3.15 ENERGY

Introduction

During the construction and operation of the proposed transit improvements in the project corridor in eastern Contra Costa County, energy resources would be required to operate construction equipment, stations, and maintenance facilities. As a result, energy would be consumed directly within the project corridor and indirectly off site. In particular, the Proposed Project involves Diesel Multiple Units (DMU) trains, which are propelled by diesel fuel. The proposed stations would primarily be powered by electricity generated off site at power plants. These power plants may burn fossil fuels such as natural gas and coal or utilize renewable resources such as wind and biomass. While these components of the Proposed Project would increase energy demand, the Proposed Project would also provide a benefit by reducing vehicle miles traveled on the roads as people choose the convenience of new transit accessibility over driving their own cars. This section describes the environmental and regulatory setting and potential impacts to energy resources as a result of the Proposed Project.

One energy-related comment received in response to the Notices of Preparation requested that the applicability of alternative forms of energy to the operation of the Proposed Project or its alternatives be considered. Alternative forms of energy to fuel eBART service to east Contra Costa County are examined in Section 5, Alternatives, of this report.

Existing Conditions

Statewide Overview

A California Energy Commission (CEC) report[1] concluded that California was the tenth largest consumer of energy in the world, slightly ahead of Italy. In satisfying this demand, 54 percent of the total energy supply was estimated to be from petroleum sources, with most of the petroleum going toward the transportation sector. The report also identified 13 percent of the energy supply coming from electricity (with electricity being generated from a mix of sources including natural gas). Table 3.15-1 presents energy consumption by sector as provided by the Energy Information Administration. As seen in this table, the transportation sector consumes the greatest amount of energy in California compared to other sectors of the economy.[2]

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1 California Energy Commission (CEC), *California Energy Demand 2000-2010, Staff Report,* June 2000.

2 Energy Information Administration, State Energy Data 2003, available at http://www.eia.doe.gov, accessed January 17, 2007.

Table 3.15-1
Energy Consumption in California by Sector, 2000 and 2004

	Percent of Total Energy Consumption (%)	
Sector	**Year 2000**	**Year 2004**
Transportation	38	38
Industrial	27	24
Residential	18	19
Commercial	17	19

Source: Energy Information Administration, 2003.

Petroleum and Natural Gas. California obtains its energy from both in-state and out-of-state sources. The state is highly dependent on imports of petroleum and natural gas. In fact, as indicated in Table 3.15-2, in-state sources contribute less than 40 percent of the petroleum and less than 15 percent of the natural gas supply. As energy demand continues to increase, the dependence on out-of-state sources may also increase to meet the demand unless measures are actively taken to reduce that dependence.

Table 3.15-2
Source of California Energy (in percent)

Source	Petroleum	Natural Gas	Electricity
In-state	39	14	78
Out-of-state (imported)	61	86	22

Source: CEC, 2006.
Note:
All numbers for calendar year 2006.

Based on the most current data available, California consumed about 5,721 million cubic feet of natural gas per day in 2005, with consumption projected to grow to 7,020 million cubic feet per day in 2015. This makes California the second largest state consumer of natural gas behind Texas. Natural gas is used for the electricity, residential, industrial, commercial, and transportation sectors as detailed in Table 3.15-3. About half of the natural gas consumed goes toward electrical generation.[3]

Electricity. California is also the second largest user of electricity among all the states, using approximately 238,710 gigawatt-hours (GWh) in 2003. However, California uses 6,732 kilowatt-hours (kWh) per capita, which is the lowest per capita of all states. Electricity consumption in terms of GWh is expected to increase 1.25 percent annually,[4] driven mostly by the anticipated increase in population.

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3 CEC, available at: http://www.energy.ca.gov, accessed June 11, 2006 and February 10, 2008.
4 CEC, *2007 Integrated Energy Policy Report*, *CEC-101-2007-008-CMF,* December 2007.

Table 3.15-3
Natural Gas Usage in California by Sector, 2004

Sector	Approximate Percent of Total Natural Gas Usage (%)
Electricity	50
Residential	22
Industrial	18
Commercial	9
Transportation	<1

Source: CEC, presentation by Gordon Schremp of the CEC's Transportation Fuel Office, *California Petroleum Market: Overview and Outlook for Diesel Fuel*, October 27, 2005; CEC, *Integrated Energy Policy Report 2005*, November 2005.

