3.8 ENERGY

Introduction

This section describes the environmental setting and effects of the proposed project with regard to energy. Specifically, this section discusses existing energy conditions within the Santa Clara-Alum Rock Corridor and describes applicable regulations pertaining to energy. Information in this section is based on the Santa Clara-Alum Rock Transit Corridor Energy Study (MO'C Physics Applied, March 31, 2008) prepared for the proposed project. [1]

Existing Conditions

Statewide Overview

A California Energy Commission (CEC) report concluded that California was the tenth largest consumer of energy in the world, slightly ahead of Italy. [2] 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 3.8-1 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.[3]

Table 3.8-1
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

Sources of Electricity. Table 3.8-2 provides a comprehensive overview of the sources of all the electrical energy that is consumed in California and provides a breakdown of the type of energy and the place of origin. The table shows the electrical energy that is imported across state lines in the

1 MO'C Physics Applied, *Energy Study for the Santa Clara-Alum Rock Corridor*, March 31, 2008.

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

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

Northwest and Southwest regions of California. For coal, "in-state" generation refers to facilities that are owned by California utilities and use coal, but generating facilities are located out-of-state. As indicated in Table 3.8-2, the predominant source of electricity is natural gas which amounts to approximately 41.5 percent of the total energy.

Table 3.8-2
2002 Gross System Electrical Power (GSP) (Gigawatt-Hours[a])

Fuel Type	In-State	Imported from across State Lines in Northwest California	Imported from across State Lines in Southwest California	GSP	GSP%
Coal	17,573	5,467	23,195	46,235	15.7
Large Hydro	43,088	10,608	2,343	56,039	19.0
Natural Gas	106,968	2,051	13,207	122,226	41.5
Nuclear	31,959	556	5,635	38,150	12.9
Renewables					
Biomass	*5,735*	*430*	*120*	*6,285*	*2.1*
Geothermal	*13,448*		*260*	*13,708*	*4.7*
Small Hydro	*5,788*	*448*		*6,236*	*2.1*
Solar	*616*			*616*	*0.2*
Wind	*4,927*	*244*	*199*	*5,370*	*1.8*
TOTALS	**230,102**	**19,804**	**44,959**	**294,865**	**100**

Source: California Energy Commission, CEC-300-2007-007*, 2006 Net System Power Report,* April 2007.

Note:

a. A "gigawatt" is a billion watts.

As shown in Table 3.8-2, a considerable percentage of the electrical power that is used in California is imported; approximately 22 percent. The practice of the CEC is to classify certain coal-fired plants that are located outside of California but controlled by California as "in-State;" so that the percent of electricity used in California that is imported is even somewhat higher than 22 percent.

Figure 3.8-1a illustrates California's history of electricity sources used in California. As shown in Figure 3.8-1, natural gas has been greatest source of electricity consistently over the past ten years. Over the past 10 years, other sources also include hydroelectric, nuclear, coal, and "Alternatives"; Figure 3.8-1b provides a breakdown of "Alternative" sources of energy summarized in Figure 3.8-1a.

The sources that are accounted for on Figure 3.8-1b show the breakdown of "Renewables" as listed in Table 3.8-2. Alternative sources of energy have not been gaining in significance in recent years, but do yield roughly 10 percent of the total electricity production. Natural gas is the primary fuel for electricity generation; natural gas-fired electricity plants are called upon to make up for dips in other forms of supply or peaks in demand, or, as in recent years, to meet the steady overall growth in demand. Other sectors of the economy consume natural gas, such as the residential (space heating,

cooking, and heating domestic hot water), industrial, mining and commercial sectors, but since about the Year 2000, electricity generation has been the primary use of natural gas in California.

