

2.3

Energy

This section analyzes the effect of the 2009 CTP on energy resources. The section identifies transportation energy laws, plans, and policies; identifies energy sources; and describes existing and projected energy consumption and trends in the study area. Related concerns regarding climate change and greenhouse gases are addressed in *Chapter 2.13: Global Warming and Greenhouse Gases*.

Existing Setting

ENERGY TYPES AND SOURCES

Petroleum products supply approximately 39.8 percent of the energy consumption in the U.S. (Energy Information Administration (EIA), 2007). Coal and natural gas each supply approximately 23 percent of the national energy demand, and nuclear and renewable sources supply the rest in roughly equal proportions. Nationally, 29 percent of energy consumption occurs in the transportation sector (EIA, 2007).

Petroleum and natural gas supply most of the energy consumed in California. Petroleum products provide approximately 46 percent of the state's energy demand, and natural gas provides approximately 29.5 percent (California Energy Commission (CEC), 2007). The remaining 24.5 percent of the state's energy demand is met by a variety of energy resources, including coal, nuclear, geothermal, wind, solar, and hydropower. California produces 13.5 percent of the natural gas it uses, 39 percent of the crude oil, and more than 75 percent of the electricity. The remaining sources are imported from other states, Canada, and other international sources (CEC 2007, 23). In California, 41 percent of energy use – the largest share by any sector – is in the transportation sector (CEC, 2007). The Bay Area Air Quality Management District (BAAQMD) completed an emission inventory for the bay Area for 2005, which gives a sense of Contra Costa's contribution to regional emissions. As detailed in Table 2.3-1. Contra Costa makes up about 15 percent of the Bay Area population, and consumes about 15 percent of the

gasoline consumed in the region. Natural gas usage in Contra Costa is significantly higher than in other parts of the region, primarily due to PG & E.

Table 2.3-1: Contra Costa County Basic Energy Use Statistics, 2005

<i>Indicator</i>	<i>Measure</i>	<i>Total</i>	<i>% of Bay Area Total</i>
Population		1,016,000	15%
Natural Gas Usage	million cu. ft. daily	817	56%
Gasoline Consumption	gallons sold per day	1,111,000	14%
Vehicle Miles Traveled	daily, in millions	23.1	16%

Source: BBAQMD, 2008. Emission Inventory. http://www.baaqmd.gov/pln/emission_inventory.htm Accessed September 15, 2008.

Petroleum

Most gasoline and diesel fuel sold in California for motor vehicles is refined in California to meet state-specific formulations required by the California Environmental Protection Agency's Air Resources Board. Major petroleum refineries in California are concentrated in three counties: Contra Costa, Kern County in central California, and Los Angeles County in southern California.

In 2007, 21 refineries in California maintain a capacity of more than 1.9 million barrels per day (CEC, 2007, 27). Approximately one-half of the crude oil came from in-state oil production facilities, one-fifth came from Alaska, and the remaining - just under one-third - came from foreign sources. The long-term oil supply outlook for California indicates that in-state and Alaska supplies are declining, leading to increasing dependence on foreign oil sources. Californians used almost 16 billion gallons of gasoline in 2006, and demand is expected to increase by 1 to 2 percent each year (CEC 2007, 29).

Natural Gas

Four regions supply California with natural gas. Three of them—the Southwestern U.S., the Rocky Mountains, and Canada—supply 86 percent of all the natural gas consumed in California (CEC, 2007). The remainder is produced in California itself. Approximately one-half of all the natural gas consumed in California is used to generate electricity, and residential consumption represented one-fifth of California natural gas use (CEC 2007).

PG&E is the primary electricity and natural gas provider for Contra Costa. PG&E obtains its energy supplies from power plants and natural gas fields in northern California and from energy purchased outside its service area.

Electricity

Power plants in California meet approximately 70 percent of the in-state electricity demand; the Pacific Northwest provides another 8 percent and power plants in the southwestern U.S. provide another 22 percent (CEC, 2008). The contribution between in-state and out-of-state power plants depends upon, among other factors, the precipitation that occurred in the pre-

vious year and the corresponding amount of hydroelectric power that is available. In the Bay Area, Contra Costa is home to 25 power plants, including 5 coal, 1 landfill gas, 17 oil/gas, and 2 wind (CEC, 2008). Of these, the Pittsburg Power Plant is one of the largest power plants in California. The natural gas power plant is the largest in the Bay Area and has a capacity of 1,311 megawatts (Mirant, 2008). Because of PG&E's power plant located in Pittsburg, Contra Costa consumes 56 percent of the Bay Area's natural gas. The electricity generated by the PG&E plants, however, is used throughout PG&E's service area, which extends, with a few exceptions, north to south from Eureka to Bakersfield, and east to west from the Sierra Nevada to the Pacific Ocean. Smaller power plants and cogeneration facilities are located throughout the Bay Area.

