3.8 ENERGY

Energy is consumed during the construction and operation of transportation projects. This section assesses the impact of the proposed project on transportation-related energy consumption in the study corridor. The analysis considers both direct (operational) and indirect energy requirements.

3.8.1 Regulatory Setting

Federal and state agencies regulate energy consumption through various policies and programs. Federal agencies, such as the U.S. Department of Transportation (USDOT), U.S. Department of Energy (USDOE) and the Environmental Protection Agency (EPA) affect energy consumption in the transportation sector through fuel economy standards, funding for transportation infrastructure and funding for energy related research and development projects. At the state level, the California Energy Commission (CEC) collects and analyzes energy-related data, prepares state-wide energy policy recommendations and plans, promotes and funds energy efficiency programs, and regulates the power plant siting process. California is preempted under federal law from setting state fuel economy standards for new on-road motor vehicles.

Federal Regulations

Energy Policy and Conservation Act

The Energy Policy and Conservation Act of 1975 required that all vehicles sold in the U.S. meet certain fuel economy goals. The Act gave the National Highway Traffic and Safety Administration (NHTSA, part of USDOT) authority to establish additional vehicle standards and revise existing standards. NHTSA set the fuel economy standard for new passenger cars at 27.5 miles per gallon (mpg) in 1990, and 20.7 mpg for new light trucks in 1996. Heavy-duty vehicles (i.e., vehicles and trucks over 8,500 pounds gross vehicle weight) are not currently subject to fuel economy standards. The Corporate Average Fuel Economy (CAFE) program, administered by the EPA, was created to determine vehicle manufacturers' compliance with the fuel economy standards. The EPA calculates a value for each manufacturer based on city and highway fuel economy test results and vehicle sales. Based on the information generated under the CAFE program, the USDOT is authorized to assess penalties for noncompliance.

Intermodal Surface Transportation Efficiency Act (ISTEA)

In 1991, Congress established ISTEA to promote the development of intermodal transportation systems, maximize mobility and address national and local interests in air quality and energy. To meet the new ISTEA requirements, Metropolitan Planning Organizations (MPOs) had to adopt social, economic, energy, and environmental policies to guide transportation decisions in the region. MPOs must also consider the consistency of transportation planning with federal, state and local energy goals. This requirement was designed to make energy consumption a decision criterion in determining the best transportation solution.

State Regulations

California Environmental Quality Act (CEQA)

Appendix F of the CEQA Guidelines describes the energy conservation information and analyses that should be included in an EIR. Energy conservation is defined in terms of decreased reliance on natural gas and oil, decreased per capita energy consumption and increased reliance on renewable energy sources. An EIR should include a discussion of potentially significant energy impacts of the proposed project, with emphasis on avoiding or reducing inefficient, wasteful and unnecessary consumption of energy.

State of California Energy Plan

The CEC identifies emerging trends in energy supply, demand, conservation, public health and safety, and the maintenance of a healthy economy in the State Energy Plan. The plan calls upon the state to reduce congestion and increase the efficient use of fuel supplies. The plan also encourages urban designs that reduce vehicle miles traveled and accommodate pedestrian and bicycle access (SCAG, 2001).

3.8.2 Environmental Setting

This section discusses the existing energy use characteristics at the state and local level. Detailed information about energy use in the project area is limited; therefore, state-level trends are relied upon to characterize energy consumption at the local level.

Petroleum products supply approximately 39 percent of the energy demand in the U.S. (MTC, 2005). Coal and natural gas each supply approximately 23 percent of national demand, and renewable and nuclear resources supply the remaining demand.

In California, petroleum use accounts for approximately 42 percent of all energy consumption (USDOE, 2004). Approximately 53 percent of petroleum use is for motor vehicle fuel. In 2000, total statewide energy consumption was 8,500 Tera BTUs (USDOE, 2003).[1] Motor vehicle fuel use accounted for 22 percent of total use, or 1,872 Tera BTUs (54.5 billion liters or 14.4 billion gallons of fuel). Figure 3.8-1 illustrates California's annual fuel consumption trends over the last three decades.