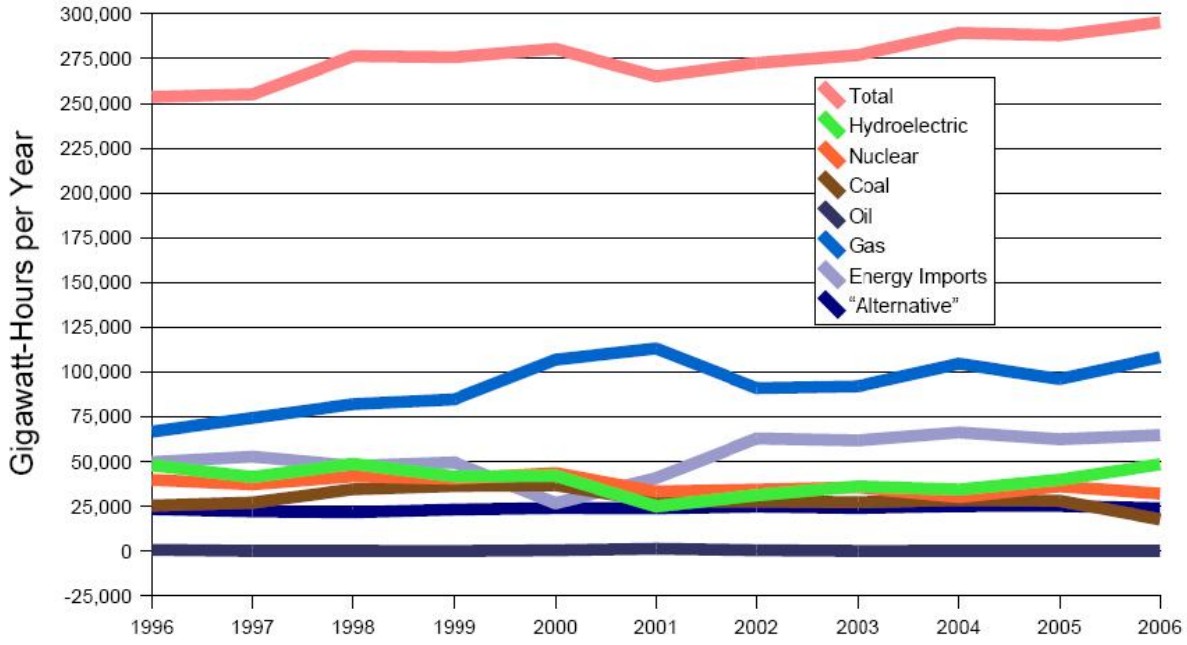

Figure 3.8-1a California Electrical Energy Alternative Sources

Source: MO'C Physics Applied, *Energy Study for the Santa Clara-Alum Rock Corridor, March 31, 2008.*

