4.7 Energy

4.7.1 Introduction

This section describes the affected environment and environmental consequences related to energy from operations of the NEPA Alternatives. Information regarding energy resources was obtained from the following sources.

- *California State Profile and Energy Estimate* (U.S. Energy Information Administration 2015)
- *California Energy Demand 2012-2022 Final Forecast* (California Energy Commission. 2012)
- *California Energy Demand Updated Forecast 2015-2025* (California Energy Commission. 2015a)
- California-modified Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (CA-GREET) model (California Air Resources Board 2015)
- Air quality technical modeling outputs (*VTA's BART Silicon Valley—Phase II Extension Project Air Quality Study* included with this SEIS/SEIR)

4.7.2 Environmental and Regulatory Setting

4.7.2.1 Environmental Setting

This section discusses the existing conditions related to energy. Various forms of energy are used in vehicle propulsion and the operation of transportation facilities. Automobiles, buses, and trucks within the study area for the BART Extension Alternative use a variety of energy forms, including gasoline, diesel, and natural gas, whereas the BART fleet is powered by electricity. These energy forms would be delivered by regional and statewide distribution networks. Accordingly, the study area for energy resources consists of the physical boundaries of the construction area, as well as the larger statewide energy distribution network.

Existing State Energy Generation and Demand

California has a diverse portfolio of energy resources. Excluding offshore areas, the state ranked third in the nation in crude oil production in 2014, producing more than 15,720 barrels (equivalent to 1,154 trillion British thermal units [BTU]). The state also ranked fourth in the nation in conventional hydroelectric generation and second in the nation for net electricity generation from renewable resources. Other energy sources in the state include natural gas, nuclear, and biofuels (U.S. Energy Information Administration 2015).

According to the California Energy Commission (CEC), total statewide electricity demand is projected to grow from 277,140 gigawatt-hours (GWh) in 2013 to 320,862 GWh in 2025 (1.23 percent annually; mid-energy demand scenario) (California Energy Commission 2015a). Natural gas demand is predicted to grow at a slightly slower rate, 0.81 percent annually between 2010 and 2022, and is forecasted to reach 14,075 million therms by 2022 (California Energy Commission 2012). While alternatively fueled vehicles will continue to penetrate the transportation market, demand for gasoline and diesel is also forecasted to increase steadily over the next 10 years.

Local Energy Providers and Distribution

Pacific Gas & Electric Company (PG&E) is the largest publicly owned utility in California and is the electricity and natural gas provider for residential, industrial, and agency consumers in the area. PG&E buys electricity from a diverse mix of generating sources, including fossil-fueled plants, hydroelectric powerhouses, wind farms, solar facilities, and nuclear power plants. Under the authority granted to BART in California Public Utility Code Section 701.8 (b), BART purchases its own power. In addition to a small amount of power purchased directly from the Western Area Power Administration, the bulk of BART's power is provide via power contracts entered into by the Northern California Power Agency (NCPA) specifically to serve BART loads, and by market power purchases via NCPA. These purchases are made from resources located in the Pacific Northwest, and are delivered into California and scheduled into the California Independent System Operator's (CAISO) market along with a day-ahead load forecast to provide a load/resource balanced schedule to the CAISO. As BART's current power contracts expire December 31, 2016, BART will be actively pursuing zero carbon resources, with a stretch goal up to 100 percent carbon free supply.

Electricity is supplied to the area through a network of distribution and transmission lines. Although transmission lines are continuously being upgraded, and new routes are being constructed, increasing electrical demand throughout the state has strained system reliability and power quality. The transmission capabilities of some portions of the state's electrical grid are occasionally inadequate to transmit electricity at a rate that satisfies the quantities of electricity demanded. This phenomenon is known as a transmission bottleneck and can result in power blackouts. The CAISO operates the transmission system to minimize such bottlenecks using a congestion charge mechanism that prices congestion into the transmission cost. The CAISO is also responsible for taking remedial actions to avoid blackouts or other operational problems, as well as to identify any grid upgrades that need to be made for reliability purposes.

Diesel and gasoline are distributed by a number of methods, including pipelines, railroads, and trucks. Natural gas is supplied through a combination of interstate and intrastate pipelines. The majority of PG&E's natural gas supply comes from Canada.

