4.8 ENERGY

4.8.1 INTRODUCTION

The FEIR included an evaluation of the long-term energy consumption impacts for BART Silicon Valley, which was updated in the SEIR-1. This section includes an updated energy analysis that entirely replaces the energy sections in the FEIR and SEIR-1. This section, which focuses only on Phase 1, contains energy data that have become available since certification of the SEIR-1.

4.8.2 ENVIRONMENTAL SETTING

4.8.2.1 Existing State Electricity Generation and Demand

In 2008, California energy sources included natural gas (45.7 percent); nuclear (14.4 percent); coal (18.2 percent); large hydroelectric (11.0 percent); and renewable (including wind, solar, and geothermal) (10.6 percent). Electricity imports in 2008 were approximately 32 percent of total production. Imports from the Pacific Northwest and Southwest accounted for 7.8 percent and 24.2 percent, respectively.[1] In 2008, peak electricity demand for California was 286,771 gigawatt hours (GWh); the peak demand projected for 2016 is 320,178 GWh.[2]

4.8.2.2 Electricity Generation and Demand Outlook

Using the growth trend that fits the California Energy Commission (CEC) demand predictions through 2018 (published in the *2008–2018 Electricity Outlook*[3]), demand for electricity in 2030 is estimated at approximately 330,000 GWh.

4.8.3 REGULATORY SETTING

The regulatory setting included in the FEIR describing the federal Corporate Average Fuel Economy Standards, Transportation Equity Act, Title 24 of the California Code of Regulations and Assembly Bill 1X remains applicable in this SEIR-2. Please refer to **subsection 4.8.2.2** of the FEIR for a discussion of these regulations.

Following is an updated discussion of the energy-related regulations enacted since certification of the SEIR-1.

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[1] California Energy Commission, Integrated Energy Policy Report, December 2009.

[2] California Energy Commission, Integrated Energy Policy Report, December 2009.

[3] Calculation based on CEC demand projections from 2002 to 2012 for normal temperature years, published in *2008 – 2018 Electricity Outlook* (California Energy Commission, 2002b). Projection to 2030 assumes an average annual growth rate of about 2.0 percent, with a range of 1.5 to 3.9 percent. This projection is for comparison purposes only.

4.8.3.1 Senate Bill 375—California's Regional Transportation and Land Use Planning Efforts

Since certification of the SEIR-1, California enacted legislation (SB 375) to reduce greenhouse gas (GHG) emissions by modifying land use practices. Under federal and State law, each of the California Metropolitan Planning Organizations (MPOs) (the transportation planning organizations for the region) is required to develop a Regional Transportation Plan (RTP). SB 375 adds a new State requirement to include a Sustainable Community Strategy, which includes an underlying land use plan for the RTPs tied to the regional transportation system, ultimately resulting in GHG reductions. If regions develop integrated land use, housing, and transportation plans that meet the SB 375 targets, new projects in these regions can be relieved of certain review requirements of the California Environmental Quality Act.

Electricity and natural gas are both alternative fuels for the transportation sector that are less GHG-intensive than gasoline or diesel. Opportunities may exist for significant growth in alternative-fueled transit services that increase energy-related emissions while reducing overall emissions.

4.8.4 PROJECT IMPACTS AND MITIGATION MEASURES

The FEIR included an evaluation of seven stations plus one future station, and the SEIR-1 evaluated six stations plus one future station, as both documents considered the entire BART Silicon Valley. This SEIR-2 addresses only Phase 1, which includes two stations and several design changes since certification of SEIR-1. As a result of the phasing of BART Silicon Valley, the remaining four stations and one future station would be included under subsequent phases of BART Silicon Valley. An updated evaluation of long-term energy consumption impacts is provided below, considering the changes in the phasing of BART Silicon Valley and resultant updates to the operating plans and ridership forecasts for Phase 1.

The direct energy requirements of Phase 1 were estimated based on the updated vehicle miles traveled (VMT) forecast for each major transportation mode in 2030. The direct energy requirements of the FEIR and SEIR-1 projects were estimated based on the VMT forecast for each major transportation mode in 2030. The travel demand model, as discussed in **Section 4.2, Transportation**, of this SEIR-2, projects hourly/weekday vehicle trips and corresponding VMT for five modes: bus, light rail transit (LRT), BART, commuter rail, and auto (including trucks). VMT was annualized for each mode using expansion factors derived from conceptual service plans (in the case of transit modes) and historical relationships of weekday and annual vehicle trips (in the case of autos).[4]

[4] The annual VMT were estimated by multiplying average weekday VMT by 291.

Table 4.8-1 summarizes the estimated annual VMT by mode for Phase 1 and No Project conditions. No Project conditions are projected to generate slightly more VMT in 2030 than Phase 1. At the transportation system level, however, the differences are negligible (less than 1 percent). This is due to the very high VMT associated with auto travel in a large travel study area, which was increased to include additional counties in the region. VMT was converted to energy use using fuel efficiency factors (e.g., gallons of gasoline or diesel fuel, or kilowatt hours [kWh] of electricity consumed per vehicle mile). These factors are listed in **Table 4.8-2**.