Alternative Fuels

The U.S. Department of Transportation currently recognizes the following as alternative fuels: methanol and denatured ethanol (alcohol mixtures that contain no less than 70 percent of the alcohol fuel), natural gas (compressed or liquefied), liquefied petroleum gas, hydrogen, coal-derived liquid fuels, fuels derived from biological materials (i.e., biomass), and electricity. The liquid fuel referred to as Methanol (M85) consists of methanol and gasoline and is derived from natural gas, coal, or woody biomass. The liquid fuel referred to as Ethanol (E85) consists of ethanol and gasoline and is derived from corn, grains or agricultural waste. Natural gas consists of a high percentage of methane (generally above 85 percent), and varying amounts of ethane, propane, butane, and inerts (typically nitrogen, carbon dioxide, and helium) and comes from underground reserves. Liquefied petroleum gas (LPG) consists mostly of propane and is a byproduct of petroleum refining or natural gas processing. Currently available alternative fuel vehicles include electric, flexible fuel (can be fueled with ethanol), natural gas, propane, biodiesel, hybrid electric, plugin hybrid electric, and fuel cell (fueled with hydrogen) (USDOE, 2008). It should be noted that the use of electricity, depending on the method of production, could have secondary and potentially significant impacts where the electricity is produced. The cost of substituting electricity for diesel could make its use infeasible.

ENERGY USE FOR TRANSPORTATION

As noted above, transportation is the largest energy consumer in the state, accounting for 41 percent of total energy use, and most—96 percent—of that demand is met with petroleum (CEC, 2007). Nearly 26 million vehicles are registered in California, consuming about 380 million barrels of gasoline and almost 100 million barrels of diesel annually (CEC 2007, 189).

Rising oil prices, which lead to higher gasoline prices, and increased reliance on foreign sources of oil, create challenges in meeting energy demand. Foreign imports now make up 45 percent of crude oil processed by California refineries (CEC, 2007). Because consumers often cannot change their transportation habits quickly, the increased costs are initially felt by the consumer and result in less disposable income.

CEC's projections for fuel use reflect a peak and then decline in gasoline demand, but also a total increase in gasoline, diesel, and jet fuel demand by 15- 27 percent, from 553 million barrels in 2005 to between 638 and 702 million barrels in 2020 (CEC, 2007). Despite the recent downturn in the cost of fuel, statewide gasoline prices are expected to continue to climb, reaching somewhere between \$4.25 per gallon to \$6.25 per gallon in 2029.

ENERGY EFFICIENCY BY TRANSPORTATION MODE

Long-term energy consumption trends for transportation will be largely determined by fuel efficiency trends for motor vehicles, since motor vehicles are the predominant transportation mode for passengers and commercial goods. Total vehicle miles traveled (VMT) in California is expected to increase from 330 billion vehicle miles in 2006 to 547 billion vehicle miles in 2030. Vehicle Fuel Consumption (VFC) is expected to increase from 18 billion gallons to 29 billion gallons over the same period. Total registered vehicles would also increase from 26 to 39 million. However, despite improved CAFE standards, Caltrans only expects fuel economy to increase from 18.21 miles per gallon in 2007 to 18.83 miles per gallon in 2030 (Caltrans, 2008). In the analysis that follows, so-called Pavley Rules are also included, described below in the regulatory setting.

Energy Used By Public Transit

Energy consumption by public transit includes energy consumed for operation of public buses and electrified rail systems (see Table 2.3-2). Energy factors calculate the number of BTUs used per vehicle mile traveled. This allows energy efficiency to be compared by mile traveled. However, it should be noted that efficiency per passenger may be different. For instance, while bus transit has the smallest energy factor, it also accommodates the smallest number of passengers and thus may not always be the most efficient on a per passenger basis.

Energy efficiency for light and heavy rail transit and buses is determined using data published by the US Department of Energy in the 2008 *Transportation Energy Book: Edition 27*. The energy factor for BART is determined by dividing annual kilowatt hours (kWh) used by annual service miles traveled and assuming a conversion factor of 10,339 (as used in the eBART DEIR) to convert kWh to BTUs. This conversion assumes that the electricity is primarily from fossil-fueled power plants with an overall energy conversion efficiency of about 33 percent. eBART energy usage is estimated based on data used in the eBART DEIR. The efficiency of each of these modes may vary according to operating conditions.