Local Energy Consumption

Santa Clara County consumes a small amount of energy relative to the state. As shown in Table 4.7-1, electricity and natural gas usage in Santa Clara County are approximately 6 percent and 4 percent of the statewide total, respectively. Gasoline usage for Santa Clara County is about 5 percent of statewide usage, and diesel fuel usage is about 3 percent of the statewide total. For reference, Santa Clara County is home to about 4.8 percent of California residents.

Table 4.7-1: Santa Clara County Energy Usage in 2010

Fuel	Santa Clara County Energy Use	Percent of State Consumption
Electricity (million kWh)	16,251	6%
Natural Gas (million therms)	446	4%
Gasoline (million gallons)	727	5%
Diesel (million gallons)	88	3%
Sources: California Department of Transportation 2009; California Energy Commission 2015b. kWh = kilowatt-hours		

4.7.2.2 Regulatory Setting

Federal

In accordance with NEPA regulations, the Council on Environmental Quality requires that the energy requirements for each alternative be analyzed and the energy conservation and mitigation measures be identified (Code of Federal Regulations, Title 40, Section 1502.16(e)). Refer to Chapter 6, Section 6.7, *Energy*, for a summary of state and local energy policies relevant to the BART Extension.

4.7.3 Methodology

4.7.3.1 Overview

Guidance for evaluating energy impacts of transportation projects subject to NEPA is outlined in Federal Highway Administration (FHWA) Technical Advisory 6640.8A, *Guidance for Preparing and Processing Environmental and Section 4(f) Documents*. The FHWA Advisory applies to projects for which an EIS is prepared. Among these projects, the majority will not require a detailed energy study, but rather a "general" discussion of project energy requirements during construction and operation. Large-scale projects with "potentially substantial energy impacts" should prepare a more robust energy analysis that includes computations of construction and operational energy requirements. Consistency with state and regional energy plans should be discussed, as well as an analysis of direct and indirect energy impacts, which are defined by the FHWA Advisory as follows.

- **Direct energy**: Energy consumed by vehicles using the facility.
- **Indirect energy**: Construction energy and such items as the effects of any changes in automobile usage.

The Federal Transit Administration has not issued guidance on energy impact analysis. Thus, FHWA guidance is used in this analysis. Consistent with FHWA's guidance, this section analyzes operational energy requirements, as well as consistency with state and regional energy plans and the conservation potential of the BART Extension. Effects on energy production and natural resource consumption are also assessed pursuant to U.S. DOT Order 5601.1D.

This analysis characterizes effects related to energy as *no effect, no adverse effect,* or *adverse effect.*

- *No effect* on energy resources would occur if the Build Alternative results in no new increase in energy consumption.
- *No adverse effect* on energy resources would result if the Build Alternative implements energy conservation policies consistent with applicable state and local energy plans and policies, and if the Build Alternative would not place a substantial strain on statewide energy resources.
- The BART Extension would result in an *adverse effect* if it would involve energy consumption that is wasteful, inefficient, and unnecessary, or is otherwise inconsistent with applicable state and regional energy plans and polices.

4.7.3.2 Calculation Approach

Operation of the BART Extension would increase electricity consumed for vehicle propulsion. The stations and related facilities built as part of BART Extension would also use electric power. This "other" energy requirement was calculated on a percentage basis. About 22 percent of BART's existing power requirements are for station and facilities operations, with the other 78 percent for vehicle propulsion. It was assumed this relationship would apply to the BART Extension as well. Based on data obtained from the air quality analysts, annual electricity consumption for vehicle propulsion along the BART Extension would be 1.4 million kilowatt-hours (kWh) (Hosseini pers. comm.). Additional electricity consumed by other facilities was therefore estimated to be about 392,000 kWh per year (1.4 million kWh x 28 percent).

