alternative. The No Project Alternative could be expected to have a smaller, though still significant, impact on energy needs for construction than the Plan Alternative since fewer new projects would be built.

Cumulative Impacts

Overall transportation energy usage is projected to be greater under the No Project Alternative than under the Plan Alternative because uses would be spread over a greater area resulting in greater VMT. Also the more compact development patterns identified by the Plan Alternative would result in less energy use.

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