Table 2.3-2: Energy Factors for Transit Service

<i>Transit Service</i>	<i>Energy Factor (BTU / Vehicle Mile)</i>
Light and Heavy Rail Transit	62,797
Bus Transit	37,310
BART	47,103
eBART Diesel Multiple Units	100,550

Source: Rail and bus factor: Transportation Data Book, Edition 27, US Dept of Energy, Oak Ridge National Laboratory, 2008. BART factor: 2006 National Transit Database; eBART factor: eBART DEIR, September 2008.

Energy used by Commercial Vehicles

Commercial vehicles, which are generally composed of light, medium, and heavy trucks generally fueled by diesel or gasoline, are part of the general fleet mix of vehicles present within the Bay Area transportation system. This energy analysis uses an average on-road commercial vehicle fleet fuel economy of 18.21 miles per gallon in 2006, based on the 2007 California Motor Vehicle Stock, Travel and Fuel Forecast (Caltrans, 2008).

REGULATORY SETTING

Federal and state agencies regulate energy consumption through various policies, standards, and programs. At the local level, individual cities and counties affect energy consumption through their regulatory and planning activities.

Federal Regulations

Energy Policy and Conservation Act, and CAFE Standards

The Energy Policy and Conservation Act (EPCA) of 1975 established nationwide fuel economy standards in order to conserve oil. Pursuant to this Act, the National Highway Traffic and Safety Administration, part of the U.S. Department of Transportation, is responsible for revising existing fuel economy standards and establishing new vehicle fuel economy standards.

The Corporate Average Fuel Economy (CAFE) program was established to determine vehicle manufacturer compliance with the government's fuel economy standards. Compliance with CAFE standards is determined based on each manufacturer's average fuel economy for the portion of their vehicles produced for sale in the United States. The U.S. EPA calculates a CAFE value for each manufacturer based on city and highway fuel economy test results and vehicle sales. The CAFE values are a weighted harmonic average of the EPA city and highway fuel economy test results. Based on information generated under the CAFE program, the U.S. Department of Transportation is authorized to assess penalties for noncompliance.

CAFE rules require the average fuel economy of all vehicles of a given class that a manufacturer sells in each model year to be equal or greater than the standard. The current CAFE standard for passenger cars is 27.5 miles per gallon and 20.7 miles per gallon for light trucks (gross vehicle weight of 8,500 pounds or less). Heavy-duty vehicles (i.e. gross vehicle weight

over 8,500 pounds) are not currently subject to fuel economy standards. The EPCA was reauthorized in 2000 (49 CFR 533). Most recently, the Energy Independence and Security Act of 2007 revised CAFÉ standards for the first time in 30 years. This Act is described below.

Energy Policy Act of 1992 (EPAAct)

The Energy Policy Act of 1992 (EPAAct) was passed to reduce the country's dependence on foreign petroleum and improve air quality. EPAAct includes several parts intended to build an inventory of alternative fuel vehicles (AFVs) in large, centrally fueled fleets in metropolitan areas. EPAAct requires certain federal, state, and local government and private fleets to purchase a percentage of light duty AFVs capable of running on alternative fuels each year. In addition, financial incentives are also included in EPAAct. Federal tax deductions will be allowed for businesses and individuals to cover the incremental cost of AFVs. States are also required by the act to consider a variety of incentive programs to help promote AFVs.

Energy Policy Act of 2005

President Bush signed the Energy Policy Act of 2005 into law on August 8, 2005. Generally, the act includes provisions for renewed and expanded tax credits for electricity generated by qualified energy sources, such as landfill gas; provides bond financing, tax incentives, grants, and loan guarantees for clean renewable energy and rural community electrification; and establishes a federal purchase requirement for renewable energy.

Energy Independence and Security Act of 2007

The Energy Independence and Security Act of 2007 is designed to improve vehicle fuel economy and help reduce U.S. dependence on oil. It represents a major step forward in expanding the production of renewable fuels, reducing dependence on oil, and confronting global climate change. The Act establishes several key standards:

- Increases the supply of alternative fuel sources by setting a mandatory Renewable Fuel Standard (RFS) requiring fuel producers to use at least 36 billion gallons of biofuel in 2022, which represents a nearly five-fold increase over current levels; and
- Reduces U.S. demand for oil by setting a National Fuel Economy Standard of 35 miles per gallon by 2020 – an increase in fuel economy standards of 40 percent.

By addressing renewable fuels and CAFE standards, the Energy Independence and Security Act of 2007 will build on progress made by the Energy Policy Act of 2005 in setting out a comprehensive national energy strategy for the 21st century.