Although the BART Extension would increase electricity consumption, it would improve existing transit opportunities, which would facilitate the removal of single occupancy vehicles from the transportation network. Regional vehicle miles traveled (VMT) with and without the extension under 2015 Existing, 2025 Opening Year, and 2035 Forecast Year conditions were obtained from the air quality analysts and are summarized in Table 4.7-2. The VMT estimates were converted to gallons of diesel and gasoline based on light duty

vehicle fuel economy data for Santa Clara County obtained from the California Air Resources Board's EMFAC2014 model.[1]

Table 4.7-2: Annual Regional Vehicle Miles Traveled (million) for the BART Extension Alternative

Mode[a]	2015 Existing		2025 Opening Year		2035 Forecast Year)	
	No Build	BART Extension	No Build	BART Extension	No Build	BART Extension
Automobile	18,057	17,944	19,075	18,970	20,663	20,557
Change from No Build		*-113 (-0.6%)*		*-105 (-0.5%)*		*-106 (-0.5%)*

Source: Hosseini pers. comm.

[a] Implementation of the BART Extension would not have a measurable effect on regional bus or truck activity (Van den Hout pers. comm.). Accordingly, VMT from regional buses and trucks are not include in the VMT analysis for the BART Extension.

Because transit and auto modes consume different types of energy, to provide for a common measure of comparison, kWh of electricity and gallons of gasoline and diesel consumed (or saved) were converted to their BTU equivalents. Energy use is expressed at two levels: in terms of the direct energy content of electricity and fuels consumed (or saved), as well as the total energy content of each energy unit. The former is the specific energy available at the point of use while the latter also includes the energy required to generate or refine and transmit or transport the energy unit to the final point of use. For instance, a kWh has a final or direct energy content of 3,414 BTUs, but an additional 4,586 BTUs of energy is required to generate and transmit the kWh to its point of use. The total energy content of a kWh is therefore estimated to be 8,000 BTUs (see Table 4.7-3). The BTU conversion factors used in the analysis are summarized in Table 4.7-3.

Table 4.7-3: Direct and Total BTU Conversion Factors by Fuel Type

Fuel Type	Direct Energy BTU per Unit	Total Energy BTU per Unit
Gasoline (gallon)	116,090	138,766
Diesel (gallon)	127,464	156,765
Electricity (kWh)	3,414	8,000

Sources: California Air Resources Board 2014; United States Department of Energy 2014.

BTU = British thermal units

kWh = kilowatt-hours

[1] Weighted fuel economy factors for light-duty vehicles (EMFAC vehicle categories of LDA, LDT1, and LDT2) under 2015 Existing, 2025 Opening Year, and 2035 Horizon Year conditions are 24.3, 35.1, and 45.4 miles per gallon, respectively.

4.7.4 Environmental Consequences and Mitigation Measures

This section identifies impacts and evaluates whether they would be adverse according to NEPA, using the criteria (i.e., context and intensity) identified in Section 4.7.3, *Methodology*. This section also identifies design commitments, best management practices, and other measures to avoid, minimize, or mitigate impacts.

4.7.4.1 No Build Alternative

The No Build Alternative consists of the existing transportation network and all programmed improvements outlined in regional transportation planning documents. The transportation projects completed under the No Build Alternative would be consistent with local policies that encourage alternative transportation and energy conservation, but would not be as supportive of regional plans to promote BART and transit-oriented joint development. Because BART is a more energy efficient form of transportation than personal automobiles are, the No Build Alternative would have greater energy use than the BART Extension Alternative. All individual projects planned under the No Build Alternative would undergo separate environmental review to define effects on energy and to determine appropriate mitigation measures, as needed.

4.7.4.2 BART Extension Alternative

Energy consumption under the BART Extension Alternative for 2015 Existing, 2025 Opening Year, and 2035 Forecast Year conditions is summarized in Table 4.7-4. The BART Extension Alternative would increase electricity usage as a result of BART vehicle propulsion and station operations, but would reduce vehicular fuel use through the removal of passenger vehicle trips from the transportation network. As shown in Table 4.7-4, this reduction in vehicular fuel use would offset increases in BART electricity consumption, resulting in a net energy reduction, relative to the No Build Alternative.