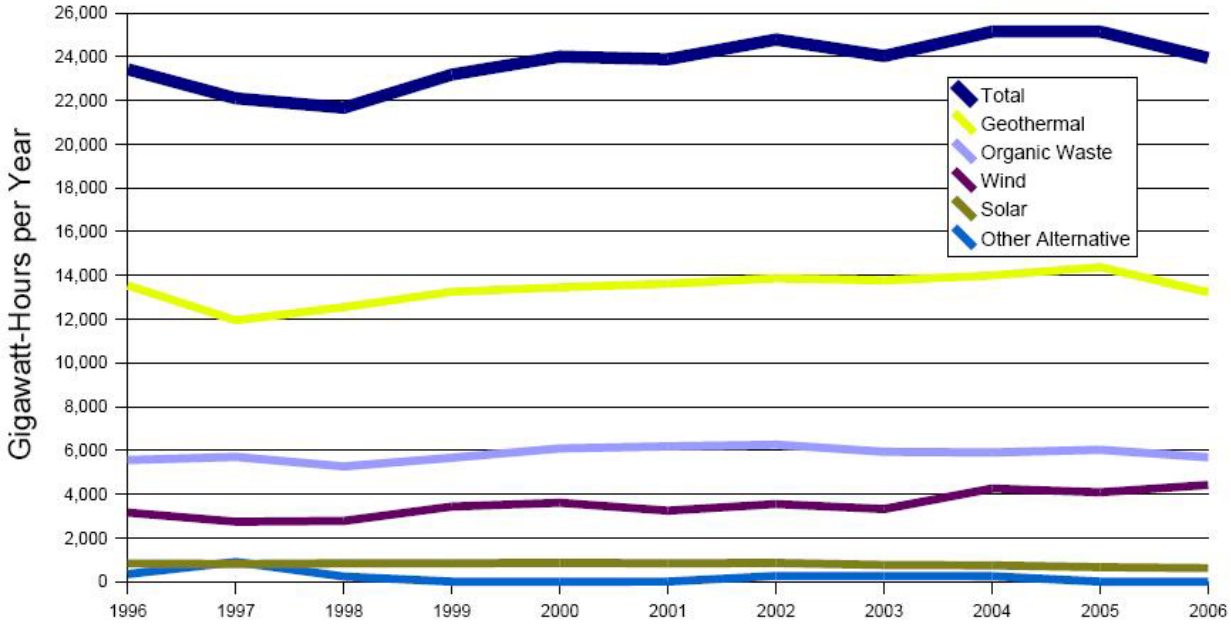

Figure 3.8-1b California Electrical Energy Alternative Sources

Source: MO'C Physics Applied, *Energy Study for the Santa Clara-Alum Rock Corridor, March 31, 2008.*

Sources of Jet Fuel, Gasoline, and Diesel Fuel. Whereas electricity is in effect "manufactured" from many sources of energy (coal, hydropower, natural gas, etc.), the liquid fuels that propel non-electric transit vehicles, trains, automobiles, and aircraft are refined almost entirely from crude oil. The data in Table 3.8-3 demonstrate that the bulk of California's crude oil supply is imported.

Table 3.8-3
2006 Source Areas of Crude Oil
(Thousands of Barrels Per Year)

California	Percent	Alaska	Percent	Foreign	Percent	Total
254,498	38.8	105,684	16.1	295,306	45.1	655,488

Source: California Energy Commission, http://ww.energy.ca.gov/oil/statistics/crude_oil_recepits.html, accessed March 2, 2008.

Other products are derived from petroleum in California's refineries, such as asphalt; however, the bulk of production in California is transportation fuels. California also directly imports some transportation fuels and fuel blend stocks, but California refineries principally meet the State's demand for transportation fuels. Figure 3.8-2 shows that the amount of imported oil used in California refineries has been increasing year-by-year in recent years.