State Regulations

Warren-Alquist Act

The 1975 Warren-Alquist Act established the California Energy Resources Conservation and Development Commission, now known as the California Energy Commission (CEC). The Act established a State policy to reduce wasteful, uneconomical and unnecessary uses of energy by employing a range of measures. The California Public Utilities Commission regulates privately-owned utilities in the energy, rail, telecommunications, and water fields.

State of California Energy Action Plan

The CEC is responsible for preparing the State Energy Action Plan, which identifies emerging trends related to energy supply, demand, conservation, public health and safety, and the maintenance of a healthy economy. At the beginning of 2008, the Energy Commission and CPUC determined that an Update to the 2005 California Energy Action Plan would be more appropriate than a new plan given the passage of Assembly Bill 32 and the critical role it will play in energy policy in coming years. Assembly Bill 32 is discussed at greater length in section 2.12: Global Warming and Greenhouse Gases. The Energy Commission's 2007 Integrated Energy Policy Report (IEPR) advanced policies for the state and provides recommended actions to achieve those policies. The 2008 Update examines ongoing actions in the context of global climate change, drawing heavily on the IEPR, which remains the overall guiding document on energy policy. The 2008 Update shifts focus to climate change. The nine major action areas, as described in previous Energy Action Plans include:

- Energy efficiency
- Demand response
- Renewable energy
- Electricity adequacy, reliability, and infrastructure
- Electricity market structure
- Natural gas supply, demand and infrastructure
- Transportation fuels supply, demand, and infrastructure
- Research, development, and demonstration
- Climate change

The report emphasizes the importance of improving fuel standards in order to reduce energy use and greenhouse gas emissions, and notes the importance of also incorporating smart growth and land use policies.

Integrated Energy Policy Report (IEPR)

The Integrated Energy Policy Report (IEPR) is prepared in response to Senate Bill 1389, which requires that the California Energy Commission prepare a biennial integrated energy policy report. The most recent IEPR was adopted on December 5, 2007. Today, the IEPR remains the overall guiding document on energy policy (California Public Utilities Commission and California Energy Commission, 2008). The 2007 IEPR is the first such report produced since the passage of AB 32, the Global Warming Solutions Act of 2006 (discussed in *Chapter 2.5: Greenhouse Gases and Climate Change*). The 2007 IEPR notes that, prior to the passage of AB 32, energy policy in California focused on ensuring adequate supply at reasonably low prices, limiting dependence on imported fuels and fossil fuels generally, environmental protection, and economic benefit to the state's economy. However, with the passage of AB 32, "California is obligated to meet its previous energy goals, but it must do so while reducing the volume of CO₂ emissions." Thus, the focus of the 2007 IEPR is to enable:

- California's industries to meet environmental goals while accommodating economic and population growth;
- Attainment of AB 32 goals to reduce California's greenhouse gas emissions to 1990 levels by 2020; and
- California to meet the challenge of growing energy needs while reducing carbon dioxide emissions.

Specific to transportation concerns, the report emphasizes improved efficiency of transportation energy use through vehicle standards. A few of the specific recommendations in the most recent IEPR *Meeting Transportation Needs* section include:

- Stress the connection between infrastructure expansion requirements and measures that reduce demand for petroleum fuels;
- Improve economic and production impact analyses of alternative fuels;
- Develop and recommend sustainability standards to guide future development of alternative fuels in California;
- Implement AB 118, which directs the California Energy Commission to develop and implement the Alternative and Renewable Fuel and Vehicle Technology Program; and
- Develop a strategic plan for alternative fuel and vehicle incentives, to be updated annually.

California Environmental Quality Act (CEQA)

Appendix F of the CEQA Guidelines describes the types of information and analyses related to energy conservation that are to be included in Environmental Impact Reports (EIRs). In Ap-

pendix F of the CEQA Guidelines, energy conservation is described in terms of decreased per capita energy consumption, decreased reliance on natural gas and oil, and increased reliance on renewable energy sources. To assure that energy implications are considered in project decisions, EIRs must include a discussion of the potentially significant energy impacts of proposed projects, with particular emphasis on avoiding or reducing inefficient, wasteful, and unnecessary consumption of energy.

Assembly Bill 2076: Reducing Dependence on Petroleum

In response to Assembly Bill (AB) 2076 (Chapter 936, Statutes of 2000), the CEC and the California Air Resources Board prepared and adopted a joint agency report, *Reducing California's Petroleum Dependence*. Included in this report are recommendations to increase the use of alternative fuels to 20 percent of on-road transportation fuel use by 2020 and 30 percent by 2030, significantly increase the efficiency of motor vehicles, and reduce per capita vehicles miles traveled¹. Further, in response to the CEC's 2003 and 2005 *Integrated Energy Policy Reports*, the Governor directed the CEC to take the lead in developing a long-term plan to increase alternative fuel use.²

A performance-based goal is to reduce petroleum demand to 15 percent below 2003 demand. The options include:³

- **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.

