3.4 ENERGY

This section provides an analysis of the energy effects as measured in terms of estimated fuel consumption. The analysis also considers construction period energy usage. The evaluation is based on preliminary estimates of projected increases in rail ridership and related potential diversions from other modes of transportation, as well as estimates of energy consumption during construction based on data from similar projects.

3.4.1 REGULATORY REQUIREMENTS

Federal

Corporate Average Fuel Economy

Corporate Average Fuel Economy (CAFE) requires vehicle manufacturers to comply with the gas mileage, or fuel economy, standards set by the Department of Transportation (DOT). CAFE values are obtained using the city and highway fuel economy test results and a weighted average of vehicle sales. The EPA administers the testing program that generates the fuel economy data. The National Highway Traffic and Safety Administration (NHTSA), part of DOT, is authorized to assess penalties based on the information EPA supplies and to modify the standards.

Executive Order 12185, Conservation of Petroleum and Natural Gas

Executive Order 12185 encourages additional conservation of petroleum and natural gas by recipients of Federal financial assistance.[1]

State

California Code of Regulations, Title 24, Part 6, Energy Efficiency Standards

Title 24, Part 6 of the California Code of Regulations, Energy Efficiency Standards, ensures efficient energy use in new buildings constructed, or for additions and alterations to, residential and nonresidential buildings in California. The standards

[1] December 17, 1979, § 44 F.R.75093

regulate energy consumed for heating, cooling, ventilation, water heating, and lighting. The standards are updated approximately every three years and are enforced through the local building permit process.[2] These standards may apply to the proposed passenger stations included within the Build Alternative.

Local

Monterey County General Plan

The Monterey County General Plan Conservation/Open Space Element provides policies to promote efficient energy use. The use of solar, wind, and other renewable resources in new buildings is encouraged, minimization of energy expenditure for transportation, and directed development to conserve energy is favored.

San Luis Obispo County General Plan

The San Luis Obispo County General Plan Conservation and Open Space Element contains policies and implementation strategies related to energy conservation. These policies prioritize increased conservation and efficiency in all sectors of energy use, development and use of renewable resources, local control of energy decisions and sources, decreasing energy consumption, offering incentives for energy conservation, and integrating green building practices and incentives.

3.4.2 METHODS OF EVALUATION

This section describes the methods used to estimate the potential energy-related impacts and benefits associated with the proposed rail improvements under study. Impacts resulting from construction and operation are identified and evaluated.

Operational Energy Use

Energy use from operations is the energy consumed in the actual operation of the train as it moves down the track. This energy usage accounts for more than half of the total energy used when analyzed in terms of the life of a project.

[2] California Energy Commission, 2014

The analysis of transportation-related energy consumption focuses on the estimated fuel consumption relative to the use of existing transportation modes (auto, air, etc.). The energy consumption factors for automobiles were obtained from the *Transportation Energy Data Book: Edition 32,* which bases its estimates on national averages for road, traffic, and weather conditions and are intended for general comparisons.[3] The analysis utilizes ridership findings, diversions from other modes of transportation, and any difference in energy usage. Reviewing the ridership forecasts from the Coast Daylight SDP provides a quantitative basis for calculating the energy consumption from VMT reduction due to increased passenger rail ridership.

Construction Energy Usage

Construction energy usage is the energy needed to construct and maintain a facility, and manufacture and maintain vehicles using the facility. The primary construction energy consumption for this analysis is the energy that would be used to construct and maintain new rail infrastructure. This method uses construction energy intensity factors[4] to calculate energy consumption. **Table 3.4-1** presents the construction energy consumption factors used in this analysis. These estimates are appropriate for comparison purposes.

Additional energy resources would be consumed by the manufacturing and transportation of materials and equipment to and from any work sites. The amount of energy resources cannot be reasonably estimated without detailed construction plans and greater certainty about which elements of the Build Alternative will move forward for further design and potential construction. Therefore, energy consumption associated with such uses would be evaluated during any subsequent project-level environmental review.

[3] USDOE, 2013

[4] U.S. Congress, Budget Office 1977; U.S. Congress, Budget Office 1982; California State Department of Transportation 1983.