Electricity supply needs to be examined in terms of both electricity provided over time (measured as GWh) and peak electricity supply and demand (measured as gigawatts or megawatts [MW]). Peak demand statewide typically occurs late afternoon during hot summer months when air conditioning units are in greatest use. In 2005 and 2006, statewide peak demand exceeded 55,000 MW. Peak demand exceeded 55,000 MW for 1.5 percent of the year (130 hours) in 2005 and peak demand exceeded 55,000 MW for 3 percent of the year (267 hours) in 2006.[5] In California, peak electricity demand is anticipated to increase 1.4 to 1.75 percent annually. Concerns about the long-term ability to meet this demand exist partly because of the uncertainty in the peak demand during the summer when air conditioning use is driven by high temperatures, which vary from year to year. There are also concerns regarding the aging transmission infrastructure and the ability of this transmission infrastructure to handle high electricity demands. To reduce the likelihood of demand exceeding supply, investor-owned utilities (such as PG&E) are now required to maintain a 15 to 17 percent planning reserve margin (in excess of peak load obligations). However, the CEC has studied scenarios in which even those reserves may not be sufficient in Southern California due to transmission constraints. The California Independent System Operator (Cal-ISO), a not-for-profit corporation in charge of operating the long-distance, high-voltage power lines that deliver electricity, expects planned projects to improve transmission systems that will ensure reliable transmission to the San Francisco Bay Area at least up to 2010.[6]

Generation of electricity comes from a variety of sources (see Table 3.15-4), with natural gas being the largest. In 2006, 11 percent of California's electricity was supplied by renewable resources. To reduce dependence on fossil fuels, California has a goal of increasing the renewable resources portion (not including large hydroelectric resources) from 10 percent in 2004 to 20 percent by 2010.

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5 CEC, *2007 Integrated Energy Policy Report*, *CEC-101-2007-008-CMF,* December 2007.

6 *Cal-ISO Transmission Plan: A Long-Term Assessment of the California ISO's Controlled Grid* (2008-2017), 2008.

Table 3.15-4
Sources for Generating Electricity in California, 2006

Resource	Percent of Total Supply (%)
Natural Gas	41.5
Coal	15.7
Large Hydroelectric	19.0
Nuclear	12.9
Geothermal	4.7
Small Hydroelectric	2.1
Wind	1.8
Solar	0.32

Source: CEC, *2007 Integrated Energy Policy Report*, December 2007.

Transportation Sector. Transportation consumes more than 40 percent of all energy used in the state and the primary sources of energy for transportation are gasoline and diesel. In 2006, 16 billon gallons of gasoline and 4 billion gallons of diesel were consumed in California for transportation.[7] To compare the consumption of gasoline and diesel on a common basis, the gallons consumed are converted to British thermal units (Btu) based on the energy content of gasoline and diesel. A Btu is defined as the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit. Gasoline has a heat content of 125,000 Btu per gallon, and diesel has a heat content of 138,700 Btu per gallon. The equivalent energy consumption of using 16 billion gallons of gasoline and 4 billion gallons of diesel is 2,550,000 billion Btu per year.

Over the past 20 years, fuel consumption for transportation needs has increased by almost 50 percent. On a per-year basis, future demand is expected to increase by 0.8 to 1.6 percent per year through 2012; 0.1 to 1.0 percent from 2012 to 2020 for gasoline and 3.0 to 3.5 percent per year through 2020 for diesel. Other sources of energy (non-petroleum) for transportation make up only 6 percent of the total. To reduce dependence on petroleum products, particularly from out-of-state sources, California has a goal of increasing the non-petroleum portion to 20 percent by 2010 and 33 percent by 2020.[8]

Regional Energy Consumption

The Proposed Project is located in the eastern portion of Contra Costa County. The primary means of transportation in the County is by cars and trucks on streets and highways. Based on 2000 Census data, 84 percent of workers commute using a private car or truck, while about 9 percent of workers use public transit. The estimated daily vehicle miles traveled in the

7 CEC, *2007 Integrated Energy Policy Report*, CEC-100-2007-008-CMf, December 2007.
8 CEC, Presentation by Gordon Schremp of the CEC's Transportation Fuel Office. *California Petroleum Market: Overview and Outlook for Diesel Fuel,* October 27, 2005.

County in 2007 is 20,782,930 miles.[9] The energy associated with gasoline and diesel fuel being consumed by automobiles can be calculated using the energy consumed per mile traveled. Using the data from the United States Department of Energy's (US DOE's) *Transportation Energy Data Book: Edition 26*[10] and assuming two-thirds of the vehicle miles are traveled by passenger cars and one-third by personal trucks (the approximate national average listed in the *Transportation Energy Data Book*), the energy consumption per mile would be 6,117 Btu. The total energy consumed by the 20.8 million miles traveled in Contra Costa County would then be approximately 37,000 billion Btu per year. This represents 1.5 percent of the total transportation energy used in California through the combustion of gasoline and diesel.