Gasoline consumption for Sonoma and Marin counties during the last three years is shown in Table 3.8-1. Motor vehicle fuel consumption increased approximately one percent in Marin County and almost five percent in Sonoma County. In the last three years, fuel consumption in the entire project corridor increased two percent.

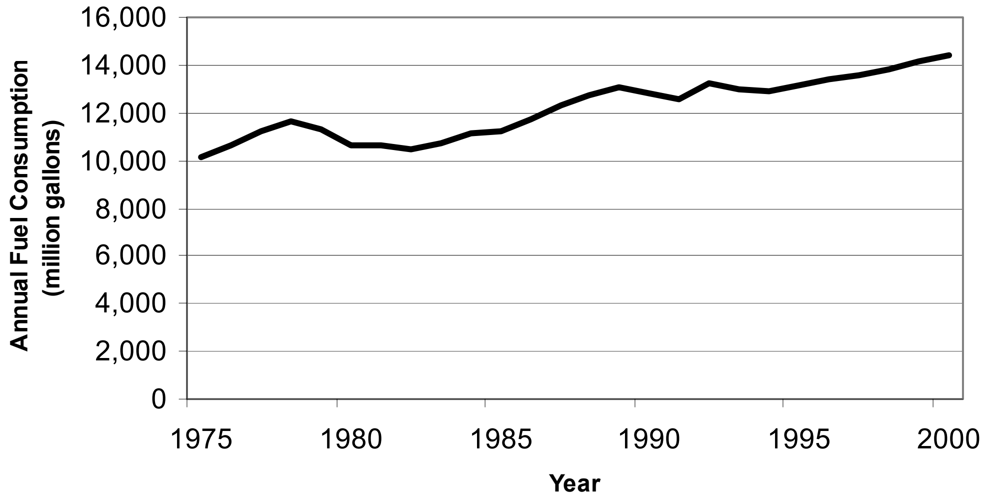
TABLE 3.8-1
GASOLINE CONSUMPTION IN SONOMA AND MARIN COUNTIES, 2000-2002

County	2000	2001	2002	Change 2000-2002
Marin	132,634	131,394	133,873	1%
Sonoma	211,209	211,971	221,054	5%
Total Bay Area	3,358,234	3,399,020	3,426,669	2%

Source: Metropolitan Transportation Commission, 2005.

[1] A Tera BTU is equivalent to one trillion BTUs.

FIGURE 3.8-1
STATE OF CALIFORNIA FUEL CONSUMPTION TREND



Source: U.S. Department of Energy, 2004.

While long-term fuel consumption data is not available for Sonoma and Marin counties, trends in vehicle miles traveled (VMT) growth suggest that the two counties have followed statewide annual fuel consumption trends. In the 1990s, combined VMT for Sonoma and Marin counties increased by 16.6 percent, or approximately 1.7 percent annually. Statewide VMT growth during the same period was 18.3 percent, or approximately 1.8 percent annually (Caltrans, 2003).

3.8.3 Significance Criteria

Based on the CEQA Guidelines, Appendix F, energy impacts would be considered significant if implementation of the proposed project would result in:

- Wasteful, inefficient, and unnecessary usage of energy; or
- Placement of a significant demand on regional energy supply or requirement for substantial additional capacity.

3.8.4 Impact Assessment Methodology

In this report, the energy consumption of the proposed project is compared to existing conditions as well as to No-Project conditions in 2025. For purposes of comparing the proposed project in 2025 to No-Project conditions in 2025, the same roadway improvements to the transportation system and growth in annual VMT are assumed for both. This comparison generally allows for an analysis of the relative impact of the proposed project on energy consumption based on like assumptions about technology, fuels and vehicles. However, the transportation analysis assumed a 15 percent increase in intracounty bus transit service for the proposed project (although the project itself does not include increased bus transit service), so the comparison of bus energy consumption between the No-Project and proposed project scenarios reflects this 15 percent increase only for the proposed project (see Section 3.6, Transportation for details on transportation assumptions).

