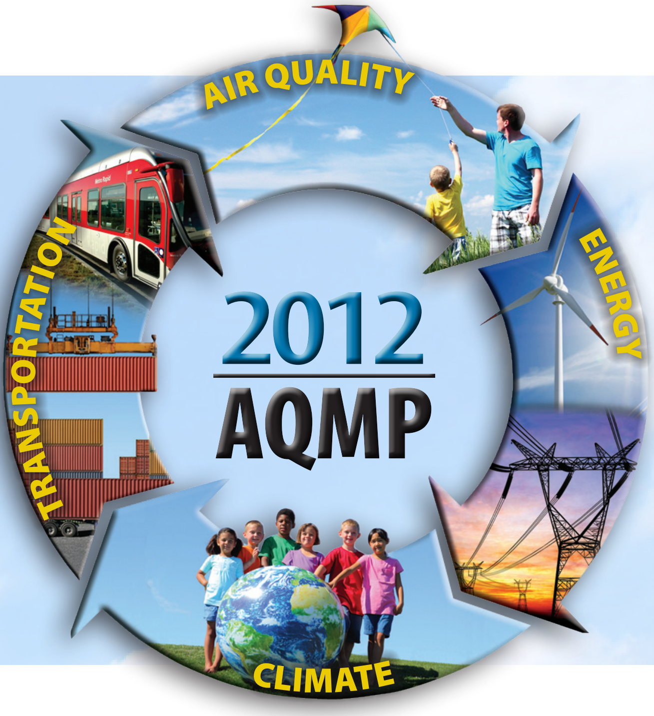

Chapter 10

Energy and Climate

South Coast Air Quality Management District

Cleaning the air that we breathe...

AQMD

CHAPTER 10

ENERGY AND CLIMATE

INTRODUCTION

In September of 2011, the AQMD Governing Board adopted the AQMD Air Quality-Related Energy Policy. This policy was developed to integrate air quality, energy issues, and climate change in a coordinated holistic manner and provides a review of energy usage within the Basin followed by ten policies and ten actions (Tables 10-1a and 10-1b). One of the action items is to provide an update of energy usage within the District in each AQMP (SCAQMD, 2011). Energy projections made in this chapter reflect past energy usage in the South Coast Basin and energy projections made from utility and other agencies' planning documents. These projections reflect existing policies and regulations. This review does not include an analysis of energy implications from the control measures within this AQMP; this analysis is conducted within the EIR review.

Energy use in Southern California plays a major role in everyone's lives for purposes such as transportation, comfort, goods movement, manufacturing, and entertainment. In the South Coast Basin this reliance on energy was at a cost of over $50 billion in 2008 and is projected to increase to over $70 billion on our current path of consumption. Unfortunately our reliance on energy usage is also the main source of criteria pollutants and greenhouse gases in Southern California. In particular, on-road transportation sources are the largest sources of GHG and criteria pollutants, emitting over 80% of the NOx and 70% of the CO_2 emissions in the Basin.

Technology changes are needed in the transportation sector over the next 10 to 20 years to meet the criteria pollutant standards and 2050 GHG goals. In the jointly developed *Vision for Clean Air: A Framework for Air Quality and Climate Planning,* technology scenarios are outlined for the transportation sector that provide insight relative to pathways forward to achieving criteria pollutant standards and climate change goals. The likely pathways also would result in greater energy independence and less money spent on energy. For example, newer transportation technologies such as hybrid and electric vehicles provide much greater efficiencies than typical internal combustion engines alone.

Despite the large quantities of energy consumed in California, the per capita energy consumption is the fourth lowest in the nation (EIA, 2011). This low per-capita energy consumption is due to California's energy efficiency programs as well as the relatively mild California climate. However, there are large improvements that need to be made through increased efficiency, renewable fuels, conservation, and renewable energy generation from all sources.

TABLE 10-1a

AQMD Air Quality-Related Energy Policy

POLICIES	
1.	Promote zero and near-zero emission technologies through ultra clean energy strategies, to meet air quality, energy security, and climate change objectives
2.	Promote zero and near-zero emission technologies in both stationary and mobile applications to the extent feasible
3.	Promote diversification of electricity generation technologies to provide reliable, feasible, affordable, sustainable, and zero or near-zero emission electricity supply for the Basin in partnership with local power producers
4.	Promote demand side management programs to manage energy demand growth. Such programs include, but are not limited to, energy conservation, energy efficiency and load-shifting measures
5.	Promote in-Basin distributed electricity generation, with emphasis on distributed renewable electricity generation, to reduce reliance on energy imports or central power plants, and to minimize the air quality, climate and cross-media environmental impacts of traditional power generation
6.	Promote electricity storage technology to improve the supply reliability, availability, and increased generation technology choices
7.	Require any new/repowered in-Basin fossil-fueled generation power plant to incorporate Best Available Control Technology (BACT) as required by District rules, considering energy efficiency for the application. These power plants shall also comply with any requirements adopted by the California Air Resources Board (CARB), California Energy Commission (CEC), Public Utilities Commission (PUC), California Independent System Operator (ISO), or the governing board of a publicly-owned electric utility, as well as state law under the California Environmental Quality Act (CEQA)
8.	Advocate, within the existing CEQA review process, maximum cost effective mitigation in the communities affected by emission increases resulting from the siting of new or repowered power plants
9.	Educate and incentivize the public and businesses to shift toward the lowest emission technologies, considering emissions of criteria pollutants, toxic air contaminants, greenhouse gases, energy efficiency, and the potential to create local jobs
10.	Incorporate energy efficiency and conservation as an emissions reductions strategy for stationary and mobile sources through AQMD's planning, rule making, advocacy, and CEQA commenting activities

TABLE 10-1b

AQMD Air Quality-Related Energy Policy

ACTIONS	
1.	Advocate for, conduct, and/or support detailed technical studies to identify viable zero and near-zero emission technologies and associated energy delivery and capacity needs to support these technologies as part of the clean air strategy for the Basin
2.	Conduct appropriate socioeconomic studies to identify the societal costs and benefits for the implementation of zero and near-zero emissions strategies, including but not limited to, further electrification and impacts on businesses and jobs
3.	Where feasible, develop an AQMD action plan to develop and deploy electrification and other zero and near-zero emissions measures for various sectors, including identification of implementation barriers and strategies to overcome such barriers
4.	Conduct studies to identify measures to reduce emissions from the transportation sector, including incentivizing early introduction of zero and near-zero emission measures and identify potential new transportation funding mechanisms to support substantial penetration of such technologies within the transportation sector
5.	Further develop and demonstrate low emitting biogas technologies and other clean energy sources from biomass
6.	Coordinate this Energy Policy with California state energy policy as promulgated by the California Energy Commission (CEC), California Public Utilities Commission (PUC), and the California Air Resources Board (CARB), and assure that rules and regulations adopted by the Board are not in conflict with state and federal laws. Actively participate in CEC, PUC, and CARB proceedings to promote policies and regulatory actions that further clean air objectives, consistent with state and federal law
7.	Convene a stakeholder working group (including, but not limited to, representatives from the building industry, local fire departments and building departments, and utilities) to develop and recommend standardized installations of electricity recharging, natural gas refueling, and other zero/near-zero emission refueling equipment for residential and commercial building applications to facilitate greater plug-in electric vehicle (PEV), natural gas vehicle (NGV), fuel cell vehicle, and other zero or near-zero emission vehicle market penetration
8.	Advocate for electricity rate structures that incentivize off-peak charging for PEVs through the Statewide PEV Collaborative (comprised of CEC, PUC, CARB, local air districts and utilities) while remaining sensitive to potential impacts on rates for existing customers
9.	Partner with local utilities and local government stakeholders to promote energy conservation and efficiency through local actions
10.	Compile and track Basin-wide energy usage and supply profiles in conjunction with each Air Quality Management Plan (AQMP) update

Many of the recently adopted and existing State regulations developed for energy efficiency, greenhouse gas reductions, and fuel economy will have impacts on the future amounts and types of energy use in Southern California and influence future-year energy consumption projections. This review helps us understand the amounts of energy being used, the associated costs, the historical and projected trends, and the energy-related emissions.

In this chapter, an overview of energy consumption within the District is presented for year 2008 and projected years 2014, 2019 and 2023. This review incorporates recent planning documents from other federal and state agencies, and utility providers. The review also utilizes information presented in other chapters and appendices of the 2012 AQMP. Finally, this chapter includes a discussion of the large benefits efficiency improvements provide and a discussion of the Basin's energy future to meet both criteria and pollutant GHG goals.