BART Energy Consumption

In addition to the vehicle miles traveled on the roads, energy is consumed to operate and maintain the BART system. Table 3.15-5 presents approximate electricity consumption for various stations and facilities on the BART system and total electricity consumption in 2006. To generate electricity at fossil-fueled power plants, a fuel such as natural gas is burned. This process of generating electricity results in consuming more energy than is produced. Therefore, electricity consumption in terms of kWh per year needs to be converted to energy consumption in terms of Btu per year to account for the inefficiencies associated with generating electricity. The conversion would theoretically vary with the method of generating electricity (e.g., fossil fuel power plants versus wind power plants). However, there is no generally accepted method of developing this factor for electricity from hydroelectric, wind, photovoltaic, or solar thermal energy sources.[11] The conversion factor used in this EIR is 10,339 Btu per kWh based on the US DOE *Transportation Energy Data Book: Edition 26*. This conversion factor assumes that the electricity is primarily from fossil-fueled power plants with an overall energy conversion efficiency of about 33 percent. Table 3.15-5 presents the equivalent energy use in terms of Btu per year based on this factor.

The peak load for BART in 2006 was 84 MW. This demand is relatively small compared to the statewide peak load of more than 55,000 MW during 2006, which made the BART peak load about 0.15 percent of the statewide peak load. Also, PG&E's peak load in 2006 was about 19,000 MW[12], making BART's peak load less than 0.5 percent of the PG&E peak load. Typically, peak load for BART occurs in the late afternoon around 5:00 p.m. to 6:00 p.m. The peak load is minimized in part because BART cars use regenerative braking, which feeds electricity back into the system when BART cars are slowing down.

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9 Wilbur Smith Associates, email to ERM, January 15 and 16, 2008.
10 US DOE, *Transportation Energy Data Book: Edition 26,* 2007.
11 US DOE, *Annual Energy Review 2006*, Report #DOE/EIA-0384 (2006), June 2006.
12 California Energy Commission website accessed June 9, 2008, http://www.energy.ca.gov/electricity/index.html#demand, "2006 Annual Non-Coincident Peak Loads".

Table 3.15-5
BART System Electricity and Energy Consumption at Facilities, 2006

Source	Electricity (kWh/yr)	Equivalent Energy (Billion Btu per year)
Traction (to power trains)	295,870,070	3,060
Total Stations and Maintenance Facilities	78,060,276	807
Total System-wide	373,930,346	3,866
Selected Stations		
Lake Merritt	3,680,137	38.0
Concord	1,499,630	15.5
Pittsburg/ Bay Point	1,227,730	12.7
MacArthur	1,212,668	12.5
Lafayette	728,526	7.5
Rockridge	721,342	7.5
Orinda	670,016	6.9
Selected Yards/Maintenance Facilities		
Southern Alameda Yard	5,781,007	59.8
Richmond Yard	3,007,590	31.1
Concord Yard	2,850,824	29.5
Daly City Maintenance Facility	2,154,570	22.3
Oakland Maintenance Facility	1,221,562	12.6

Source: BART, email from BART to ERM, December 27, 2007 and January 8, 2008.
Note:
Conversion factor of 10,339 Btu/kWh is used to estimate equivalent energy.

The electricity needed for the existing BART system is supplied primarily through power generators located in the Pacific Northwest. About 66 percent is from hydroelectric sources, 22 percent from natural gas, 9 percent from coal, 2 percent from nuclear, and 1 percent from other renewable resources. BART is planning to gradually increase the other renewable portion (including wind power, biomass, geothermal, wind, and solar) of the supply starting in 2010, so that the renewable portion is 20 percent of the total by 2016.

Applicable Policies and Regulations

Corporate Average Fuel Economy Standards. At the federal level, the Energy Policy and Conservation Act of 1975 established a program to regulate fuel economy of passenger automobiles and light-duty trucks. As a result of this act, the Corporate Average Fuel Economy Standards (CAFE) were developed, which require that manufacturers maintain a fleet average fuel economy standard for their passenger automobiles and light-duty trucks. CAFE originally included only automobiles with a gross vehicle weight rating (GVWR) of less than

6,000 pounds (lb). The standard was then revised to include automobiles with GVWR of less than 8,500 lb starting with model year 1980. According to the current CAFE standards, manufacturers must maintain a fleet average of 27.5 miles per gallon (mpg) for their passenger automobiles.

The standard for light-duty trucks will gradually increase from 20.7 mpg for model year 2002 to 22.2 mpg for model year 2007. After model year 2007, new CAFE rules will change how manufacturers must meet the standards for light-duty trucks. After a transition period for model year 2008 through 2010, light-duty truck fuel economy standards will be based on a mathematical function that relates required fuel economy to the footprint of the truck (wheelbase times track width). The new standards will also include trucks with GVWR of up to 10,000 lb.[13] In December 2007, President Bush signed into law a requirement to improve the fleetwide (including light trucks) gas mileage to 35 mph by 2020. California is preempted under federal law from setting its own fuel economy standards.