Direct Energy

Direct energy consumption includes the fuel required for the operation of passenger vehicles (automobiles, vans and light trucks), transit buses and passenger rail vehicles. The method used to estimate direct energy consumption under each of the alternatives is outlined in FTA's Reporting Instructions for the Section 5309 New Starts Criteria (USDOT, 2002). The direct energy analysis for each alternative was based on modeled year 2025 corridor traffic VMT, as documented in Section 3.6, Transportation. The daily VMT was then adjusted using a factor of 290 days per year to provide annual VMT for passenger vehicles, transit buses and passenger rail (Caltrans, 1983).

The factors in Table 3.8-2 reflect the variable rates at which different modes consume energy. Annual VMT values were adjusted using these factors to provide the direct energy consumption under each alternative.

TABLE 3.8-2
OPERATIONAL ENERGY CONSUMPTION RATES

Vehicle Type	Energy Consumption/Vehicle Mile
Passenger Vehicles (auto, van, light truck)	6,233 BTU[1]/Vehicle Mile
Transit Bus (all vehicle types)	41,655 BTU/Vehicle Mile
Proposed Passenger Rail Vehicle (DMU)	75,000 BTU/Vehicle Mile
Traditional Passenger Rail Vehicle (diesel)	100,000 BTU/Vehicle Mile

Source: U.S. Department of Energy, 1996; Source for the Diesel Multiple Units is Colorado Railcar Company, LLC, 2003.
Note [1] One BTU is the quantity of energy necessary to raise the temperature of one pound of water by one degree Fahrenheit.

The proposed project would rely on diesel multiple units (DMUs) for the passenger rail cars. Therefore, operational energy calculations for passenger rail in this report rely on the DMU energy consumption factor. DMUs use 25 percent fewer BTUs per vehicle mile than traditional passenger rail vehicles.

In addition, SMART is considering operating the DMUs on a biodiesel fuel mixture. Biodiesel blends of 20 percent or less can be used in DMU vehicles without requiring any modifications to the vehicles. Fuel efficiency is expected to be slightly less than DMUs operated on conventional diesel—two miles per gallon for diesel fuel (Colorado Railcar Manufacturing, LLC, 2003) and 1.96 miles per gallon for biodiesel (EPA, 2002). A biodiesel consumption rate is not currently available.

SMART is also considering the use of hybrid engines for the proposed project. Hybrid diesel engines are currently in development by several rail car manufacturers. A prototype hybrid DMU, however, has not yet been developed. Energy consumption rates are therefore not available for this analysis.

<u>Indirect Energy</u>

Indirect energy consumption includes three components: (a) the initial energy investment required to build the project; (b) the initial energy required to manufacture the operating vehicles; and (c) the energy required for the annual maintenance or periodic rehabilitation of the infrastructure. The indirect energy analysis was conducted using the Input-Output Method. This method converts VMT, lane-miles or construction dollars into energy consumption based on existing data from other rail projects in the United States. The indirect energy consumption rates in Table 3.8-3 reflect the amount of energy that is consumed in the construction of the rail guideway and the manufacturing and maintenance of passenger vehicles, transit buses and passenger rail cars.

TABLE 3.8-3
INDIRECT ENERGY CONSUMPTION RATES

Activity	Energy Consumption Rate
Manufacturing	
Passenger Vehicles	1,410 BTU/VMT
Transit Buses	3,470 BTU/VMT
Passenger Rail[1]	2,108 BTU/VMT
Rail Guideway[2]	12,200 BTU/VMT
Maintenance	
Passenger Vehicles	1,400 BTU/VMT
Transit Buses	13,142 BTU/VMT
Passenger Rail	7,060 BTU/VMT

Sources: Caltrans, 1983. Rail Guideway information is from Congress of the United States, 1977.

Notes: [1] Passenger Rail consumption rates are based on traditional passenger rail cars. An indirect energy consumption rate is not currently available for DMUs. Energy consumption associated with maintenance and manufacturing of DMUs is expected to be similar to traditional rail cars.

[2] Rail guideway consumption includes only construction of the permanent way (e.g., rails and ties). Consumption associated with constructing stations is not included.