ENERGY CONSUMPTION INVENTORY AND PROJECTIONS

In 2008, the end use energy needs of the South Coast Basin were 2.1 quads (1 quadrillion [10^{15}] British Thermal Units) as shown in Figure 10-1. This is equivalent to 2% of the energy consumption within the U.S. The large majority of energy use in the South Coast Basin is devoted to transportation purposes as shown in Figure 10-2. This is the result of several factors related to the region's dense urban population, development structure, and economy. Southern California has two of the largest maritime ports in the United States that account for up to 40% of all U.S. container traffic. This goods movement system includes local distribution networks that require numerous diesel-powered trucks and trains. The Basin also has three large airports that involve both air and ground transportation. Most importantly Southern California is home to approximately 16 million residents that primarily rely on freeway and road infrastructure for mobility. As a result the largest energy use is gasoline consumption. As shown in Figure 10- 1, in 2008, 0.9 quads of gasoline were consumed in the South Coast Basin, approaching 50% of the total energy consumed. End use electricity consumption accounts for the second largest source of energy in Southern California, principally the result of commercial and residential usage.

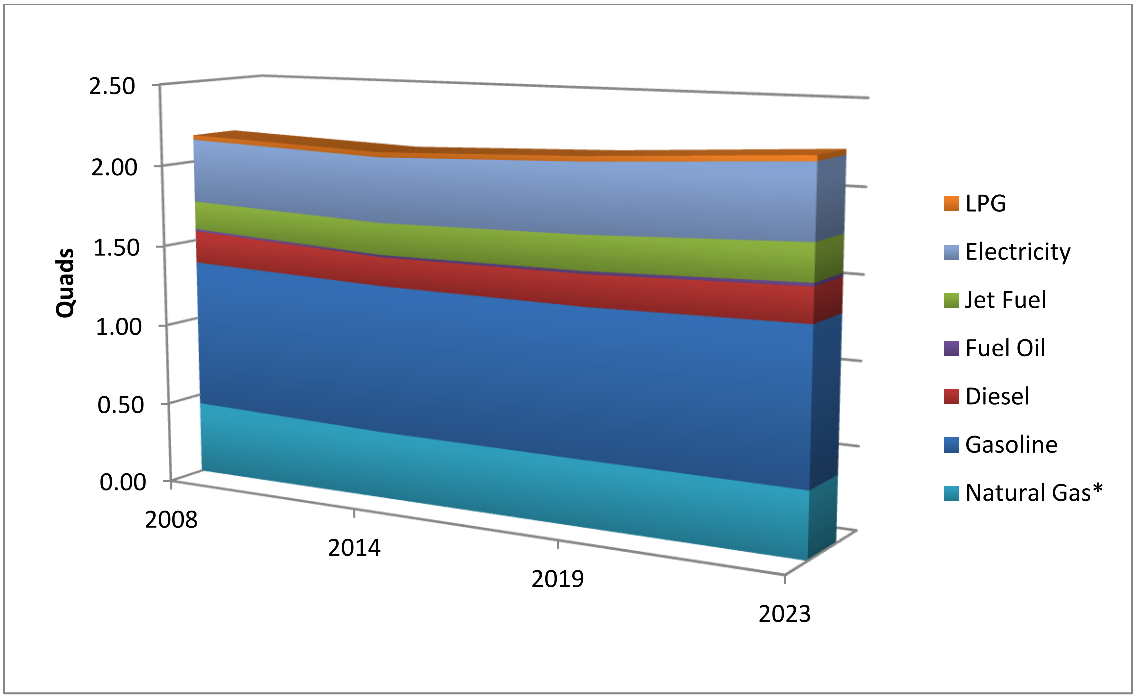

FIGURE 10-1

Total End Use Energy Consumption in the South Coast Basin by Fuel Type in 2008 and Forecasted Energy Growth

*Natural Gas consumption does not include consumption for electricity generation. Future projections are discussed in each energy type category.

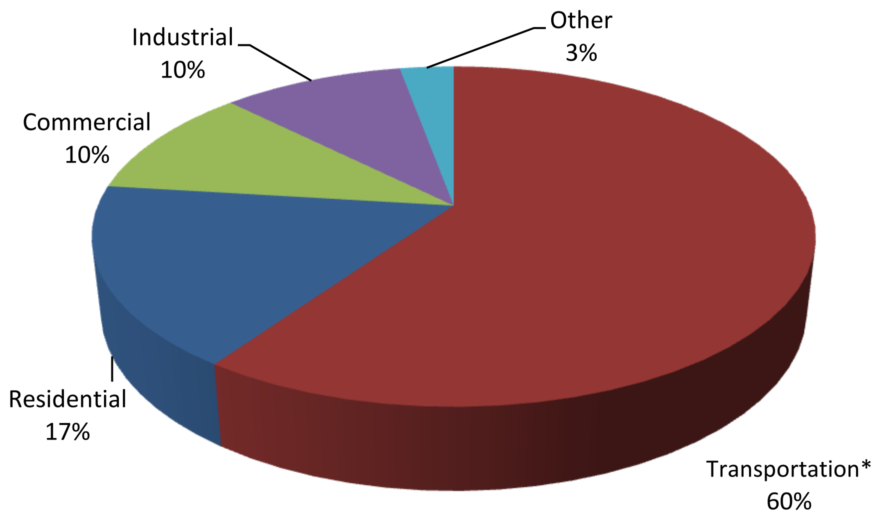

FIGURE 10-2

Share of Energy Use in South Coast Basin in 2008
*Transportation includes off-road sources

The energy usage in Southern California comes with a significant price tag. In 2008, over $54 billion was spent on energy usage within the Basin. As shown in Figure 10-3, the energy usage is projected to grow relatively slowly and will reach slightly over 2.2 quads in 2023 (i.e., a 0.1 quad increase between 2008 and 2023). Unfortunately, Figure 10-4 shows that the cost of energy consumption within the Basin is projected to increase by 27% in 2023 to $74 billion (EIA AEO, 2011).