Federal Transportation Planning and Energy Conservation. The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 established an integrated and systematic approach to develop a transportation system that considered mobility, local economy, and the environment (including energy consumption). The ISTEA made the local metropolitan planning organization responsible for creating a long-range transportation plan in cooperation with local and state agencies. The transportation plan must consider, among other factors, consistency with conservation programs, goals, and objectives and the overall energy effects. The Transportation Equity Act for the 21st Century (TEA-21) was signed into law in 1998 and builds on the ISTEA, providing transportation funding from 1998 to 2003. More recently, after several extensions of the TEA-21, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) was signed into law in August 2005. This law reauthorized transportation funding through 2009 and provides funding that is 30 percent higher than under the TEA-21. These laws require that energy conservation be considered during the planning of transportation systems.

[13] The new CAFE standards for light trucks were struck down by the Ninth Circuit Court of Appeals in opinions issued in November 2007 and August 2008, in part due to the government's failure to adequately analyze climate change impacts and alternatives under the National Environmental Policy Act. In June 2008, the National Highway Traffic Safety Administration proposed more stringent standards for additional model years; however, this proposal has also received adverse comments from the plaintiffs in the litigation. To the extent that the implementation of new standards may be delayed, the analysis of energy savings in this EIR is conservative, in that delayed standards would result in a less-efficient vehicle fleet under less-stringent existing standards. By comparison to such a less-efficient vehicle fleet, the Proposed Project would result in somewhat greater net energy savings than stated in this EIR. Nevertheless, it is reasonable to expect that more stringent standards eventually will take effect, after which the Proposed Project would result in somewhat reduced net energy savings compared to a more-efficient future fleet. In each case, the effect would be limited by the percentage of light trucks among the vehicles currently used by commuters who would switch to the Proposed Project.

California Energy Planning and Efficiency Standards. At the state level, the CEC (created in 1974) is the primary agency for developing energy policy. The five major responsibilities of the agency include:

- Forecasting future energy needs and maintaining historical energy data;
- Licensing thermal power plants that are 50 MW or larger;
- Promoting energy efficiency through appliance and building standards;
- Developing energy technologies and supporting renewable energy; and
- Planning for and directing state response to any energy emergency.

In 1978, the CEC established the Building Energy Efficiency standards (Title 24, Part 6 of the California Code of Regulations [CCR]) to help reduce the state's energy consumption. The CEC updated the standards in 2005, which apply to residential and nonresidential buildings and include requirements for indoor and outdoor lighting, ventilation systems, and roofing.

BART Energy Conservation Policy. BART's *Strategic Plan* (updated 2003) identifies goals and strategies in its role as a major transit system in the San Francisco Bay Area. One of the goals is to reduce energy and resource use. In addition, the *Strategic Plan* states that BART will adopt applicable provisions of the Leadership in Energy and Environmental Design (LEED) Guidelines. LEED provides guidelines to construction and/or improve buildings to be environmentally responsible and considers many elements including energy conservation.

Impact Assessment and Mitigation Measures

Standards of Significance

The following standards of significance apply to the construction and operational phases of the Proposed Project. The Proposed Project would have significant energy impacts during construction and operation if it would result in the following:

- Lead to a wasteful, inefficient, and unnecessary usage of energy;
- Place a significant demand on regional energy supply or require significant additional capacity;
- Significantly increase peak and base period electricity demand; or
- Cumulatively contribute (together with regional growth) to a collectively significant shortage of regional energy supply.

To determine impacts to energy resources, a level of significance is determined and reported in the italicized summary impact statement that precedes each analysis. Conclusions of significance are defined as follows: significant (S), potentially significant (PS), less than significant (LTS), no impact (NI), and beneficial (B). If the mitigation measures would not diminish potentially significant or significant impacts to a less-than-significant level, the impacts are classified as "significant and unavoidable effects" (SU). For this section, EN refers to Energy.

Methodology

Energy consumption can be categorized as either indirect or direct. For the purposes of this EIR, direct energy is energy consumed to operate the proposed DMU trains (i.e., energy contained in the diesel fuel burned), stations, and other facilities. Indirect energy includes energy consumed to construct the proposed system and maintain the DMU vehicles and facilities.

Energy consumed during construction is addressed on a qualitative basis in this EIR. On the other hand, direct and indirect energy impacts during operation are presented on a quantitative basis. The direct energy consumed by the operation of the DMU is compared to the reduction in energy consumed by vehicles because fewer people are driving their own vehicles and are instead taking public transit. Direct energy is consumed not only by the DMU and automobiles, but also by the stations and maintenance facilities associated with the Proposed Project. Along with direct energy, indirect energy is also expended to maintain the DMU vehicles and facilities. The reduction in energy consumption by automobiles would also include indirect energy saved that would have been used to maintain the automobiles.