¹ Reducing California's Petroleum Dependence, California Energy Commission and Air Resources Board, joint agency report, August 2003, publication #P600-03-005.

² Letter from Governor Arnold Schwarzenegger to the Legislature, attachment: Review of Major Integrated Energy Policy Report Recommendations, August 23, 2005.

³ 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.

Recommendations include:

- 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.

Assembly Bill 1493: Reduction of Greenhouse Gas Emissions

Assembly Bill (AB) 1493 (Chapter 200, Statutes of 2002), known as the “Pavley bill,” amended Health and Safety Code sections 42823 and 43018.5 requiring the California Air Resources Board (CARB) to develop and adopt regulations that achieve maximum feasible and cost-effective reduction of Greenhouse Gas (GHG) emissions from passenger vehicles, light-duty trucks, and other vehicles used for noncommercial personal transportation in California. The regulations prescribed by AB 1493 apply to 2009 and later model years.

In September 2004, pursuant to AB 1493, the CARB approved regulations to reduce greenhouse gas emissions from new motor vehicles. Under the regulations, one manufacturer fleet average emission standard is established for passenger cars and the lightest trucks, and a separate manufacturer fleet average emission standard is established for heavier trucks. The regulation took effect on January 1, 2006, and set near-term emission standards, phased in from 2009 through 2012, and mid-term emission standards, phased in from 2013 through 2016 (referred to as the Pavley Phase 1 rules). The CARB intends to extend the existing requirements to obtain further reductions in the 2017 to 2020 timeframe (referred to as Pavley Phase 2 rules). However, the U.S. EPA has thus far refused to grant a waiver that would allow California to implement these standards, and California has challenged this action in federal court. The CARB calculates that in calendar year 2016, the Pavley Phase 1 rules will reduce California’s GHG emissions by 16.4 million metric tons of carbon dioxide equivalents, and by 2020, Pavley Phase 2 would reduce emissions by 31.7 million metric tons of carbon dioxide equivalents. Further, the AB 1493 new vehicle requirements would cumulatively reduce GHG reductions 45 percent by 2020 compared to the new federal CAFE standard in the Energy Independence and Security Act of 2007 (above).⁴ At the same time, both Pavley Phase 1 and Phase 2 rules would increase

⁴ California Air Resources Board, Comparison of Greenhouse Gas Reductions for the United States and Canada Under ARB GHG Regulations and Proposed Federal 2011-2015 Model Year Fuel Economy Standards, Addendum to February 25 Technical Assessment (2008).

vehicle fuel efficiency and thereby reduce consumption of gasoline and other motor vehicle fuels.

Assembly Bill 1007: State Alternative Fuels Plan

Assembly Bill (AB) 1007 (Chapter 371, Statutes of 2005) required the CEC to prepare a state plan to increase the use of alternative fuels in the transportation sector in California. The CEC prepared the State Alternative Fuels Plan (Plan) in partnership with the California Air Resources Board and in consultation with the other state, federal, and local agencies. The Plan was adopted in October 2007. The Plan presents strategies and actions California must take to increase the use of alternative non-petroleum fuels in a manner that minimizes costs to California and maximizes the economic benefits of in-state production. Specific strategies include combining private capital investment, financial investment, technology advancement, investment in infrastructure, and others. The Plan also assessed various alternative fuels and developed fuel portfolios to meet California's goals to reduce petroleum consumption, increase alternative fuels use, reduce greenhouse gas emissions, and increase in-state production of bio-fuels without causing a significant degradation of public health and environmental quality.

Senate Bill 1078: California Renewables Portfolio Standard Program

Senate Bill (SB) 1078 (Chapter 516, Statutes of 2002) establishes a renewable portfolio standard (RPS) for electricity supply. The RPS requires that retail sellers of electricity, including investor-owned utilities and community choice aggregators, provide 20 percent of their supply from renewable sources by 2017. This target date was moved forward by SB 1078 to require compliance by 2010. In addition, electricity providers subject to the RPS must increase their renewable share by at least one percent each year. The outcomes of this legislation will impact regional transportation powered by electricity.