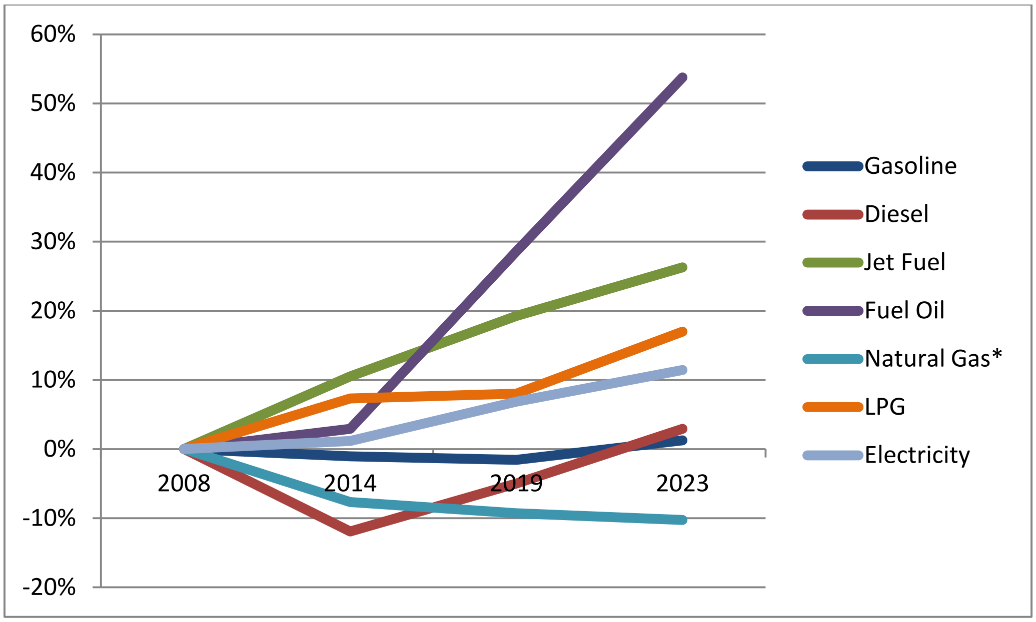

FIGURE 10-3

Projected Basin Energy Usage Growth by Fuel Type Relative to 2008

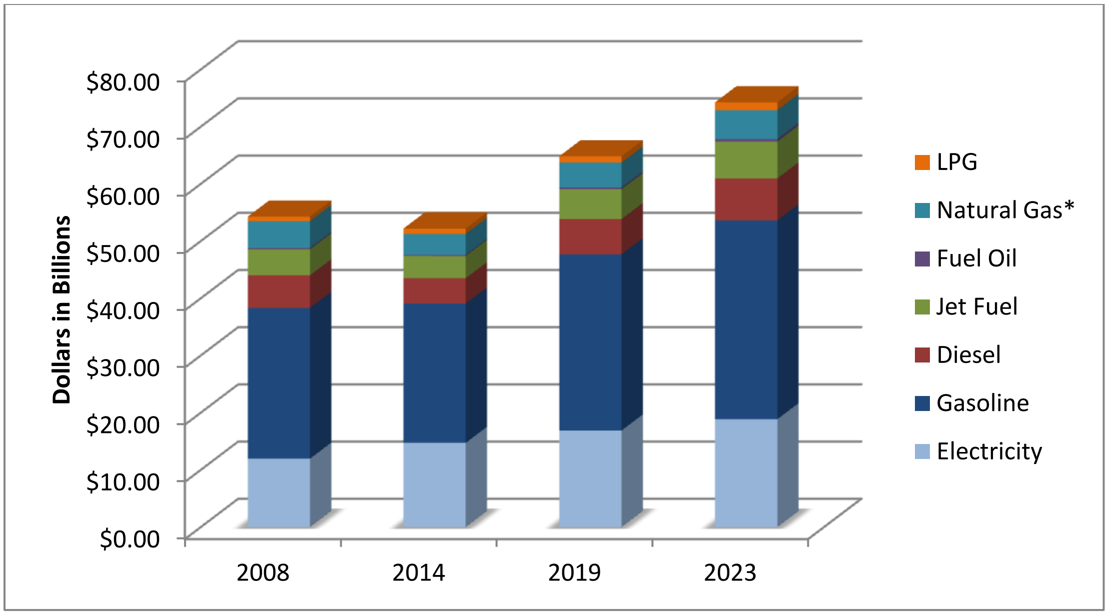

FIGURE 10-4

Dollars Spent on Energy End Use in 2008 and
Projected Years in the South Coast Basin

Note: Prices based on EIA Energy Outlook 2011 reference case for the Pacific except electricity (EIA AEO, 2011); electricity prices based on LADWP and SCE rates for 2008 and projected (CEC Energy Demand, 2009).

While transportation sources accounts for over 50% of the energy use, the majority of NOx emissions are attributable to transportation sources (Figures 10-5 and 10-6). Within the transportation sector, the majority of the NOx is emitted from diesel-powered vehicles. This is largely the result of years of effective stationary source and light-duty vehicle controls, the large numbers of vehicles in use, and the slow rate of fleet turnover for diesel- powered vehicles. Increased fleet turnover, fuel economy standards, diesel repowering and other state regulations are projected to lower NOx emissions. However, these reductions are far from what is needed to achieve ozone standards. Figure 10-7 provides the corresponding data for PM2.5 emissions by fuel type. Similarly, the majority of PM2.5 emissions are attributable to transportation sources.

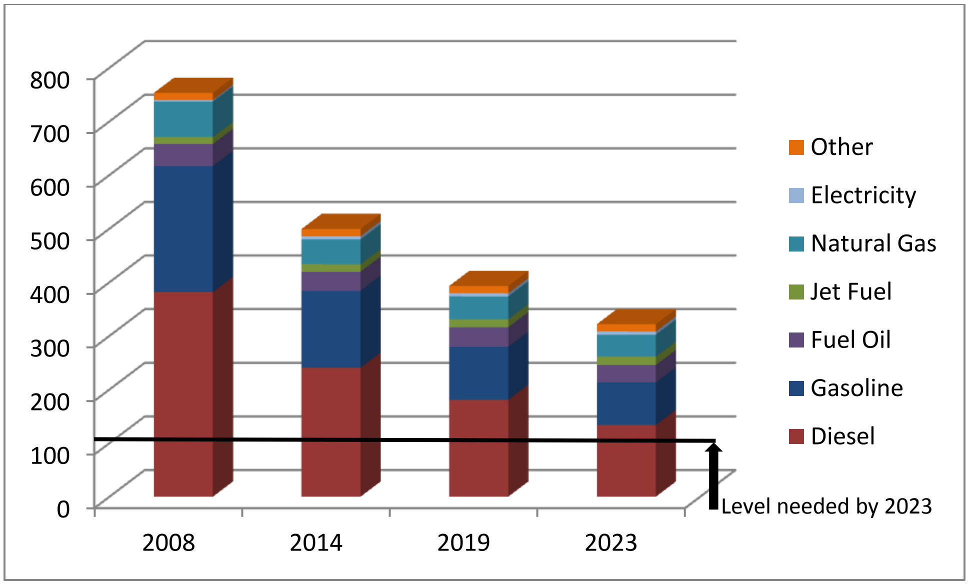

FIGURE 10-5

NOx Emissions in Tons per Day by Fuel Type

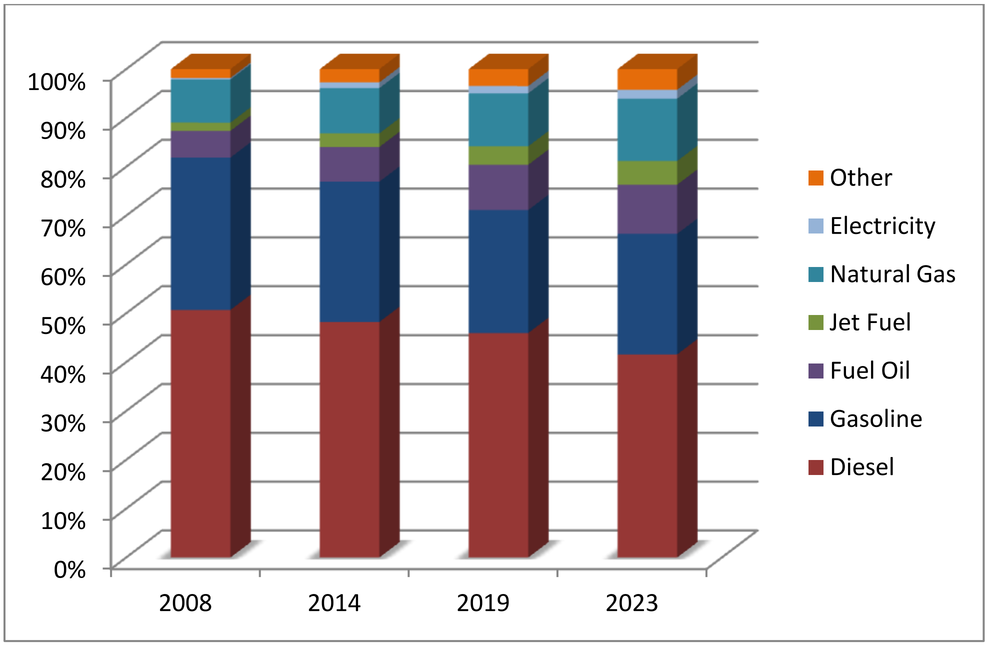

FIGURE 10-6

Percentage of NOx Emissions by Fuel Type

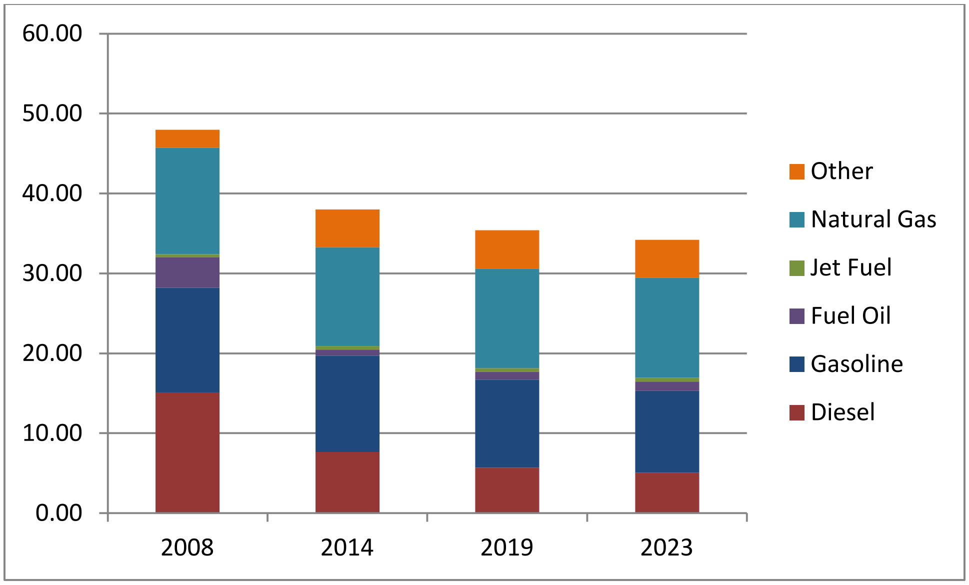

FIGURE 10-7

PM2.5 Emissions by Fuel Type

In 2008, the carbon dioxide emissions from fuel use were 134 MMT (million metric tons) in the Basin (Figure 10-8). This accounts for 32% of the total 421 MMT of carbon dioxide released in California in 2008 (CARB). The CO2 emissions from fuel usage in Southern California are dominated by the use of transportation fuels. By 2023, emissions of carbon dioxide are projected to remain relatively flat. This is largely the result of programs and regulations being implemented in California and discussed in further sections.