Table 4.7-4: Annual Direct and Total Energy Use for the BART Extension Alternative (Million BTU)

Condition and Source	Direct Energy[a]	Total Energy[b]
2015 Existing		
BART Electricity	6,388	14,969
Change in Vehicular Fuel from Increased Ridership	-538,819	-644,067
Overall Net Change in Energy Consumption (Existing Plus BART Extension vs. No Build)	*-532,431*	*-629,098*
2025 Opening Year		
BART Electricity	6,388	14,969
Change in Vehicular Fuel from Increased Ridership	-347,882	-415,834
Overall Net Change in Energy Consumption (Opening Plus BART Extension vs. No Build)	*-341,494*	*-400,865*
2035 Forecast Year		
BART Electricity	6,388	14,969
Change in Vehicular Fuel from Increased Ridership	-270,620	-323,480
Overall Net Change in Energy Consumption (Forecast Plus BART Extension vs. No Build)	*-264,232*	*-308,511*

[a] Direct energy includes energy required at the point of use.

[b] Total energy includes the energy required to generate or refine and transmit or transport the energy unit to the final point of use.

BART's Policy Framework for Sustainability includes a goal to "Apply sustainable techniques and procedures into BART's maintenance projects and operations in a cost-effective manner." Energy conservation is an important aspect of this goal. For example, variable speed escalators that stop and re-start or that operate at a low-speed mode will be evaluated for implementation to reduce off-peak energy consumption as they are being done on VTA's Phase I Project.

Although the BART Extension would increase electricity consumption, relative to the No Build, the adjacent transit centers, parking garages and other supporting facilities would incorporate VTA's Sustainability Program green strategies, which would help conserve energy. For example, LED lighting, photosensor-driven lighting and dimming controls could be applied to minimize artificial lighting during daylight hours and reduce power during off-peak periods. Photovoltaic solar panels may also be incorporated, which would minimize purchased power and demand on PG&E loads. These strategies are consistent with state and local energy plans and policies to reduce energy consumption, including the State of California Energy Action Plan. The BART Extension Alternative would also facilitate implementation of the Metropolitan Planning Commission's *Plan Bay Area* by promoting regional transit and reductions in single occupancy vehicle use. Plan Bay Area is a long-range integrated transportation and land-use strategy through 2040 for the San Francisco Bay Area.

With regard to effects on local and regional energy supplies, BART would procure and PG&E would distribute electricity to the BART Extension through 115-kilovolt alternating current lines. Power feed lines connecting high-voltage substations to existing PG&E towers and lines would be required. Electricity consumption would be highest during peak-periods (3 to 7 p.m.) and would be on the order of 11 megawatts, which is approximately 0.018 percent of historic (2011) peak demand (California Energy Commission 2015c). The degree to which VTA is able to conserve energy and generate renewable power through implementation of the strategies described above would dictate the BART Extension Alternative's dependency on PG&E.

Natural gas consumption, which would be supplied by PG&E, would be highest during peak-periods (3 to 7 p.m.), with demand greatest during the winter months. The degree to which VTA is able to utilize natural gas conservation would dictate its dependency on PG&E and have a direct effect on supply from PG&E.

PG&E uses local and regional development plans to forecast and plan for the energy needs of its service territory. This dynamic process is subject to regulatory oversight by the Public Utilities Commission (PUC), where every 2 years in Long Term Procurement Plan proceedings, the PUC assesses the system and local resource needs of the state's three investor-owned utilities over a 10-year horizon. The PUC establishes upfront standards for utility procurement activities and cost recovery by reviewing and approving proposed procurement plans prior to their implementation. Integral to this process is the utility demand forecast, which is subject to review by the CEC. As part of this process, BART's 20-year load forecast, which includes extension loads, is submitted to PG&E for long-term planning. To ensure consistency with approved plans, the PUC conducts annual Energy Resource Recovery Account proceedings in which energy forecasts are refined based on existing procurement. This continual planning process ensures local utilities will accommodate the current and planned local energy requirements for a region. Consequently, it is anticipated the BART Extension Alternative would have *no adverse effect* on local and regional energy supplies, nor on any requirements for additional capacity. No mitigation would be required.

4.7.5 NEPA Conclusion

The BART Extension Alternative would result in a net energy reduction, relative to the No Build Alternative. Implementation of VTA's Sustainability Program green strategies would ensure the BART Extension Alternative is consistent with state and local energy plans and policies to reduce energy consumption. Peak electrical demand would not impede PG&E's ability to meet regional loads, and ongoing utility and system planning processes would be employed to accommodate increases in future electricity consumption. Accordingly, the impact would have negligible intensity under NEPA and there would be *no adverse effect*. No mitigation is required.