Direct Energy. Annual energy consumption from the operation and propulsion of the vehicles associated with the Proposed Project is estimated by multiplying the energy intensity in terms of Btu per mile by the annual miles traveled by the DMU and automobiles. The energy intensity factor for passenger cars was 5,489 Btu per mile in 2004.[14] This factor is expected to decrease as fleet average fuel economy improves. To account for this decrease, the factor was adjusted assuming the fleet average fuel economy improves linearly with the change in fuel economy standard. The resulting energy intensity factors are 4622 Btu per mile in 2015 and 4313 Btu per mile in 2030. When estimating energy savings from a reduction in vehicle miles on the road, the analysis conservatively assumes the reduced miles are all associated with passenger cars which generally consume less energy than personal trucks on a per mile basis.

DMU energy consumption is based on fuel consumption data from LTK Engineering Services in an energy assessment of the proposed DMU prepared for BART.[15] The report presents average fuel economy for a DMU rail car traveling between the transfer platform and the proposed Hillcrest Avenue Station and includes fuel consumption during idling. The overall estimated fuel consumption is 0.725 gallon per mile. This value is multiplied by the energy content of diesel (138,700 Btu per gallon, as presented in the US DOE *Transportation Energy Data Book*, Table B.4) to obtain a Btu per mile energy intensity factor. The resulting energy intensity factor is 100,550 Btu per mile.

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[14] *US DOE,* Transportation Energy, Table 2.12, 2007.

[15] LTK Engineering Services, Draft *eBART Phase 1 Project to Hillcrest Terminal, DMU and LRV Comparison,* March 17, 2008.

Energy consumption by the stations and maintenance facilities is based on electricity consumption in 2006 at various existing BART facilities. This EIR conservatively assumes electricity consumption is equivalent to the larger BART facilities.

Indirect Energy. Indirect energy consumption for the maintenance of the DMU and cars is estimated based on energy intensity factors presented in Table 3.15-6.

Table 3.15-6
Energy Intensity for Maintenance of Vehicles/Cars

Vehicle	Maintenance Energy Intensity (Btu per mile)
Automobile	1,400
Light Rail Vehicles (LRV)	7,060

Source: Caltrans, *Energy and Transportation Systems, Table E-13,* July 1983.
Note:
Energy to maintain LRV is assumed to be equivalent to energy to maintain DMU.

Vehicle Miles Traveled. The above energy intensity factors are multiplied by DMU or car miles traveled to estimate energy consumption. Daily and annual miles traveled for the Proposed Project were provided by Wilbur Smith Associates (WSA) transportation consultants for this EIR.[16] The Proposed Project assumes annual miles based on the equivalent of 348 operating days multiplied by the daily operational miles as estimated by WSA. Also, the annual miles traveled for the DMU project is based on the operating plan which estimates that two DMU cars are used per trip during peak hours in year 2015 and three DMU cars are used per trip during peak hours in year 2030. Off-peak hours would require one DMU car per trip for both analysis years. Finally, this EIR assumes annual miles traveled by the automobiles (to estimate reduction in energy consumption) conservatively occur over 290 weekdays.[17]

Project-Specific Environmental Analysis

Operational Impacts

Impact EN-1 *Operation of the proposed DMU trains would increase energy demand; however, the reduction in energy demand by motorists that are diverted from driving more than offsets the increased energy use by the DMU trains. As a result, there would be an overall net reduction in energy consumption with the Proposed Project. (B)*

During operation, the Proposed Project would directly consume energy to power the DMU rail cars and operate the stations and maintenance facilities. In addition, indirect energy would be consumed by the Proposed Project as part

16 Wilbur Smith Associates, email to ERM, January 15 and 16, 2008.
17 Caltrans, *Energy and Transportation Systems,* July 1983.

of maintenance activities on the rail cars. However, the total direct and indirect energy consumed by the Proposed Project during operations would be more than offset by the reduction in energy consumed by removing automobiles from the road as more people would take transit with implementation of the Proposed Project. This reduction would result not only from lowering the direct energy consumed to power the automobiles but also from lowering the indirect energy consumed to maintain the automobiles. An example of indirect energy expended to maintain automobiles includes energy to replace engine parts (manufacturing and replacement of part) to ensure continued operability of the automobile.

DMU Rail Propulsion. Based on the proposed operating plan for the Proposed Project, it is estimated that the total annual miles traveled by the DMU rail cars as part of revenue service (this estimate does not include miles traveled for maintenance activities) would be 615,264 miles in 2015 and 757,248 in 2030. This estimate assumes two DMU rail cars during peak hours in 2015 and three DMU rail cars during peak hours in 2030. For both years, one DMU rail car would operate during off-peak hours. Based on this schedule, the Proposed Project would consume 61.9 billion Btu annually in 2015 and 76.1 billion Btu annually in 2030.