The carbon dioxide emissions in Figure 10-8 were determined from fuel consumption data and future fuel consumption projections. Sector-specific carbon dioxide emissions can be found in Appendix III – Table F.

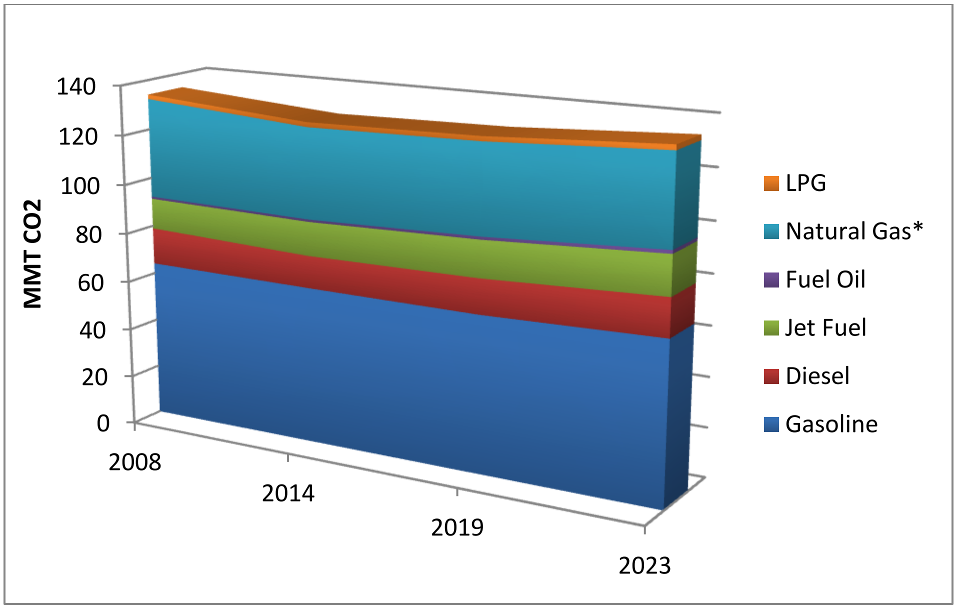

FIGURE 10-8

Carbon Dioxide Emissions by Fuel Type

*Natural Gas emissions include all combustion sources including electricity generation

Electricity Sources

Within the Basin in 2008, electricity end use accounted for 114,400 GWh of energy usage and 23% of the energy costs. While electricity generated within the Basin accounted for 26,000 GWh or 24% of the total electricity consumed in the Basin (CEC QFER). The generation mix for electricity produced within the Basin as of 2008 was mostly from natural gas fueled power plants (Figure 10-9) as it is for most of California; the majority of electricity in the U.S. derives from coal-fired power plants. As shown in Figure 10-9, the remaining supply of electricity into the Basin from Southern California Edison (SCE) and Los Angeles Department of Water and Power (LADWP) are likewise broken out to show percentages of their electricity from coal-powered plants in 2008. The percentages of power from coal between these two utilities have come down from 12% and 44% for SCE and LADWP to 7% and 39% in 2010 respectively (SB1305). SB 1368 (Perata, Chapter 598, 2006), and its implementing regulations by the CEC and CPUC, has explicit constraints on utilities regarding the development of new coal-powered facilities or contracts for coal-powered generation. Due to this legislation, and as the State's renewable portfolio standard and cap-and-trade program are implemented, the power procurement from coal will continue to decline through time.

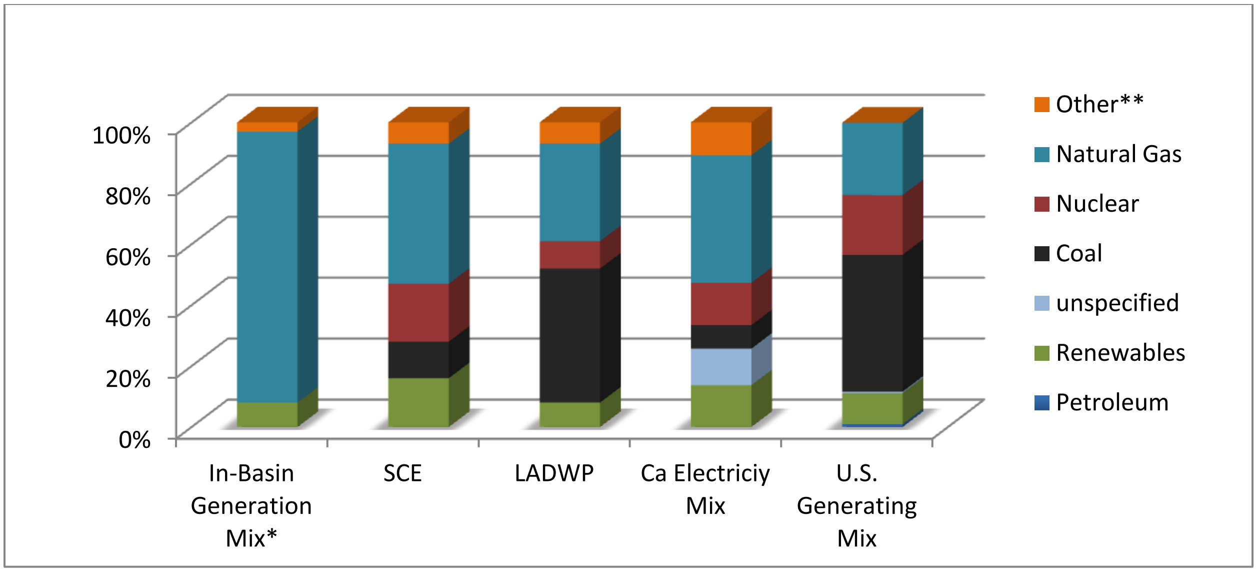

FIGURE 10-9

Electricity Generating Mix by Type in 2008

*Wind and Solar not included in Basin generation renewable mix, location data not available;
** Includes large hydro not accounted in renewable and fossil derived co-generation

Basin Electricity Consumption

As stated above, total electricity consumption within the Basin was 114,400 GWh in 2008 and is predicted to grow to an estimated 123,600 GWh by 2020 as shown in Figure 10-10. This is determined from the net energy loads for L.A. Basin and LADWP service territories within the CEC California Energy Demand Forecast 2010-2020 (CEC Energy Demand Outlook, 2009). Electricity consumption is recovering from a recent decline due to the economic recession that began in 2008.

The projected electricity use within the Basin is estimated to grow an average of 0.5% per year until 2020. In 2008, $12 billion was spent on end use electricity deliveries within the Basin. Using the projected electricity rates in the CA Demand Forecasts and anticipated electricity deliveries between SCE and LADWP, it is estimated that $18 billion will be spent on electricity in the Basin in 2020.