Table 4.8-1: Annual Vehicle Miles Traveled (in millions) for Vehicle Operations by Mode (2030)

Transportation Mode	No Project Conditions	Phase 1
Bus	14.4	14.2
LRT	5.1	5.1
BART	109.4	117.6
Commuter Rail	2.7	2.7
Subtotal	128.9	137.0
Auto/Truck	64,615.6	64,576.4
Total	**64,744.5**	**64,713.4**
Difference from No Project Conditions	0.0	-31.1
Percent Change	0.00%	-0.05%

Source: ICF, 2010.

Because transit and auto modes consume different types of energy, to provide for a common measure of comparison, kWh of electricity or gallons of fossil fuels consumed (or saved) were converted to their British thermal unit (BTU) equivalents. Energy use is expressed at two levels: in terms of the direct energy content of electricity and fuels consumed or saved, and as the total energy content of each energy unit. The former is the specific energy available at the point of use, while the latter includes the energy required to recover, refine, and transport the energy unit to its final point of use. For instance, a kWh has a final or direct energy content of 3,416 BTUs, but an additional approximately 4,600 BTUs of energy is required to generate and transmit the kWh to its point of use. Therefore, the total energy content of a kWh is estimated at approximately 8,000 BTUs.

Direct and total energy use for vehicle operations, by mode, was converted to direct and total energy use by multiplying energy use in BTUs per vehicle mile by the annual VMT by mode.

Table 4.8-2: Direct and Total Energy Use by Transit and Auto Mode (millions of Vehicle Miles Traveled)

Mode	Energy Unit[a]	Direct Energy BTU per Energy Unit[b]	Total Energy BTU per Energy Unit[c]	Ratio Total to Direct	Modal Energy Vehicle use Per Mile[d]	Direct BTUs	Total BTUs
Bus	gallons diesel equivalent[e]	127,460	162,370	1.27	0.17 gallons	21,668	27,603
LRT	kilowatt-hour	3,416	8,000	2.34	8.50 kWh	29,036	68,000
BART	kilowatt-hour	3,416	8,000	2.34	4.00 kWh	13,664	32,000
Commuter Rail	gallons diesel[e]	127,460	162,370	1.27	0.62 gallons	79,025	100,669
Auto/Truck	gallons gasoline equivalent[f]	113,430	150,210	1.32	0.04 gallons	4,537	6,008

[a] Primary form of energy used. For bus and auto, various energy sources may be in use by 2030 and 2030, including electric, hybrid gas-electric, fuel cell, and gasoline. These have been expressed in one energy type and in the energy content equivalent for that type.

[b] BTU = British thermal unit. The net energy content of energy unit at its point of use.

[c] The total energy content of a unit, including energy used to recover, refine, and transport to the point of use.

[d] Assumed bus fuel economy of 6 miles per gallon (mpg), commuter rail of 1.6 vehicle mpg, and combined auto/truck economy of 28.5 mpg.

[e] Diesel values are reported for ultra low sulfur diesel.

[f] Gasoline values are reported for California reformulated gasoline, which is blended with an oxygenate (ethanol).

Sources: California Air Resources Board, 2009; TIAX LLC; California Energy Commission, 2007; Parsons Corp., 2003; Energy and Transportation Systems, Caltrans, 1983; PG&E.

Annual direct and total energy for vehicle operations is shown in **Table 4.8-3**. With two stations, Phase 1 is estimated to operate with 68.1 billion fewer BTUs per year in direct energy and 24.8 billion higher BTUs in total energy than No Project conditions (less than 0.1 percent).

In addition to energy for vehicle operations, energy for facility operations was estimated for each transportation mode and Phase 1. This “other” energy requirement was calculated on a percentage basis. For example, about 25 percent of BART’s existing power requirements are for station and other facilities operations (the other 75 percent is for vehicle propulsion). It was assumed that this relationship would apply to Phase 1 as well. The facilities and other energy requirements for other transit modes were estimated at 10 percent of the total power requirements for a mode. No facilities or other energy requirements were estimated for autos. This was because the change in auto VMT between Phase 1 and No Project conditions was marginal relative to total transportation system auto VMT. The relatively small change was determined not to have a measurable effect on the annual energy required to operate and maintain the road and highway system. Like the analysis of propulsion energy impacts, the energy requirements for facilities and other operations were estimated in terms of both direct and total energy.