Senate Bill 375: Transportation Planning and Sustainable Communities

Senate Bill (SB) 375 (Chapter 728, Statutes of 2008), approved by the legislature and signed by Governor Schwarzenegger in September 2008, requires the state's metropolitan planning organizations, including MTC, to prepare a new element of their regional transportation plans, known as a "Sustainable Communities Strategy," to help California reach its strive to reach its greenhouse gas (GHG) emissions reduction targets. (The 2013 regional transportation plan will be the first Bay Area plan subject to SB 375.) The Sustainable Communities Strategy, which will be jointly developed with the Association of Bay Area Governments (ABAG), as is generally the case for regional growth forecasts, will incorporate three new elements into the regional transportation planning process: a land use component identifying how the region could house growth for up to 20 years, a discussion of resource and farmland areas to be protected, and a demonstration of how the development pattern and the transportation network can work together to reduce GHG emissions. As with any plan that results in GHG emissions reductions

through means such as reduced vehicle travel, a secondary benefit would be a reduction in regional energy use.

See *Chapter 2.5, Climate Change and Greenhouse Gases*, for additional details about SB 375.

Other Legislation

AB 118 was signed into law in 2007, which provided funding source for incentives to encourage investment in alternative fuels.

Executive Order S-1-07 calls for a Low Carbon Fuel Standard for California, which would result in a 10 percent reduction in the carbon content of all passenger vehicle fuels sold in California.

In 2006, Governor Schwarzenegger issued Executive Order S-06-06 to establish biomass production and use targets for California. Biomass is a large but primarily unused resource including residues from forestry, urban, and agricultural wastes and can be used to create electricity, transportation fuels, and biogas. Use of biomass could not only increase energy production but also reduce the waste stream (CEC 2007, 29). The Order states that biomass should comprise 20 percent of the state's Renewables Portfolio Standard for 2010 and 2020, and California shall produce a minimum of 20 percent of its biofuels within the state by 2010, 40 percent by 2020, and 75 percent by 2050. Additional funding and research will go to further developing these technologies and integrating them into use.

Local Regulations

The Contra Costa County General Plan includes a discussion of renewable energy resources (pages 8.48-8.51), and establishes goals, policies, and implementation measures for the utilization of these resources. The Housing Element of the Plan, as required by State law, also contains a discussion focused on energy conservation in residential development. The Plan does not establish policies for the use of non-renewable resources, such as petroleum or natural gas.

The following Renewable Energy Resources Goals from the Contra Costa County General Plan are relevant to the proposed Project:

- Goal 8-K. To encourage the use of renewable resources where they are compatible with the maintenance of environmental quality.
- Goal 8-L. To reduce energy use in the County to avoid risks of air pollution and energy shortages which prevent orderly development.

Criteria of Significance

Implementation of the 2009 CTP will have a potentially significant adverse effect on energy resources if it results in one or more of the following:

- **Criterion 1:** Result in a greater than 5 percent increase in transportation energy consumption compared to existing conditions.

- **Criterion 2:** Conflicts with adopted plans or policies related to energy conservation.

Method of Analysis

Energy consumption includes energy required for operation of the transportation system (private vehicles and public transit) as well as energy used for construction and maintenance of the transportation system. Therefore, both direct (operations) energy and indirect (construction and maintenance) energy impacts are assessed. This analysis builds upon output from the transportation model to assess the impacts of the 2009 CTP and alternatives through the year 2030.

Both direct and indirect energy consumption is measured in British thermal units (BTUs). One BTU is the quantity of energy necessary to raise one pound of water one degree Fahrenheit at one atmosphere of pressure.

DIRECT ENERGY CONSUMPTION

Direct energy is that energy used in the daily operation of the transportation system, including the propulsion of on-road vehicles and transit vehicles under varying conditions. In assessing the direct energy impact, consideration was given to the following factors:

- Fleet mix;
- Annual VMT; and
- Variation of fuel consumption rates over time and by vehicle type.

The direct energy analysis for each alternative is based on Project year 2030 VMT obtained from the traffic analysis in Section 2.1, and compared to existing conditions and to the No Project Alternative (2030). This analysis compares the estimated gasoline/diesel consumption of vehicles on the countywide roadways network (i.e., the portion of the network included in the travel demand model) that would result under implementation of the CTP, with estimates for the 2007 base year. This difference would be the relative impact of the proposed CTP on vehicular energy use within the county. The analysis includes an assessment of both the changes in VMT due to the 2009 CTP and the additional travel in the regional transportation system generated by planned land uses and projected growth.

The analysis parallels the Air Quality and Greenhouse Gases sections of this EIR in depicting the relative influence of state regulations on energy use by presenting direct energy calculations for each alternative for three fuel efficiency conditions: with no implementation of the Pavley rules to increase vehicle mileage, with implementation of only the Pavley Phase 1 rules, and with full implementation of both Pavley Phases 1 and 2 (as described in the regulatory setting for AB 1493).