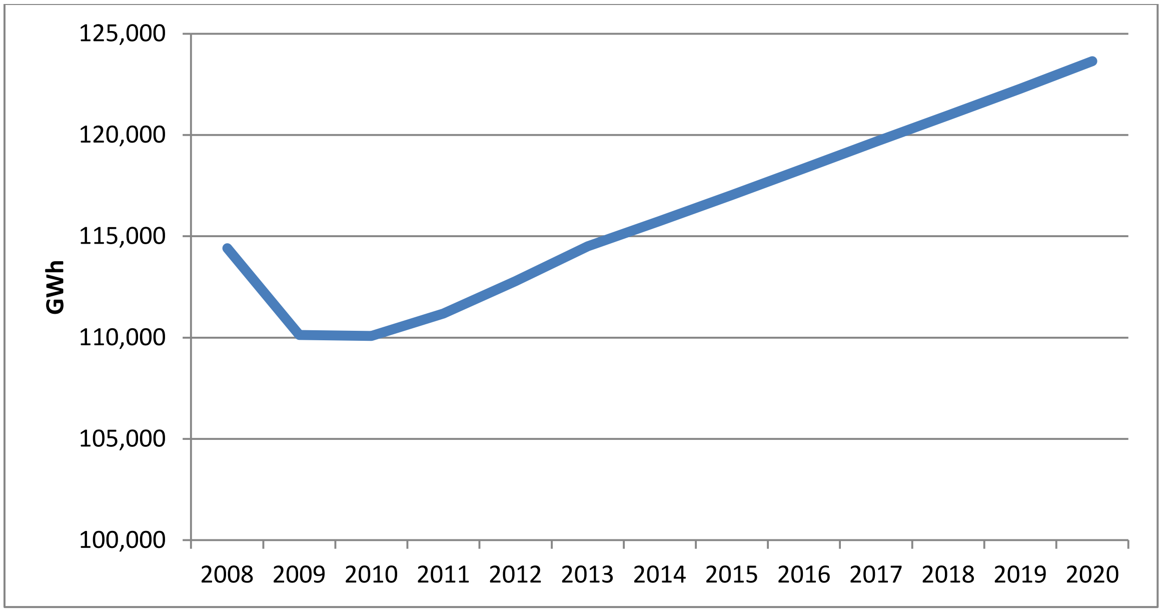

FIGURE 10-10

Total Basin End Use Electricity Consumption and Projections
within the South Coast Basin

Electricity Consumption by Sector

The 2008 electricity consumption and future projections within the residential, industrial, and commercial source categories are shown in Figure 10-11 based on the SCE and LADWP service areas in the adopted CEC California energy demand forecasts and prices (CEC Energy Demand Outlook, 2009). These projections include electricity energy efficiency savings of 14,000 GWh in 2008, growing to an estimated 24,000 GWh in 2020. These savings are anticipated from new and existing appliance standards, building standards, and utility programs.

Electricity projections from these two utility service areas correspond closely, but not exactly, to the expected energy use in the Basin. For instance, total electricity consumption in the Basin in 2008 was 114,400 GWh as compared to 129,700 GWh in these service areas. These two utility service area demand forecasts include the local municipal utilities located within the Basin, except for electricity services provided by the Cities of Burbank, Glendale and Pasadena; individual source categories for these power providers were not available.

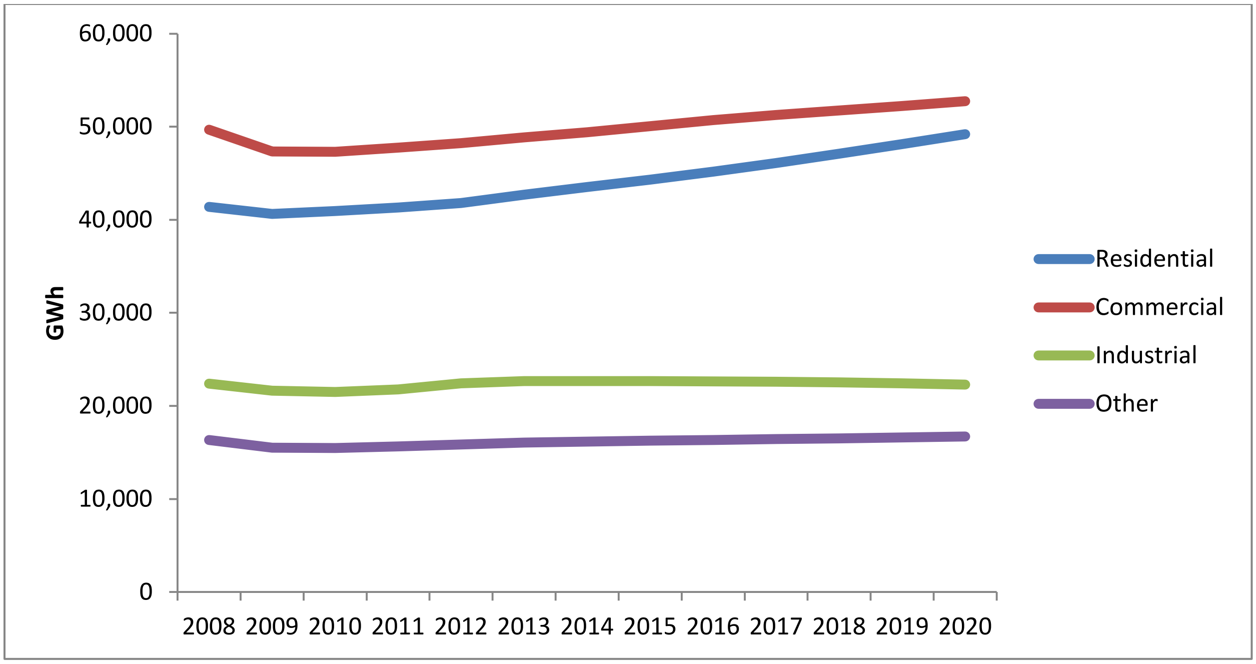

FIGURE 10-11

Electricity Consumption and Projections for LADWP and SCE Service Areas by Sector

RECENTLY IMPLEMENTED STATE REGULATIONS AND ELECTRICITY GENERATION

There are several state regulations that will impact the sources of electricity, the emissions of GHGs from electricity production, and the demand for repowered or new fossil-fueled plants in the future. These regulations were very recently implemented and represent a groundbreaking shift in how electricity is generated in California. The number of recently adopted regulations that affect the power sources in California, along with future conservation and efficiency programs, will significantly impact energy planning efforts in the future.

SBX 1-2 Renewable Portfolio Standard (RPS) – The expanded RPS was adopted in April 2011 and requires both publicly owned utilities and investor owned utilities to serve 33% of retail electricity sales with renewable generation sources by 2020. Compliance periods monitor the progress of procuring renewable power by California electricity-servicing utilities; the first period ending in 2013 requires utilities to have an average of 20% of sales from eligible renewables; by 2016, 25% must be from renewables; and then 33% by 2020 and beyond. Eligible renewable power sources that meet the compliance requirements include photovoltaics, wind, geothermal, solar thermal, power from renewable fuels, and small hydroelectric less than 30 MW.

Adding large percentages of renewable power requires changes to the existing grid and generation requirements for fossil-fueled plants. Large solar power generation facilities in the desert areas have required new transmission lines, such as the San Diego Sunrise 500 kV line linking the Imperial Valley solar resources with the San Diego urban area demand. Other implications include providing ancillary services on the grid to account for the intermittency of some renewable power generation sources. New and existing fossil-fueled generation will need to provide some of these services since these generating sources can provide voltage support through inertia and fast ramp rates when needed. Storage technologies and pumped hydro may also help provide the needed ancillary services for supply stability.

Once-Through Cooling (OTC) – In May 2010, the State Water Resources Control Board adopted the Statewide Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling. This regulation places restrictions on the use of seawater for power plant cooling in order to protect marine life. Using billions of gallons of seawater to cool California’s power plants significantly harms the environment by killing marine life primarily on the lower end of the food chain as they are trapped against the intake screens or drawn into the power plant cooling system where they are exposed to high heat and pressure. In California, nineteen power plants are affected by this regulation. The plants may undertake several options to comply, including incorporating a 93% reduction in their seawater intake, screening, or switching to evaporative cooling, with certain exceptions given to the two nuclear generating facilities. The coastal plants affected by this regulation in Southern California include seven fossil fuel powered plants and the San Onofre Nuclear plant. These Southern California plants provide over 7,000 MW of generating capacity and have varying compliance dates under this regulation (Table 10-2). To comply with this regulation, some of the Southern California fossil-powered generation plants will need repowering and some units are planned for shutdown.