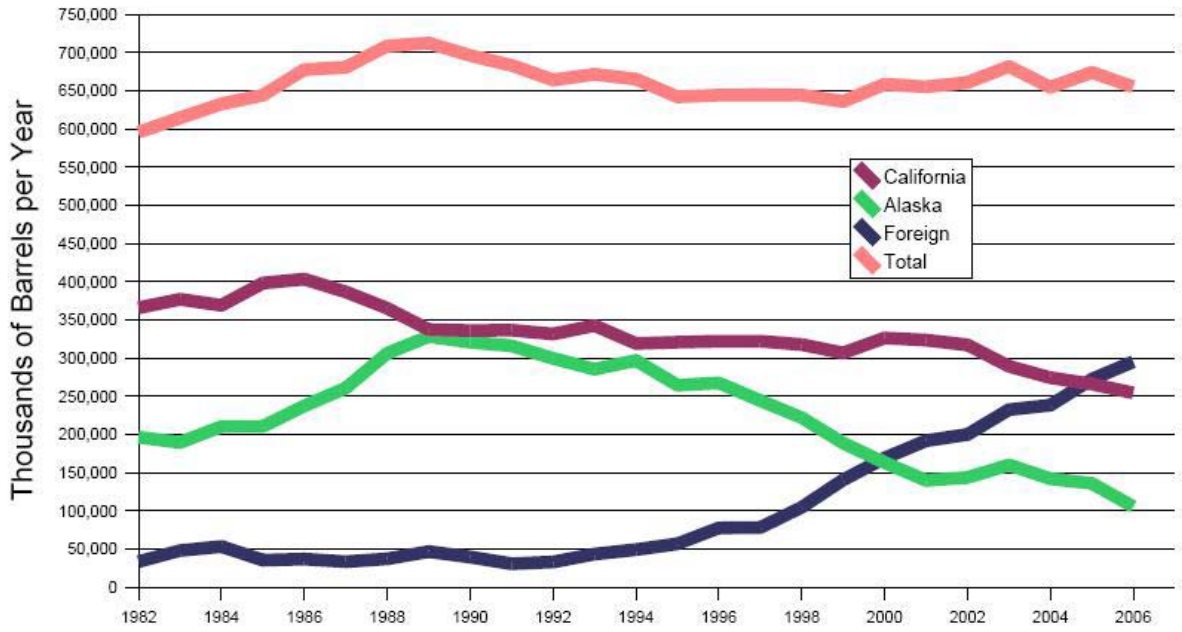

Figure 3.8-2 Oil Supply Sources to California Refineries

Source: MO'C Physics Applied, *Energy Study for the Santa Clara-Alum Rock Corridor, March 31, 2008.*

Table 3.8-4 shows a breakdown of the products that are produced from crude oil in California refineries. The table does not demonstrate that the gasoline currently sold in California contains about 5.7 percent ethanol (drinking alcohol) by volume, as an additive, which is principally made by the fermentation of corn mash.

Table 3.8-4
California Petroleum Use

Fuel Type	Percent
Gasoline	51
Distillate Fuel Oil	15.3
Jet Fuel	12.6
Still Gas	5.4
Marketable Coke	5.0
Residual Fuel Oil	3.3
Liquefied Refinery Gas	2.8
Other	4.2
Total:	**100**

Source: California Energy Commission, *http://www.energy.ca.gov/gasoline/whats_in_barrel_oil.html,* accessed March 4, 2008.

Limited Versatility of Source Forms of Energy. Natural gas, the primary source of electrical energy in California, cannot be transformed into wholesale gasoline or diesel fuel. Similarly, it is not practical to convert any of the other sources of electrical power (refer to Table 3.8-2) into gasoline or diesel fuel. Gasoline and diesel fuel both derive almost entirely from petroleum. Similarly, petroleum, almost the only source of gasoline, is not used in California to produce electricity.

Existing Energy Use

Santa Clara County. Electricity usage in Santa Clara County is approximately six percent of the Statewide total.[4] Gasoline usage for the County is about five percent of Statewide usage, whereas diesel fuel usage is about three percent of the Statewide total.[5]

The data presented in the Tables above infers that energy is effectively portable over great distances. Consequently, Santa Clara County's own limited generation of energy products does not constrain the growth of energy use in the County. The balancing of demand and supply occurs on a regional scale. All but a fraction of energy consumed in the County is imported in finished form from elsewhere in the State and beyond.

Applicable Plans and Policies

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)

[4] California Energy Commission, http://www.energy.ca.gov/electricity/electricity_by_county_2005.html, accessed March 6, 2008.

[5] California Department of Transportation, California Motor Vehicle Stock, Travel, and Fuel Forecast, December 2006.

were developed, which requires 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. 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.

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.

California Air Resources Board. The California Air Resources Board (CARB) has also established regulations to help reduce emissions associated with diesel particulates. Under 13 CCR §2023.3, "Zero-Emission Bus Requirements," electrical buses of any kind would meet the requirements, but at present, the leading electrically-powered contenders are hydrogen fuel-cell powered buses.

Impact Assessment and Mitigation Measures

Standards of Significance

Based on significance criteria used by VTA, the proposed project may result in adverse effects related to energy if it would:

- 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.

Methodology

The methods used to evaluate the potential effects from operation (direct energy effects) of the proposed project are described below. The effects that the proposed project would have on regional energy supply (the combination of energy derived from petroleum fuels and electrical energy) were assessed. The effects on electricity reserved by the operation of Single LRT service during periods of peak-demand were also assessed.