Based on the travel demand projections developed by WSA for this EIR, it is estimated the associated reduction in total daily car miles traveled on the road as a result of the Proposed Project would be 193,106 in 2015 and 340,841 in 2030. This diversion of motorists off the roads would translate to a reduction of 56.0 million vehicle miles traveled in 2015 and 98.8 million vehicle miles traveled in 2030. This decrease in automobile travel would result in a reduction of energy consumption of 258.9 billion Btus in 2015 and 426.3 billion Btus in 2030.

Stations and Maintenance Facilities. Using Table 3.15-6 and the fuel consumption estimates by LTK for the DMU, Table 3.15-7 presents the estimated energy consumed in 2015 and 2030 by the Proposed Project for maintenance of the vehicles. Table 3.15-7 conservatively assumes that the transfer platform, the staff building, Railroad Avenue Station, Hillcrest Avenue Station, and train control huts associated with the Proposed Project would consume the same of amount of energy as three existing BART stations consumed in 2006, based on data from the Orinda BART Station. The Proposed Project stations would have platforms that are shorter than the Orinda Station (about 400 feet versus 700 feet) and have overall less lighting than the Orinda Station. In addition, the Proposed Project would add about 2,900 parking spaces between the Railroad Avenue and Hillcrest Avenue Stations (no additional parking would be added for the transfer platform). The existing

Table 3.15-7
Energy Consumption of the Proposed Project

Category	Energy Consumption (Billion Btu per year) 2015	2030
Direct		
Increased Demand due to Rail Car Operation[a]	61.9	76.1
Increased Demand for Station Operations[b]	20.8	20.8
Increased Demand for Maintenance Facility Operation[c]	17.5	17.5
Decreased Demand due to Reduction in Automobile Miles Traveled[d]	-258.9	-426.3
Indirect		
Increased Demand from Maintenance of Rail Cars[e]	4.3	5.4
Decreased Demand from Reduction in Maintenance of Automobiles[f]	-78.4	-138.4
Net Energy Consumption	**-232.8**	**-444.9**

Source: ERM, 2008

Notes:

a. Equal to annual miles traveled multiplied by energy intensity factor of 100,550 Btu/mile.

b. Based on existing Orinda Station.

c. Average of Oakland Maintenance facility (12.6 Btu/yr) and Daly City Maintenance facility (22.3 Btu/yr).

d. Equal to annual miles traveled multiplied by energy intensity factor of 4622 Btu/mile in 2015 and 4313 Btu/mile in 2030. Passenger automobile fleet average fuel economy is assumed to increase linearly based on fuel economy standard for new passenger cars. Standard in 2004 was 27.5 miles per gallon (mpg) and standard in 2020 will be 35 mpg.

e. Equal to annual miles traveled multiplied by energy intensity factor of 7,060 Btu/mile.

f. Equal to annual miles traveled multiplied by energy intensity factor of 1,400 Btu/mile.

Orinda Station has about 1,440 parking spaces. By assuming the Proposed Project stations are equivalent to three Orinda Stations, the analysis is taking into account energy consumption associated with lighting for a total of 4,300 parking spaces (more than the 2,900 spaces included as part of the Proposed Project). In addition, the Orinda Station would overstate the energy consumption for the proposed transfer platform, which would not have fare collection equipment, escalators, and other features found at BART stations that consume energy. The Proposed Project maintenance facility is expected to be similar to the Oakland maintenance facility, although the Proposed Project maintenance facility is expected to handle fewer cars than the Oakland maintenance facility. For conservatism, the Proposed Project maintenance facility is assumed to consume the average amount of energy consumed by the

Oakland maintenance facility and the higher energy consuming Daly City maintenance facility.

Summary. Even with these conservative assumptions, Table 3.15-7 shows that the Proposed Project would result in a net reduction in energy consumption. Therefore, the Proposed Project would not adversely impact regional energy; in fact, the net reduction in transportation energy demand would be a beneficial effect of the Proposed Project. The Proposed Project would reduce energy consumption by 233 billion Btu in 2015, and this savings would increase to 445 billion Btu by 2030. In addition, BART would implement various design features to conserve energy and further increase sustainability which would further help to reduce overall energy consumption. These features are identified in Section 2, Project Description.