TABLE 10-2

Southern California Fossil-Fueled Power Plants affected by OTC

FACILITY	UNITS	TOTAL MW	OTC REPLACEMENT DATE
Alamitos, Long Beach	Boilers 1-6	1,950	2020
Huntington Beach	Boilers 1-4	880	2020
Redondo Beach	Boilers 5-8	1,310	2020
El Segundo	Boilers 3-4	670	2015
Haynes, Los Angeles	Boilers 1,2,5,6 Turbines 9,10	1,654	2029
Harbor, Los Angeles	Turbines 1,2	364	2029
Scattergood, Playa del Rey	Boilers 1-3	818	2024

SCAB Electricity Needs Assessment (AB-1318) – The passage of AB-1318 required the state power regulatory agencies, in conjunction with CARB, to conduct a needs assessment of electricity generation for the South Coast Basin. This analysis is also needed for implementing the OTC regulation, to determine how many plants will need to be repowered. This analysis is currently being conducted and initial estimates under several base case scenarios indicate the OTC regulation results in new generation needs of 2,400 MW. A draft report is expected in the summer of 2012.

Cap-and-Trade – The Global Warming Solutions Act of 2006 (AB-32) seeks to reduce GHG emissions in California to 1990 levels by 2020. Under the Governor's Executive Order, an additional goal was established to reduce GHG emissions 80% below 1990 levels by 2050. To achieve the initial 2020 goal CARB has set forth a scoping plan that contains voluntary and regulatory measures to help reduce GHG emissions. One of these measures is to establish a cap on GHG emissions for the largest emitters in the state. The CARB cap-and-trade regulation was adopted in October 2011 and goes into effect in January 2013 for facilities with emissions greater than 25,000 MT CO_2e. This inclusion threshold encompasses most large fossil fueled generating plants. Additionally, the cap-and- trade program also applies to fuel providers and importers of electricity. Participants falling under this regulation must surrender allowances to meet their emissions over three-year compliance periods with some annual monitoring. Allowances under this program will be obtained through direct issuance, available through auctions; or may be partially obtained from allowable GHG offsets. Under this regulation, the electrical distribution utilities will be given allowances that they must auction, the proceeds from these allowance auctions are then used to help isolate the electricity ratepayers from fee increases (§95892 Cap-and-Trade Regulation). How the utilities will use these proceeds may provide opportunities to further reduce consumption and incentivize clean power through incentives such as efficiency programs and appropriate distributed generation sources while also providing other co-benefits.

NATURAL GAS

Figure 10-12 shows the natural gas consumption by major customer end use categories, including the electricity generating sector, in the Southern California Gas Company's service area within the District (consumption data and forecast provided by SoCal Gas Co.).

The decline of natural gas prices relative to liquid fuels will likely result in natural gas continuing to be a large component of California's electricity production and increased usage as a transportation fuel. In addition, natural gas plants will help integrate renewables into the grid by providing peaking assistance, fast ramp rates and other ancillary services. The declining consumption forecast for natural gas in the commercial and industrial sectors is due to improved energy efficiency/conservation programs in place through the CEC and CPUC. This declining consumption is partially offset by a projected increased usage for transportation purposes.

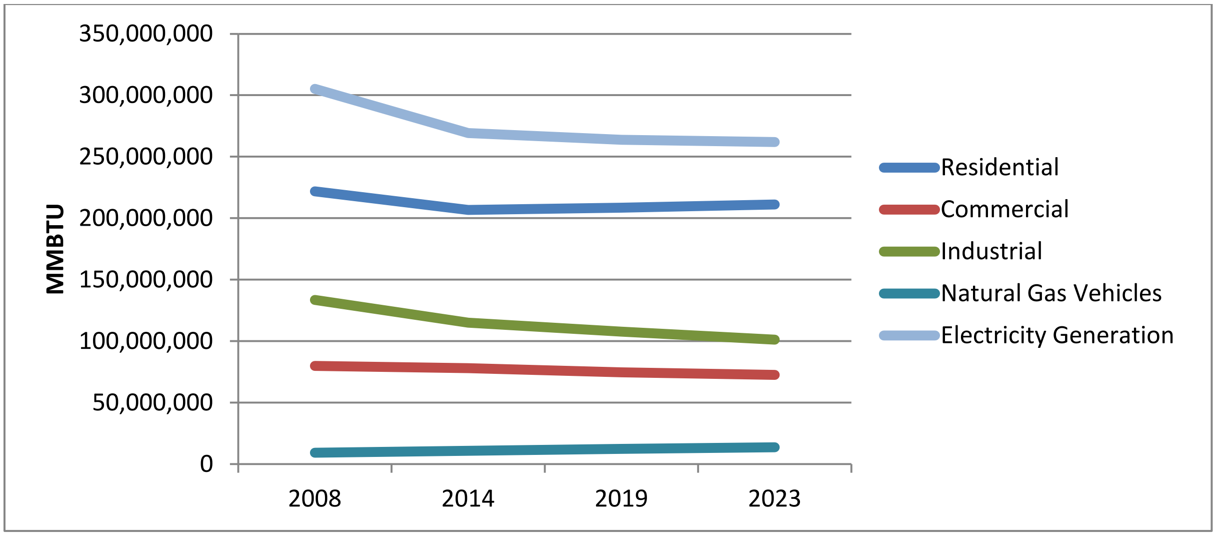

FIGURE 10-12

Natural Gas Consumption in the Basin by Sector

TRANSPORTATION FUELS

The use of transportation fuels in Southern California as shown previously in Figures 10-6 and 10-7 accounts for the majority of NOx emissions and fuel-related emissions of fine particulate. Diesel fuel use in Southern California is dominated by on-road heavy-duty diesel vehicles. Overall usage of transportation fuels in the Basin is slightly over a staggering 10 billion gallons annually (Figures 10-13 and 10-14).