Environmental Analysis

In order to determine energy impacts due to construction and operation of the proposed project, a level of significance is determined and reported in the impact statement. 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 (SU)." For this section, ENG refers to Energy.

For the purposes of this analysis, the proposed project includes the implementation of BRT and Single Car LRT in the Santa Clara-Alum Rock Corridor in two phases. Phase 1 includes the implementation of BRT service and Phase 2 includes the implementation of Single Car LRT service. Potential energy impacts associated with Phase 1 and Phase 2 of the proposed project, including proposed project options, would be largely similar. Therefore, the analyses for the two proposed project phases are discussed together. Areas in which the effects of the two phases differ are detailed within the discussion of each significance threshold.

Potential impacts associated with the extension of transit services in the Capitol Expressway Corridor were analyzed in the Capitol Expressway Light Rail Final Supplemental Environmental Impact Report (FSEIR) dated January 2007, which is incorporated herein by reference. Potential impacts of the

proposed project not analyzed in the Capitol Expressway Light Rail FSEIR are described below, as necessary.

EN-1. Implementation of the proposed project would not lead to a wasteful, inefficient, or unnecessary usage of energy. (LTS)

The articulated diesel-powered buses proposed for use in the Corridor with implementation of BRT service would consume approximately 65,000 gallons of diesel fuel per year. The BRT service would constitute roughly 0.07 percent of the annual consumption of diesel fuel in Santa Clara County of about 88,000,000 gallons, which is based on the starting assumption that the buses would run solely on diesel power.

In the future, some of the diesel fuel used by the buses could possibly be replaced by hydrogen fuel. VTA has recently complied with a requirement of the CARB respecting "zero-emission buses" (ZEB's) by procuring three buses that utilize hydrogen-gas-fueled fuel cells.[6] The three buses that are now in operation are part of a demonstration program and performance data are being gathered. VTA is required to obtain additional ZEB's; a minimum of 15 percent of buses acquired of the 2011 through 2026 model years must be ZEB's.[7] Consequently, the adoption of ZEB's will not immediately shift the use of diesel fuel (that would be used by BRT service) to the use of natural gas, which is the primary source of hydrogen. However, under the proposed project, there would be a shift from diesel fuel to natural gas by approximately 15 percent by about 2026.

The electrically powered articulated LRT cars would consume approximately 2.2 gigawatt-hours of electricity per year, which is roughly 0.01 percent of the annual consumption of electricity in Santa Clara County of about 16,000 gigawatt-hours.

Since petroleum is not considered a practical fuel for generating electricity in California, the demand for electricity required by Single Car LRT service would need to be met by sources of energy other than petroleum that are suitable to the production of electricity, such as natural gas. However, any gasoline savings as a result of Single Car LRT service (due to transit patrons reducing automobile usage) could ease overall demand for petroleum.

A public transit project, such as the proposed project, has the potential to alter the pattern of energy use—not only to consume new amounts of energy in a particular form, but to also diminish the energy use in some other form. For example, a new diesel bus route, such as BRT, would lead to additional consumption of diesel fuel. However, these new bus routes should also lead to a reduction in gasoline use due to some of the transit patrons substituting personal automobile use with transit use. Similarly, a new electrically powered LRT line may

---

6 California Code of Regulations, 13 CCR §2023.3.

7 Battery-powered buses or electric trolley buses powered by twin overhead wires would also qualify as ZEB's. ZEB's may have fuel-fired heaters for passenger comfort provided that the heaters are rigged so as to be inoperable if the ambient (outdoor) temperature exceeds 40 degrees Fahrenheit (° F).

diminish gasoline use somewhat, but also increase electricity use. The two phases of the proposed project represent shifts in demand from one end-use form of energy to another.

Therefore, while the implementation of either BRT service or Single Car LRT service would lead to increased energy use to power buses or LRT vehicles, respectively, these increases would be offset by a reduced demand for energy to power automobiles. Neither service would lead to a wasteful, inefficient, and unnecessary use of energy; therefore, a less-than-significant impact is anticipated.