Table 4.8-3: Annual Direct and Total Energy Use for Vehicle Operations by Mode and Alternative in 2030

Mode	No Project Conditions: Direct BTUs	No Project Conditions: Total BTUs	Phase 1: Direct BTUs	Phase 1: Total BTUs
Bus	311,361	396,640	308,411	392,881
LRT	148,943	348,813	148,943	348,813
BART	1,494,400	3,499,766	1,607,181	3,763,890
Commuter Rail	212,985	244,932	212,985	244,932
Subtotal	2,167,689	4,490,151	2,277,520	4,750,517
Auto/Truck	293,173,873	388,236,335	292,995,973	388,000,750
Total	**295,341,563**	**392,726,486**	**295,273,493**	**392,751,267**
Difference from No Project Conditions	0	0	-68,070	24,781
Percent Change	0.00%	0.00%	-0.02%	0.01%

Source: ICF, 2010.

The estimates of energy consumed in vehicle propulsion and in facilities operation were combined to yield a net energy requirement for Phase 1. **Table 4.8-4** shows the net annual direct and total energy use, with a further breakdown by mode. Phase 1 is estimated to require 30.8 billion fewer BTUs per year in direct energy than No Project conditions. This relationship reflects the annual energy savings under Phase 1 operations due to reduced auto travel, which more than offsets the additional energy requirements of operating more transit service under No Project conditions.

Phase 1 includes only two stations and the extension of the BART alignment to the proposed Berryessa Station; thus, the energy requirements are substantially less than what was assumed in the FEIR and SEIR-1 for the entire BART Silicon Valley.

Table 4.8-4: Net Annual Direct and Total Energy Use for Vehicle and Facilities Operations by Mode and Alternative

Mode	No Project Conditions: Direct BTUs	No Project Conditions: Total BTUs	Phase 1: Direct BTUs	Phase 1: Total BTUs
Bus	345,957	440,711	342,679	436,535
LRT	165,492	387,570	165,492	387,570
BART	1,992,533	4,666,354	2,142,908	5,018,521
Commuter Rail	236,650	272,147	236,650	272,147
Subtotal	2,740,633	5,766,782	2,887,729	6,114,772
Auto/Truck	293,173,873	388,236,335	292,995,973	388,000,750
Total	**295,914,506**	**394,003,117**	**295,883,702**	**394,115,522**
Difference from No Project Conditions	0	0	-30,804	112,405
Percent Change	0.00%	0.00%	-0.01%	0.03%

Source: ICF, 2010.

Since the 2004 FEIR was approved, the slow to flat growth in electricity demand that occurred after the 2000–2001 energy crisis has accelerated. In addition to population and economic growth, higher-than-average summer temperatures and decreased consumer conservation efforts have increased electricity consumption in California from 250,241 GWh in 2001 to 270,927 GWh in 2004 to 286,771 GWh in 2008. The CEC forecasts that consumption will grow by 1.2 percent annually from 2010 to 2018, with peak demand growing an average of 1.3 percent annually over the same period (CEC, 2009). At the same time, the electricity generation and 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 retirement of aging power plants, slow pace of new plant construction, 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 45.7 percent of the fuel for power plants in California) may affect the ability of the state's energy infrastructure to generate and deliver electricity to where it is needed.

In general, Phase 1 will have a neutral effect on overall energy use, but it would reduce VMT slightly and generate a small increase in total electricity demand. However, information from the CEC suggests that any project that will increase the demand for electricity will have a significant energy impact due to constraints on electricity supply, especially during peak periods.

Phase 1 would increase demand for electricity slightly. As shown in **Table 4.8-4**, under the No Project conditions, BART would use a total of 1,992,533 direct BTUs. Under Phase 1, BART would use 2,142,908 direct BTUs, resulting in an increase of about 7.5 percent for electricity demand for BART. Because forecasts indicate that existing and planned resources will not meet demand, the importation of surplus energy from other generators will be required, particularly in the Southwest and Pacific Northwest. Due to the availability of imported energy from neighboring states, the impact of Phase 1 on the electrical power generation system would not be significant.

However, according to the 2005 Integrated Energy Policy Report,[5] congestion and bottlenecks along the state's transmission lines have worsened, causing serious disruptions in service, especially on hot summer days. Until the recommended improvements in transmission infrastructure are implemented, reliability cannot be assured. Because the project would increase demand on the statewide electrical transmission grid, this impact is potentially significant.

The required mitigation would involve implementing recommended improvements in the statewide transmission infrastructure. Because the project has no control over these improvements and there is no guarantee that these improvements will be implemented, electricity demand as a result of Phase 1, especially during peak periods, is considered significant and unavoidable.

4.8.5 CONCLUSION

The design changes made since certification of the SEIR-1 result in no new significant impacts related to total energy demand. As Phase 1 incorporates the phasing of BART Silicon Valley, and thus involves only the 9.9-mile extension of the BART alignment and two stations, Phase 1 would result in reduced energy demand compared to the entire BART Silicon Valley evaluated in the FEIR and SEIR-1. However, recognizing the deficiencies in the statewide transmission infrastructure, there is no cost-effective, feasible mitigation for ensuring that the demand for electricity by Phase 1 can be accommodated during peak periods without disruptions. As a result, this impact is still considered potentially significant and unavoidable.

[5] California Energy Commission, 2005 Integrated Energy policy Report, November 21, 2005.

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