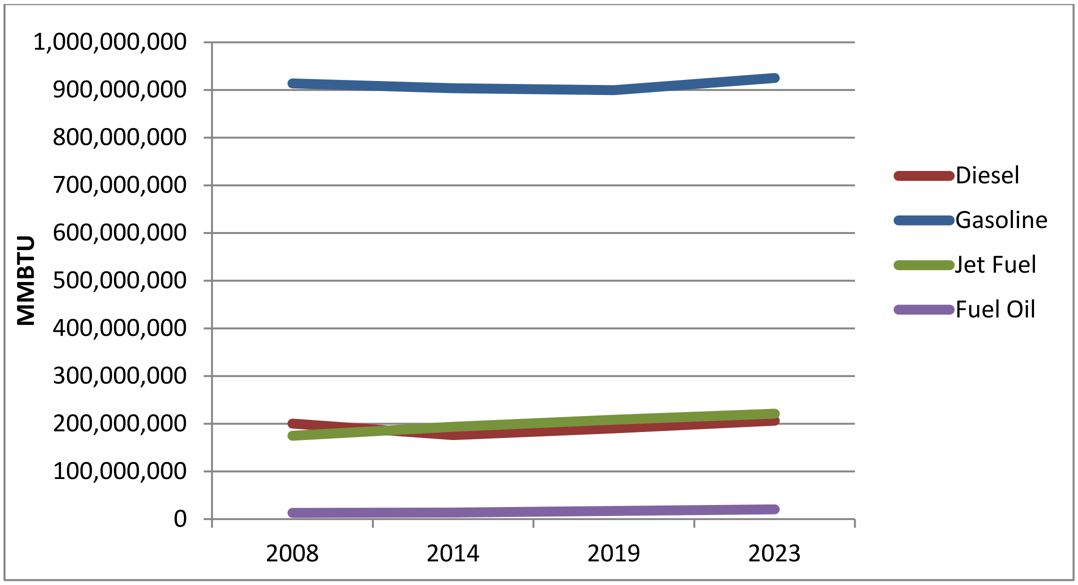

FIGURE 10-13

Consumption of Transportation Fuels in the Basin in 2008 and Projected Years

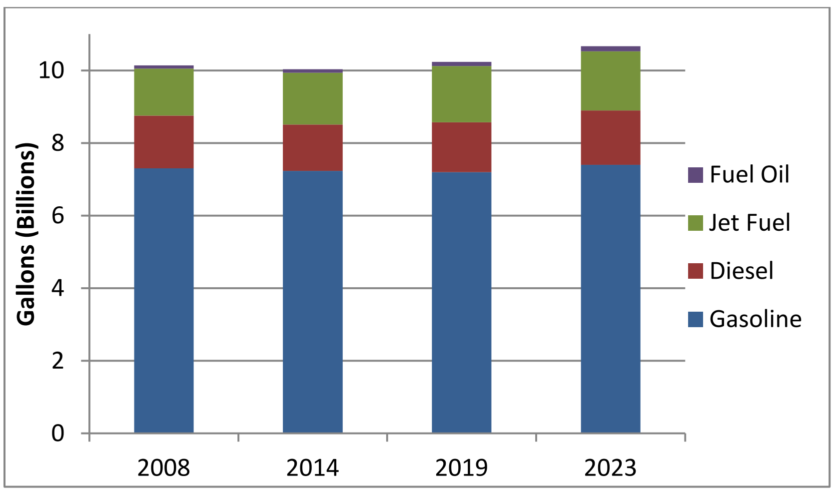

FIGURE 10-14

Fuel Consumption by Type

Fuel consumption figures for transportation fuels were obtained from several sources. The on-road portions of diesel and gasoline vehicles were obtained from the annual average emissions in Appendix III within attachment D. An estimation of the jet fuel consumption within the Basin was determined using the EIA sales to California for 2008 and adjusting for the Basin consumption using the NOx inventory for the Basin relative to the State, then projected to future years using the inventory in Appendix III (CARB Almanac). The diesel consumption estimates for ocean-going vessels were limited to the 100 nm regulatory zone for the Basin ports (CARB OGV). The consumption figures estimated for trains were determined using consumption numbers developed in 2004 for South Coast and grown using inventory numbers for future years (CARB). Other off-road users of diesel were determined from CARB's OFFROAD model.

EFFICIENCY IMPACTS ON ENERGY USE

Energy efficiency is an increasingly important strategy in reducing impacts from volatile and rising energy prices. For example, in 2008 the South Coast Basin consumed over 10 billion gallons of gasoline at a cost of over $26 billion dollars. Unfortunately, the typical gasoline fueled vehicle utilizes, at best, 20% of the energy contained in a gallon of gasoline for propulsion (fueleconomy.gov). The remaining 80% of the energy content of gasoline is mostly wasted as heat. Small changes in the fuel efficiency of gasoline vehicles can have major impacts on the amount of gasoline consumed and money spent while also providing major emission reductions.

Other benefits of implementing efficiency projects include helping to minimize strains on existing infrastructure, providing positive environmental impacts, helping to promote economic growth, and providing job opportunities. Although the term energy efficiency is often used interchangeably with energy conservation, there are key differences. Energy conservation techniques typically involve reducing the "level of service" consumers derive from energy usage, such as raising thermostat levels in the summer or driving less by foregoing leisure travel. Conservation measures are typically behavior based and more difficult to rely on for meeting a specific air quality or climate objective. Energy efficiency, on the other hand, means obtaining the same level of service while using less energy. An example of an energy efficiency project might be installing a high efficiency air conditioning unit as a replacement for an older less efficient one. The consumer is still obtaining the benefit of a cool house, but uses less electricity, requiring less power generated, and thus less pollution from such power plants.

In California, incentive funding administered by the CPUC and distributed to ratepayers through utilities for efficiency projects has helped alleviate the need for new power plants while also reducing the infrastructure needs for energy distribution. Since 2010 these efficiency incentives in the South Coast Basin have reduced 3.8 million GWh of electricity and 71,000 MMBTU of natural gas (http://eega.cpuc.ca.gov/Default.aspx) consumption, resulting in a reduction of 1.4 million MT of CO_2 from being released into the atmosphere (equivalent to the combustion of 154 million gallons of gasoline) and energy cost savings of well over half a billion dollars (based on $0.10.kWh and $2/therm). In addition to energy cost savings, these efficiency projects have reduced criteria pollutant emissions such as PM and NOx. Other efficiency requirements, such as the Title 24 building standards for residential and non-residential buildings, have saved an estimated $66 billion in energy costs since 1978. These efforts have helped California's per-capita energy consumption to remain relatively flat since 1973 while the U.S. per-capita consumption has increased over 60% during this time (CEC per capita).

Globally there is an increase in energy use and demand as emerging markets further develop and thus, global energy markets are becoming increasingly volatile. Addressing energy issues through policy and technology improvements is a lengthy process, combining scientific, engineering, economic, social, and political elements that take long periods of time to develop and implement. However, implementing efficiency measures provides for actions that can be taken quickly and provide several immediate benefits. These benefits include emission reductions from electricity generation or process equipment and typically have quick payback periods given the energy cost savings.

Example: Manufacturing, Industrial and Commercial Boilers

The manufacturing and industrial sectors have significant opportunities for additional efficiency gains that can be captured as a compliance strategy for NOx and GHG reductions. These two sectors account for 20% of energy end use in the United States and 23% within California (IEA). It is estimated that 4.7-7.7 quads of energy can be saved in the United States by 2020 in these sectors through efficiency measures that have rates of return from energy savings of at least 10% (NAS). Of the equipment within these sectors, boilers account for the largest sources of energy consumption. Efficiency improvements on boilers often have higher initial capital costs but result in quick payback from energy savings. Table 10-3 shows a partial list of efficiency improvements, which when properly applied, have payback periods of less than two years (DOE; Itron).

TABLE 10-3

High Impact Efficiency Measures for Boilers

NATURAL GAS BOILER EFFICIENCY MEASURE	DESCRIPTION	POTENTIAL EFFICIENCY GAIN
Reduce Steam Demand	Optimize process steam requirements	High
Maintenance	Maintain burners and condensate return systems, clean heat transfer surfaces, use proper water treatment, steam trap maintenance	>30%
Economizer	Flue gas heat used to preheat feed water	4-8%
Burner Efficiency	Oxygen trim systems to optimize air-fuel mixture, new burners	2-5%
Load Control	Optimize use of several boilers	3-5%
Improved Insulation	Improving insulation (type, thickness, quality)	6-26%
Scheduling	Optimizing boiler usage	2-8%

Boilers have widespread use to produce steam and provide hot water for industrial processes and commercial buildings. Because boilers are large consumers of fuel, primarily natural gas in Southern California, there are numerous opportunities to implement efficiency measures with quick payback periods from reduced energy use. Nearly 49% of fuel consumed by U.S. manufacturers is used for steam processes (http://www1.eere.energy.gov/manufacturing/tech_deployment/steam.html). In the South Coast Basin there are over 2,000 boilers ranging in size from 5 to greater than 50 MMBtu/hr with an average age greater than 14 years old which consumed 143,000 mmscf of natural gas (2008). This accounts for 20% of natural gas consumed within the South Coast Basin. Figure 10-15 below shows energy usage in 2008 from boilers was 143,000 mmscf of natural gas at a cost of $1.23 billion dollars. This resulted in emissions of 870 tons of NO_x and 8 million MT of CO_2. (http://info.ornl.gov/sites/publications/files/Pub25191.pdf).

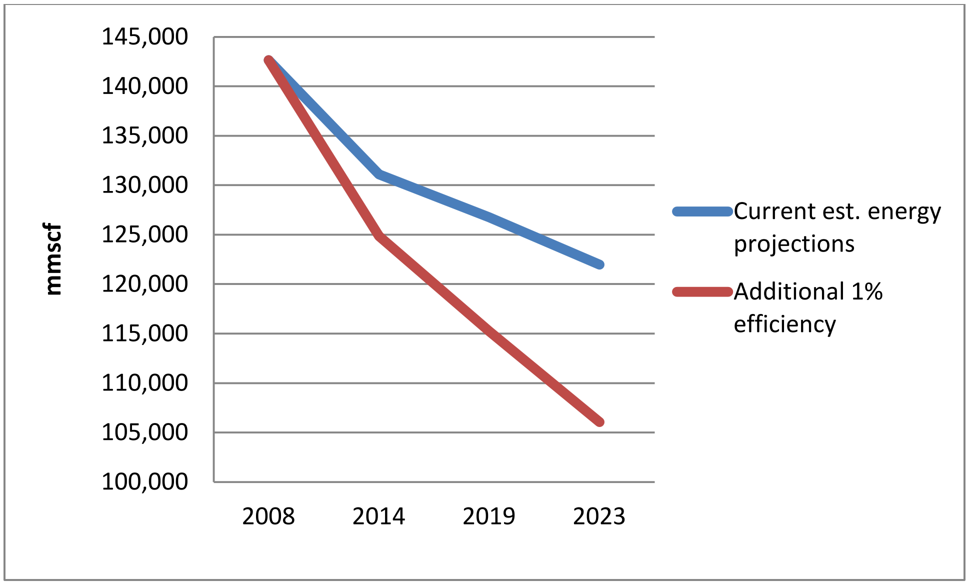

FIGURE 10-15

Boiler Energy Usage within the Basin

Note: Current estimated energy use projections accounting for existing efficiency programs and an accelerated one percent per year efficiency increase above projection.