EN-2. Implementation of the proposed project would not place substantial demand on regional energy supply. (LTS)

For BRT service, transit vehicles used in the Santa Clara-Alum Rock Corridor would be 60-foot articulated diesel-powered buses, which are similar or identical to those that are already operated by VTA. Approximately 476,700 additional transit vehicle miles per year would be associated with the operation of BRT in the Corridor. As previously mentioned, the articulated diesel-powered buses used for BRT service would consume approximately 75,000 gallons of diesel fuel per year, which is roughly 0.02 percent of the annual consumption of diesel fuel in Santa Clara County.

With the implementation of Single Car LRT service, LRT vehicles would be electrically powered articulated light rail cars similar to those that are presently in use on other VTA LRT lines. These 100-foot long cars can be connected together to form trains with "consists" of more than one car. However, only single-car consists are proposed for this Corridor, so that the 'trains' would actually be 'cars'. There would be approximately 328,900 new transit vehicle miles per year associated with Single Car LRT service. The electrically powered articulated LRT cars would consume approximately 4.3 gigawatt-hours of electricity per year, which is roughly 0.02 percent of the annual consumption of electricity in Santa Clara County.

The direct effects of the proposed project would be to place new demands on electricity and diesel fuel supplies. Conversely, the proposed project would reduce demands on gasoline due to transit patrons substituting the use of personal vehicles with transit use. VTA's 2005-2006 On-Board Passenger Survey, Final Report, October 2006 included the following question for transit riders: "If transit didn't exist, how would you have made this trip?" A total of 21 percent of riders replied that they would drive alone, which would result in approximately one in five transit riders generating additional greenhouse gases by using personal vehicles if transit did not exist. Therefore, the proposed project would not place a substantial demand on energy and would have a less-than-significant impact associated with regional energy demand.

EN-3. Implementation of the proposed project would not significantly increase electricity demand. (LTS)

The implementation of BRT service would not increase electricity demand, as it would rely on diesel power. Implementation of Single Car LRT service, however, would place new demands

on electricity and potentially natural gas supplies, which is primarily used in California to generate electricity. On the other hand, Single Car LRT service would reduce demands on gasoline due to transit patrons substituting automobile use with some transit use. Nonetheless, the demands on electricity would not be significant. As described above, the electrically-powered articulated light rail cars would consume approximately 4.3 gigawatt-hours of electricity per year, which is roughly 0.02 percent of the annual consumption of electricity in Santa Clara County of about 18,000 gigawatt-hours. This would not result in a significant increase in electricity demand and a less-than-significant impact is expected.

EN-4. Implementation of Phase 2, Single Car LRT, would increase peak period electricity demand. (SU)

The electricity transmission network in California is under increasing strain to meet the growing demand, especially during peak periods. Peak period demand can be significantly higher than off-peak demand. The ability of California's energy infrastructure to generate and deliver electricity during peak periods may be affected by the retirement of aging power plants; the slow pace of new plant construction; the limitations of the transmission network to supply surplus electricity from other regions; and inadequate infrastructure for the delivery and storage of natural gas, which provides 40 percent of the fuel for California's power plants.

Phase 1 - BRT would not increase peak period electricity demand, as it would rely on diesel power. In general, Phase 2 - Single Car LRT would have a beneficial effect on overall energy use by reducing vehicle miles traveled and generating a relatively small increase in total electricity demand. However, information from the California Energy Commission suggests that any proposed project that would increase the demand for electricity would have an energy impact due to constrains on electricity supply, especially during peak periods. Since Single Car LRT increases demand on the Statewide electrical transmission grid, an energy impact would occur during peak hours. However, Single Car LRT would be designed to incorporate energy efficiency features consistent with VTA's Sustainability Program, thereby reducing the long-term energy requirements and the operating costs. Because no mitigation is available to reduce this impact to a negligible level, it is considered significant and unavoidable.