Impact EN-2 *Operation of the Proposed Project would have a beneficial impact on petroleum demand. (B)*

Crude oil is used to produce various petroleum products at refineries including gasoline and diesel. As described previously for the transportation sector, gasoline demand is expected to increase by less than 1.0 percent from 2012 to 2020, while diesel demand is expected to increase by about 3 percent. At this rate, diesel demand would reach about 5 billion gallons per year in 2030. Starting in 2006, California suppliers were required to phase in ultra low sulfur diesel (ULSD) fuel which has a sulfur content of 15 parts per million (ppm). According to the CEC presentation by Gordon Schremp, by 2010, 105 of the 114 refineries producing diesel fuel in the United States will be producing the ULSD fuel. In 2010, 86 of these refineries are expected to produce more diesel fuel than they did in 2003.[18]

In 2030, the Proposed Project would consume about 500,000 gallons of diesel fuel. This would represent about 0.01 percent of the total demand expected in California in 2030. While the Proposed Project would result in a relatively small increase in diesel fuel consumption, petroleum consumption would decrease by reducing the number of automobiles on the road. Table 3.15-7 shows that in 2030, the DMU is estimated to consume about 76.1 billion Btu in the form of diesel fuel. However, the reduction in vehicle miles would result in reducing about 426 billion Btu worth of petroleum products in the form of gasoline and diesel fuel. Thus, overall, the Proposed Project would result in a net benefit by reducing petroleum consumption.

18 Schremp, G., CEC, Presentation to California Trucking Association "California's Petroleum Market Overview and Outlook for Diesel Fuel," October 27, 2005.

Impact EN-3 Operation of the Proposed Project would have a less-than-significant impact on electricity demand. (LTS)

Electricity expressed as kilowatts (kW) or megawatts (MW) would be needed to operate the stations and maintenance facilities of the Proposed Project. The ability of the state to satisfy electricity demand depends not only on generating capacity but also transmission capacity. PG&E is required to have an approximately 15 percent reserve margin to meet peak load at its power plants; however, there is much uncertainty regarding the ability of California's transmission system to transfer the electricity from the power plants to the users during peak demand. Cal-ISO expects reliable transmission service to the San Francisco Bay Area until at least 2010. Because the Proposed Project would be constructed after 2010, there is some uncertainty about the adequacy of the transmission capacity when the Proposed Project is in revenue service.

For the Proposed Project, electricity demand would be expected to be fairly constant throughout the day. The system would not be subject to higher demand during peak hours of service because the DMU rail cars would be powered by diesel fuel and not electricity; the only electrical demand from the Proposed Project would be from station and maintenance facility operations. For comparison purposes, the statewide peak load in 2005 and 2006 exceeded 55,000 MW. BART peak load in 2006 was 84 MW, about 0.15 percent of the statewide peak load. Regionally, PG&E's peak load in 2006 was about 19,000 MW,[19] making BART's system-wide peak load in 2006 less than 0.5 percent of the PG&E peak load. As is discussed in Section 5, Alternatives, a conventional BART extension is anticipated to have a peak load that is less than four percent of the system-wide peak load. The Proposed Project would not have a "peak" load but a constant load throughout the day from the station and maintenance facility that would be less than four percent of the system-wide load expected with a conventional BART extension.

Also, overall electricity consumption over time in terms of Btu or kWh would be relatively small for the Proposed Project. The overall electricity consumption in 2006 by the BART system considering consumption from stations, maintenance facilities, and trains, was about 3,866 billion Btu (373,930,346 kWh). The Proposed Project would not substantially increase overall BART electricity demand, since the proposed DMU technology would not consume electricity. Electricity consumption from the Proposed Project would primarily be from the transfer platform, two stations, and one maintenance facility. Table 3.15-7 shows the conservatively estimated

[19] California Energy Commission website accessed June 9, 2008, http://www.energy.ca.gov/electricity/index.html#demand, "2006 Annual Non-Coincident Peak Loads."

electricity consumption to be about 38 billion Btu in 2015 and 2030 from these facilities. This conservative value represents less than one percent of the BART system-wide electricity consumption in 2006.

Because of the relatively low electricity demand from the Proposed Project (for station and maintenance facility operation) and the fact that electricity demand would not sharply peak during the day when regular BART service would be greatest, impacts to peak and base-period electricity demand from the Proposed Project are expected to be less than significant.

Construction Impacts

Impact EN-4 *Construction of the Proposed Project may consume nonrenewable energy resources in a wasteful, inefficient, and unnecessary manner. (PS)*

Energy would be consumed initially to construct the transfer platform, the staff building, two stations, maintenance facility, tracks, train control huts, and associated utilities and infrastructure. Additional energy would be consumed by equipment (e.g., dump trucks, scrapers, bulldozers, loaders, rollers, generators) and vehicles (e.g., construction worker commuter vehicles) used during construction.

At this early stage of project design, energy conservation practices have not been developed for construction of the Proposed Project. It is expected that construction would follow good construction practices and energy management techniques such as minimizing the number of material deliveries required, maintaining equipment in good condition, and minimizing equipment idling. However, because a detailed conservation plan is not currently in place, it is conservatively assumed that construction of the Proposed Project may result in potentially significant energy consumption impacts.