Efficiency programs already in place are projected to decrease the natural gas consumption used in boilers as shown in Figure 10-15. If these efficiency measures can be enhanced to achieve an additional one percent efficiency gain per year, the resulting savings in 2023 will be 16,000 mmscf. This would result in a yearly savings of $140 million, prevent 87,000 MT of CO_2 emissions, and produce reductions in criteria pollutant emissions.

Waste Heat Recovery

Additional efficiencies can be gained in the commercial, manufacturing and industrial sectors through utilizing waste heat recovery. There are widespread applications of waste heat recovery in the commercial, industrial and manufacturing sectors. Applying waste heat recovery systems can provide a holistic approach to energy use. Some technical approaches to waste heat recovery include the following:

Combined Heat and Power (CHP) - Utilizing CHP takes advantage of both electricity production and thermal energy from one energy source. Efficiency benefits of CHP systems can be achieved through utilizing waste heat of electricity production from small generating sources like a fuel cell or micro turbine to increase the efficiency of another thermal process such as preheating boiler feed water. Combined systems can achieve overall thermal efficiencies greater than 90%. Certain steam industrial applications may benefit from generating power directly from their steam production using a high pressure steam boiler coupled with a turbine. In California, currently 8,444 MW are online from approximately 1,000 CHP systems (ICF database). In Southern California some of the largest generators of electricity are utilizing waste heat to generate electricity (CEC QFER, large kWh from refinery CHPs).

Waste Heat to Cooling or Refrigeration - Waste heat may also be used to help with cooling or refrigeration needs utilizing absorption chillers.

Heat to Heat – Some applications can use waste heat to supplement another heating process such as supplementing space heating requirements or utilizing an economizer to preheat feed water.

Available Tools to Develop Projects

The DOE has developed a suite of software tools to evaluate existing boiler systems and provide benefit estimates from a suite of efficiency and performance tools. Other resources such as energy assessments on specific industries, best practices, and literature resources are available at the DOE Advanced Manufacturing website (http://www1.eere.energy.gov/manufacturing/tech_deployment/steam.html). The providing local utilities also offer technical assistance in developing efficiency projects.

EFFICIENCY INCENTIVES AND FINANCING

There are many business reasons for undertaking efficiency projects, including rising energy prices, high demand use charges, environmental concerns and regulations, increased productivity, and business sustainability. Despite these strong business cases and potentially short payback periods for capital investments, financing and incentives are necessary to help implement efficiency projects (AP NORC). Implementing efficiency projects on industrial applications often requires a large initial capital outlay, time to implement the project, and personnel to administer the project. Often the largest hurdle is securing the initial capital to undertake the project. Providing efficiency incentives and loan programs can help overcome the limited capital improvement budgets that businesses have for such projects. Additionally, incentive programs also can provide funding and technical assistance in developing a project which also helps limit staff hours allocated to these projects. Incentives available for efficiency projects include direct rebate incentives often administered through the local utility, tax incentives, and favorable loan terms. Some resources to find available incentives include:

-Flex Your Power: www.fypower.org

-CEC low-interest loans for energy efficiency projects: www.energy.ca.gov/efficiency/financing/index.html

-Energy Star: http://www.energystar.gov/index.cfm?c=tax_credits.tx_index

-WRCOG HERO program: http://herofinancing.com/HEROFinancing/

SOUTHERN CALIFORNIA'S ENERGY FUTURE

The energy use projections presented above represent a base case scenario of energy use in the South Coast Basin in the near future. The control measures proposed as SIP commitments for the PM2.5 attainment and progress toward the ozone standard do not in themselves cause substantial change in current energy consumption. However, in order to meet the ozone standards and GHG goals, energy consumption related NOx and carbon emissions would need to be reduced. In the transportation sector, fleet turnover along with newer emission control designs will help reduce criteria pollutants from this sector but as shown in Figure 10-5 these reductions alone will not be enough to meet federal ozone standards by the 2023 deadline.

To greatly impact energy usage, attain healthful air quality levels, and meet the 2050 climate change goals, significant technology shifts are needed in the transportation sector, including efficiency shifts and increased renewable sources of energy, especially for electricity production.

Transportation and goods movement are our largest energy consumption sectors, responsible for 80% of NOx emissions and 70% of the CO2. The majority of our transportation and goods movement activities rely on the internal combustion engine, which has dominated these sectors for well over the past hundred years and is inherently energy inefficient. Reliance on internal combustion engines results in a vehicle fleet that utilizes only 20% of the gasoline energy consumed for mobility while the rest is lost primarily to wasted heat. From the over $26 billion spent on gasoline in 2008 within the South Coast Basin, this significant inefficiency means over $20 billion in gasoline costs was wasted as unused heat. On a national level in 2008, $455 billion was spent on gasoline, thus wasting $364 billion dollars as unused heat. Other transportation fuels for the most part have a slightly higher efficiency than gasoline; however, a similar situation applies, resulting in the vast majority of the fuel being wasted as heat. This wastefulness in transportation fuels represents a dramatic opportunity for efficiency increases in the transportation and goods movement sector that would reduce criteria and toxic pollutant emissions, GHG emissions and provide many other co-benefits.

Currently, emerging global markets are developing infrastructures reliant on existing transportation technologies. As these are implemented, more people globally are being exposed to the same transportation-related emissions and will encounter the negative effects of volatile energy prices. It will not take long for the cost benefits of a cleaner more efficient transportation system to be realized, especially when looking at the energy cost savings. The business-as-usual scenario without these changes may cause significant increases and will certainly delay decreases in air pollution related health problems as the population increases, both in California and the rest of the world.

New fuel economy standards will eventually help improve the effectiveness of transportation fuels in providing mobility. More transportation choices are coming into the marketplace providing higher efficiencies that utilize electricity either solely or in hybrid applications. In the jointly developed Vision for Clean Air: A Framework for Air Quality and Climate Planning, information is presented that shows the benefits of implementing these new technologies and renewable energy sources.

As outlined earlier, more renewable power sources will be put online as utilities work toward meeting their obligations under the Renewable Portfolio Standard. Coupling renewable electricity sources with transportation can mean large reductions in the total amount of energy spent for transportation, provide emission reductions in all areas, and support energy independence along with buffering from increasingly volatile transportation fuel prices. Under AB32, there is also a need to implement renewable sources of transportation fuels which would help with GHG reductions.

Transformation of the Energy Sector

The recent shutdown of the San Onofre Nuclear Generating Station has required temporary return to service of two units at the Huntington Beach natural gas plant which had been voluntarily shut down. This event demonstrates the vulnerabilities in the current energy planning process. The planning and investments in the energy infrastructure must consider reliability; reductions in criteria pollutants, air toxics, and greenhouse gases; provide energy security, energy diversity, and energy cost certainty. The transformation of the energy sector to maximize these co-benefits can start with:

- Coordinated planning efforts – Agencies such as the CEC, CPUC, CARB, AQMD, EPA, and CaISO need to be working closely together in planning and regulatory efforts. A holistic, integrated approach, considering the objectives, constraints, and legal responsibilities of all agencies, needs to be addressed. Regulations and actions by one agency can negatively impact the other agencies. A coordinated planning strategy would not only help to avoid such conflicts, but also identify synergies whereby the goals of multiple agencies could be furthered simultaneously.

- Scheduling for infrastructure and technology needs – New and existing mobile source technologies can provide a more efficient means of mobility and goods movement. Implementing these technologies requires the supporting energy infrastructure to allow acceptance and greater use, similar to the Actions to Deploy Advanced Control Technologies (ADV) measures in Chapter 4 and Appendix IV-B. These efforts should also be implemented in a coordinated manner with multi-agency participation and support.

To achieve these planning objectives, the District will enhance its outreach and coordination efforts with the appropriate state and federal agencies. Through scheduled public hearing testimony, as well as meetings, conferences, workshops, and the formation of interagency working groups, the District desires to help catalyze the coordinated planning efforts that are needed to achieve air quality, climate and energy goals.

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