3.8.5 Impact Summary

Implementation of the proposed project would not result in the wasteful, inefficient or unnecessary consumption of energy, nor would it place a significant demand on regional energy supplies. DMUs, which are the preferred rail vehicle for the proposed project, would consume 25 percent less energy than a traditional diesel-powered rail vehicle. Although energy would be consumed for the manufacture, maintenance and operation of the proposed passenger rail project, the consumption of energy by other modes would be reduced as a result of diverting automobile travel to passenger rail service. In addition, implementation of the proposed project would result in a slight decrease in both indirect and direct energy consumption compared to the No-Project Alternative. Therefore, energy impacts are not considered significant and no energy mitigation measures are required.

3.8.6 Impacts and Mitigation Measures

Construction-Related Impacts

Indirect energy is the energy required to construct and maintain the proposed project. Indirect energy construction estimates for the proposed project are provided in Table 3.8-4. This table also shows the barrels of crude oil that would be consumed under each alternative. The energy consumption estimates for construction and maintenance represent a one-time expenditure of energy.

Impact E-1: Construction and maintenance of the proposed project would require indirect energy consumption. *(Less than significant)*

Energy consumption for project construction and maintenance is calculated based on projected VMT, listed in Table 3.8-5, and adjusted using the energy consumption rates in Table 3.8-3. Energy consumption related to vehicle manufacture and maintenance is based on the amount of energy necessary to produce material, create component parts and assemble the vehicles. The results of this analysis are in Table 3.8-4.

TABLE 3.8-4
ESTIMATES OF INDIRECT ENERGY CONSUMPTION

	2025 No-Project	2025 Proposed Project
Construction (in billion BTUs)		
Passenger Vehicle Manufacturing	7,947	7,910
Transit Bus Manufacturing	43	49[1]
Passenger Rail Manufacturing	0	0.849
Rail Guideway	0	4.91
Total Construction	7,990	7,964
Total Construction in Barrels of Oil (in thousands)[2]	1,378	1,373
Change in Barrels of Oil from No-Project Alternative		(445)
Maintenance (in billion BTUs)		
Passenger Vehicle	7,891	7,854
Transit Bus	164	1851
Passenger Rail	0	3
Total Maintenance	8,055	8,042
Total Maintenance in Barrels of Oil (in thousands)	1,389	1,387
Change in Barrels of Oil from No-Project Alternative	-	(2,237)
Summary		
Total Indirect Energy Consumption (in billions of BTUs)	16,045	16,006
Total Indirect Energy Consumption (in thousands of Barrels Of Oil)	2,766	2,760

Source: Parsons Brinckerhoff Quade & Douglas, Inc., June 2004.

Note [1] The travel demand model demonstrated that intracounty trips to and from proposed rail stations via transit bus would increase 15 percent under the proposed project. As trips increase, it is conservatively assumed that the number of transit buses manufactured and maintained would also increase.

[2] The Energy Information Administration estimates that there are approximately 5.8 million BTUs per barrel of crude oil.

This energy use represents an initial consumption amount, rather than an annual operational consumption rate. Energy consumption related to the proposed project's construction and manufacturing would necessarily represent an increase in energy use over existing conditions, as it would require the manufacturing and maintenance of new rail vehicles and rail facilities. A more meaningful way to assess this indirect energy use is to compare it to future conditions without the project (No-Project scenario). As shown in Table 3.8-4, the manufacturing of vehicles and construction associated with the proposed project, in addition to manufacturing of passenger and other non-rail vehicles that would be in service in the year 2025, would consume approximately 1.4 million barrels of oil (7,964 billion BTUs). The proposed project's indirect energy consumption represents a decrease of 0.32 percent compared to the No-Project Alternative. This decrease is due to lower passenger auto manufacturing and maintenance energy use, which offsets the increase in energy use for the rail vehicle manufacturing and assumed increased bus service. Maintenance under the proposed project combined with maintenance of passenger and other non-rail vehicles would require approximately 1.4 million barrels of oil (8,042 billion BTUs) through 2025. Energy consumption due to maintenance would decrease 0.16 percent compared to the No-Project Alternative. Therefore, the proposed project's indirect energy consumption would not represent a wasteful or inefficient use of energy. This one-time energy use would not place a significant demand on regional energy supplies. Although the proposed project would not cause a significant increase of indirect energy consumption, measures could be implemented that further reduce energy demand during the construction period.