MITIGATION MEASURE. The following measure would reduce the potentially significant construction energy impact to less than significant. (LTS)

EN-4.1 *Develop and implement a construction energy conservation plan.* Prior to project construction, BART shall ensure all contractors prepare and implement a construction energy conservation plan, subject to BART approval, that includes measures such as, but not limited to:

- Use energy-efficient equipment and incorporate energy-saving techniques during construction;
- Minimize idling of construction equipment to 5 minutes unless absolutely necessary for construction;

- Reduce the number of vehicle/truck trips by consolidating material deliveries (90 percent of deliveries shall consist of fully loaded vehicle/trucks) and encourage construction worker carpooling (e.g., provide at least two incentives such as set aside parking spaces and/or provide free lunch for carpooling construction workers);
- Schedule delivery of materials during non-rush hours to minimize time vehicles/trucks are idling on the roads; and
- Maintain equipment in good working condition as recommended by manufacturers.

Hillcrest Avenue Station Options Analysis

During operations, the energy and petroleum consumption for the Northside West, Northside East, and Median Station East options would be similar to the Median Station of the Proposed Project. However, all three Hillcrest Station options would consume slightly more energy than the Median Station because the DMU trains would travel a greater distance to reach the station platforms and the maintenance facilities. The Northside East Station option would consume the most energy because under this option the DMU trains would travel the greatest distance. However, the Northside West, Northside East, and Median Station East options would still result in an overall net reduction in energy and petroleum consumption.

During construction, the Hillcrest Avenue Station options would likely consume more energy than the Median Station because of the need to construct the tunnels and the longer lengths of tracks. However, overall energy impact during construction for the three other station options would also be similar to the Median Station (potentially significant). The implementation of Mitigation Measure EN-4.1, develop and implement a construction energy conservation plan, would reduce the potentially significant construction energy impact associated with the Northside West Station, Northside East Station and Median Station East options to less than significant.

Cumulative Analysis

The geographic context for cumulative impacts of energy supply and demand can be viewed from a regional, statewide, national, and even global perspective. The cost of a barrel of crude oil in the Middle East influences the price of gas here and directly affects transit ridership. However, to consider cumulative energy impacts on a global scale is impractical and introduces too many variables to offer anything but a highly speculative and general examination. Instead, this assessment focuses on growth in travel on SR 4 and thus considers only the transportation sector of energy consumption. Growth in regional travel takes into account the SR 4 widening project, the SR 4 Bypass, and ABAG's regional growth forecasts, as amended by the County's regional traffic model. The cumulative analysis also accounts for potential development of

1,845 residential units and 1,004,000 square feet of new commercial space at the Railroad Avenue Station area. At the Hillcrest Avenue Station area, up to 2,500 new residential units and 2,150,000 square feet of office and retail space would be added.

Operational Impacts

The transportation projections for the Proposed Project were based on the CCTA travel demand model that takes into account local and regional growth. These traffic forecasts are reflected in the preceding assessments (see Impact EN-1 and Impact EN-2) which show the cumulative effect of traffic plus the Proposed Project. The Proposed Project has a cumulatively beneficial effect since it reduces the transportation energy consumption and the region's petroleum consumption. In terms of electricity demand, the Proposed Project's contribution is less than cumulatively considerable since operations would almost entirely involve diesel fuels and negligible amounts of electricity for stations and maintenance. As a result, cumulative impacts on electricity demand would be less than significant.

Construction Impacts

Impact EN-CU-5 *Construction of the Proposed Project in combination with other foreseeable development may cumulatively consume nonrenewable energy resources in a wasteful, inefficient, and unnecessary manner. (PS)*

As discussed in Impact EN-4, the Proposed Project on its own may have a potentially significant impact on nonrenewable energy resources during construction. The construction of the Proposed Project would result in a temporary increase in energy consumption over a period of about four years. The demand from the Proposed Project would contribute to the increase in energy consumption together with other construction projects along the corridor, most notably the SR 4 improvements, which would occur concurrently with Proposed Project construction. Construction energy impacts from residential and commercial projects approved by local jurisdictions in east Contra Costa County would add to those from the transportation projects.

The environmental documents for the SR 4 projects concluded that construction of the widening and bypass projects would not be done in a wasteful or unnecessary manner. However, given the Proposed Project's potentially significant contribution during construction, the impacts from these other projects combined with the Proposed Project may be cumulatively significant. The cumulative construction impacts of the Northside West Station, Northside East Station, and Median Station East options would be similar to the Median Station.

MITIGATION MEASURE. Implementation of Mitigation Measure EN-4.1 (develop and implement a construction energy conservation plan) would reduce the potentially significant construction energy impact of the Proposed Project to less than significant. In addition, other projects would also need to apply similar mitigation measures as part of their environmental review. Because construction of the Proposed Project would occur over a relatively short time frame, be staged to occur concurrently with the SR 4 widening project, and would require the implementation of energy conservation measures, the Proposed Project's contribution combined with the contribution from other projects would have a less-than-significant cumulative impact. (LTS)