While three fuel efficiency conditions are presented in the analysis, in accordance with CARB recommendations, impact conclusions in this section assume that both Pavley Phases 1 and 2 rules are enforced. For this analysis, an average on-road vehicle fleet fuel economy of

17.51 miles per gallon for the baseline (2007) year and 27.3 miles per gallon for 2030. Major differences between existing and future fuel economy include the implementation of Pavley rules and changes in technology. The fuel efficiency numbers used to reflect Pavley rules in this analysis are based on regional modeling completed by the Metropolitan Transportation Commission (MTC) for the Transportation 2035 Plan DEIR. While the exact numbers for Contra Costa may vary from the regional numbers, the regional estimate provides a useful tool in analyzing the impact of fuel efficiency in the 2009 CTP.

INDIRECT ENERGY CONSUMPTION

Indirect energy is the energy required to construct, operate, and maintain the transportation network, as well as to manufacture and maintain on-road vehicles and transit vehicles. Indirect energy consumption also includes changes in energy demand due to a project, such as changes in trip origins and destinations or travel mode. These changes are reflected in the modeling of transportation network and the resultant change to VMT and mode share.

Because precise cost estimates and allocations for many of the projects included in the CTP are not yet available, no detailed quantitative assessment of construction and maintenance impacts is possible. Instead, a rough estimate of the energy that would be consumed for construction and maintenance purposes under the 2009 CTP can be made by applying the Input-Output methodology developed by Caltrans. The Input-Output method converts VMT, lane-miles or construction dollars into energy consumption based on estimates developed by Caltrans in 1983. Table 2.3-3 shows the indirect energy consumption factors used in this analysis.

Table 2.3-3: Indirect Energy Consumption Factors

<i>Mode</i>	<i>Factor</i>
<i>Construction</i>	
Automobiles and Trucks (manufacturing)	1,410 BTUs ¹ /Vehicle Mile
Bus (manufacturing)	3,470 BTUs/Vehicle Mile
Roadway (cost of construction)	8,388 BTUs/2007\$ ²
Rail (construction)	2,108 BTUs/Vehicle Mile
Tunnel (construction)	46,228 BTUs/Mile ³
<i>Maintenance</i>	
Automobiles and Trucks	1,400 BTUs/Vehicle Mile
Bus	13,142 BTUs/Vehicle Mile
Roadway	1.71x10 ⁸ BTUs/lane mile/Year
Rail	7,060 BTUs/Vehicle Mile

¹ British Thermal Units.

² BTUs/ 2007 dollars converted from original BTU/ to 1977 dollar factor,

³ Estimated to be ten times the energy impact of road construction.

Source: Caltrans, 1983.

Using these factors along with estimated costs, vehicle miles traveled by mode, and lane miles projected by the Countywide Model, estimates for the indirect energy use of the pro-

posed Project are made. This indirect energy analysis is similar to that used in previous Regional Transportation Plan EIRs and CTP 2000 and 2004 Update EIRs.

Summary of Impacts

Implementation of the 2009 CTP, combined with projected growth and development over the next 22 years as well as the implementation of State fuel efficiency standards and improvements in vehicle technology would result in lower per capita daily energy use. However, there would be a 12 percent increase in daily energy use when compared to existing conditions. While the impact is considered cumulatively significant, given the similarity in energy use between the Project and No Project the contribution of the Project is not expected to be considerable.

The 2009 CTP is consistent with energy plans and policies through its inclusion of increased transit services, land use linkages (through the Growth Management Program) and support of increased fuel efficiency.

Impacts and Mitigation Measures

IMPACT

2.3-1 Cumulative implementation of the 2009 CTP, combined with regional growth and State fuel efficiency standards, would result in increased energy consumption. (*Significant Cumulative Impact, Project Contribution Not Cumulatively Considerable.*)

Transportation Energy Consumption

Table 2.3-4 shows the direct on road transportation energy use in Contra Costa. Table 2.3-5 shows the total transportation network fuel consumption in the county compared with existing (2007) conditions and with the No Project (2030) Alternative. As described in the setting, non-renewable energy sources make up the vast majority of transportation energy.

Under existing conditions, daily transportation energy usage is estimated to be 209 billion BTUs, with 20,292,608 vehicle miles traveled. Under the No Project Alternative, the daily VMT for vehicles within the corridor is forecast to be 29,705,497 in 2030. For the Project, daily VMT is forecast to be 29,879,205 in 2030. Daily VMT is higher in both the No Project and Project than in existing conditions in both the peak hour VMT and daily VMT projections. However, as described in *Section 2.1: Transportation and Circulation* VMT is lower during peak periods for the Project when compared to the No Project indicating a reduction in congestion and an increase in speeds, which improves fuel efficiency.