Mitigation Measure E-1: Implement energy conservation measures during construction such as:

- Using energy efficient measures at rail stations, such as solar panels;
- Reducing idling of trucks delivering construction material;
- Consolidating material delivery; and
- Scheduling material delivery during off-peak hours, to allow trucks to travel without traffic and at fuel-efficient speeds (45 – 55 mph).

Long-Term Impacts

Impact E-2: Operation of the proposed project would require energy use. *(Less than significant)*

The preferred rail vehicle for the proposed project is the DMU, which consumes 25 percent less energy (BTU/VMT) than a traditional diesel rail vehicle. In addition, the proposed project would slightly reduce the amount of energy consumed by automobiles in the region by diverting some automobile users to passenger rail service. Overall energy consumption would be slightly less with the proposed project in 2025 compared to the No-Project Alternative in 2025.

Projected annual operational energy consumption of the proposed project is compared to the No-Project Alternative and the existing condition in Table 3.8-5, and is discussed below.

TABLE 3.8-5
ESTIMATES OF DIRECT ENERGY CONSUMPTION

	2000 (Existing)	2025 No-Project	2025 Proposed Project
Vehicles miles traveled (in millions)			
Daily Passenger Vehicle	15.03	19.43	19.34
Annual Passenger Vehicle	4,359	5,636	5,610
Daily Transit Bus	0.0430	0.0431	0.0487
Annual Transit Bus	12.5	12.5	14.1
Daily Passenger Rail	0	0	0.0014
Annual Passenger Rail	0	0	0.4028
Estimated BTUs (in billions)			
Passenger Vehicle	27,170	35,130	34,966
Transit Bus	519.3	520.5	588.7
Passenger Rail	0	0	30.21
Summary			
Total BTUs (in billions)	27,690	35,650	35,585
Total Barrels of Oil (in thousands)	4,774	6,146	6,135
Change in Barrels of Oil from No-Project			(11,000)

Source: Parsons Brinckerhoff Quade & Douglas, Inc., June 2004.

Under the proposed project, annual VMT within the project corridor is forecast to be 5.6 billion miles for passenger vehicles, 14.1 million miles for transit buses and 402,800 miles for passenger rail in 2025. All vehicles operating within the corridor are anticipated to consume approximately 6.1 million barrels of oil (35,585 billion BTUs), an 11 thousand barrel decrease in direct energy consumption as compared to the No-Project Alternative.

When compared to the existing condition, the difference between the proposed project and the No-Project Alternative is minimal. Both scenarios result in an increase in energy use due to projected regional growth and associated increased vehicle travel. By 2025, annual passenger VMT will increase 29 percent under the No-Project Alternative. With implementation of the proposed project, annual passenger VMT would be slightly less, increasing 28 percent during the same time period. This small energy savings under the proposed project, however, would be partially offset by an increase in transit bus and passenger rail vehicle miles.

The proposed project would result in a 0.2 percent decrease in total energy consumption compared to the No-Project Alternative. Relative to future conditions without the proposed project, this is a beneficial effect. Implementation of the proposed project would not result in wasteful, inefficient or unnecessary usage of energy. Because the proposed project would consume fewer barrels of oil than the No-Project Alternative, it would not place a significant demand on regional energy supply or require substantial additional capacity.

Cumulative Impacts

The above analysis takes into consideration many of the expected changes to the transportation system that will take place between 2000 and 2025. Expected development in the region is incorporated into the model. These assumptions are made in order to accurately compare the No-Project Alternative to the proposed project in 2025. Accordingly, the analysis is cumulative in nature. The proposed project would result in an overall decrease in total energy consumption compared to future conditions without the project, and would not contribute to cumulative energy impacts in the region.