Table 2.3-4: Direct On Road Transportation Energy Use in Contra Costa County*

	Daily VMT	Average Speed (mph)	Fuel Economy (mpg)**	BTU/mile***	On-Road Energy Use (Billion BTU/day)
2007 Existing Conditions	20,292,608	42.4	17.5	7226	147
2030 No Project					
No Pavley	29,705,497	34.1	17.9	7068	210
Pavley I	29,705,497	34.1	24.2	5213	155
Pavley I & II	29,705,497	34.1	26.9	4694	139
2030 Project					
No Pavley	29,879,205	36.7	18.2	6956	208
Pavley I	29,879,205	36.7	24.6	5137	154
Pavley I & II	29,879,205	36.7	27.3	4628	138

⁴ *Not including transit

⁵ **Pavley numbers are based on regional fuel efficiency derived for the MTC 2035 Draft EIR.

⁶ ***BTU per mile is based on regional (MTC estimated) fleet mix for diesel and gasoline vehicles.

Source: Dyett & Bhatia, 2008; DKS, 2008; Energy Information Administration, 2008; MTC 2035 Draft EIR, 2008.

When vehicle fuel efficiency assumptions, including Pavley phases 1 and 2, are taken into account, as well as energy consumed by transit operations, daily direct energy usage in the county in 2030 is anticipated to be approximately 144 billion BTUs daily for the No Project and 143 billion BTUs for the Project, both a decrease from the existing condition of 149 billion daily BTUs. Indirect energy emissions for the No Project are projected to be 89 billion BTUs and emissions for the Project are projected to be 92 billion BTUs, both an from the existing condition of 60 billion daily BTUs.

As shown in Table 2.3-5, total transportation energy consumption under the proposed Project is estimated to be 235 billion BTUs daily, a 12 percent increase over existing conditions, and about 1 percent greater than the No Project Alternative. This indicates that the increase in energy consumption is largely due to projected regional growth and development, rather than the Project itself. During this time period, from 2007 to 2030, the population in Contra Costa is expected to increase from 1,033,188 to 1,234,091, a 19.4 percent increase, more than the increase in energy use over the same period. Overall per capita daily energy use is less in the Project and No Project than in existing conditions. The Project results in 6 percent fewer daily BTUs per capita when compared to existing conditions and less than one percent more than the No Project. This further indicates that the Project's contribution to the cumulative impact is less than significant.

Table 2.3-5: Estimated Daily Countywide Direct and Indirect Energy Consumption (in Billion BTUs)

	2007 Existing Conditions	2030 No Project	2030 Project	Change 2007 to 2030 Project		Change 2030 No Project to Project	
				Number	Percent	Number	Percent
Direct Energy (in Billion BTUs)							
On-Road Vehicles	146.6	139.4	138.3	-8.3	-5.7%	-1.1	-0.8%
Transit Vehicles	2.6	4.3	4.3	1.7	64.3%	0.00	0.00%
<i>Direct Energy Total</i>	<i>149.2</i>	<i>143.7</i>	<i>142.5</i>	<i>-6.7</i>	<i>-4.5%</i>	<i>-1.1</i>	<i>-0.8%</i>
Indirect Energy (in Billion BTUs)							
Roadway Maintenance	1.7	1.8	1.9	0.2	9.1%	0.1	3.1%
Auto Manufacturing & Maintenance	57.0	83.5	84.0	26.9	47.2%	0.5	0.6%
Transit Manufacturing & Maintenance	0.9	1.4	1.4	0.5	60.0%	0.00	0.00%
Manufacturing & Maintenance Total	59.6	86.7	87.3	27.6	46.3%	0.5	0.6%
Construction	-	1.9	4.8	4.8	-	2.9	152.8%
<i>Indirect Energy Total</i>	<i>59.6</i>	<i>88.6</i>	<i>92.0</i>	<i>32.4</i>	<i>54.3%</i>	<i>3.42</i>	<i>3.9%</i>
Total Daily Energy (in Billion BTUs)	208.9	232.3	234.6	25.7	12.3%	2.3	1.0%
Per Capita Daily Energy (in BTUs)	202,159	188,234	190,081	-12,078	-6.0%	1,846	1.0%

Source: Dyett & Bhatia, 2008. DKS, 2008.

MITIGATION MEASURES

None required.

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