Table 3.4-1. Construction-Related Energy Consumption Factors

Type of Facility	Rural Compared to Urban[g]	Factor (billions of BTUs)
Highway – At grade	Rural[a]	17.07/one-way lane mile
	Urban[b]	26.28/one-way lane mile
Highway – Elevated	Rural[a]	130.38/one-way lane mile
	Urban[b]	327.31/one-way lane mile
Railway – At Grade	Rural[c]	12.29/one-way trackway mile
	Urban[d]	19.11/one-way trackway mile
Railway – Elevated	Rural[c]	55.46/one-way trackway mile
	Urban[d]	55.63/one-way trackway mile
Railway – Tunnel	NA[d]	99.51/one-way trackway mile
Railway – Station	NA[e]	78[f]/station

a Estimates reflect average roadway construction energy consumption.

b Estimates reflect range maximum for roadway construction energy consumption.

c Estimates reflect typical rail system construction energy consumption.

d Estimates reflect energy consumption for BART system construction as surrogate for rail construction through urban area.

e Discreet (i.e., non-alignment-related facilities) are not differentiated between rural or urban because the data used to develop the respective values were not differentiated as such. Some difference between the actual values might be expected.

f Value for construction of freight terminal. Used as proxy for station consumption factors.

g Differences between the construction-related energy consumption factors for urban and rural settings reflect differences in construction methods, demolition requirements, utility accommodation, etc

Source: U.S. Congress, Budget Office 1977; U.S. Congress, Budget Office 1982; California State Department of Transportation 1983.

3.4.3 AFFECTED ENVIRONMENT

The study area for energy use is the portion of the Coast Corridor between Salinas and San Luis Obispo, including the areas inside and outside of the existing railroad ROW in which potential physical improvements could be constructed.

Regional Environment

The transportation sector consumes the most energy of all sectors in California, making up approximately 38 percent of the total energy budget.[5] According to the California Energy Commission (CEC), the population in California is expected grow at an annual compound average rate of 1.1 percent between 2009 and 2030.[6] By 2020, California's infrastructure will face increased demands given the estimated 11 million more people and 98 million added intercity trips. This anticipated population growth is expected to result in increased demand for travel in California.

In general, demand for transportation services (and, therefore, transportation-related energy use) mirrors growth in population and economic output. In California, the CEC used historical trends coupled with current population and economic growth and gasoline price projections to estimate that on-road miles traveled will increase by 41 percent between 2003 and 2025 statewide—from 314 billion to 446 billion. Notwithstanding this large increase, the CEC predicts that in-state road transportation fuel gasoline usage is anticipated to remain steady at about 15 billion gallons of gasoline (315 million barrels of oil-equivalent) per year, as a result of the introduction of more fuel-efficient cars.[7]

Electricity Demand

The portion of the Coast Corridor considered in this document is located within the 70,000 square-mile service area of Pacific Gas and Electric (PG&E), a large investor-owned utility that serves 15 million people throughout northern and central California. PG&E produces or buys its energy from a mix of conventional and renewable generating sources, which is then delivered via 141,215 circuit miles of electric distribution lines and 18,616 circuit miles of interconnected transmission lines.[8]

3.4.4 ENVIRONMENTAL CONSEQUENCES

No Build Alternative

The No Build Alternative assumes that the only physical rail improvement that would be added between Salinas and San Luis Obispo would be the implementation

---

[5] EIA, 2011

[6] CEC, 2010, p. 11

[7] CEC, 2005a

[8] PG&E, 2013

of PTC. Construction-period energy use would be assumed during implementation of such improvements; operation of PTC would also require additional energy usage above existing levels.

Under the No Build Alternative, enhancement of passenger rail operations between Salinas and San Luis Obispo would not occur and existing passenger rail service would continue, including the Coast Starlight and Amtrak service to Southern California. Therefore, there would be little or no change in operational energy consumption related to passenger rail service in the Corridor.

As set forth in Chapter 9 of the SDP, freight rail operations in the Corridor are projected to increase. As of 2013, 2 daily long-haul freight trains travel between Salinas and San Luis Obispo. By the year 2020, the SDP projects that a total of 4 daily long-haul freight trains would travel along the Corridor. Accordingly, energy consumption related to freight rail would likely increase over existing conditions, though new freight rail service could potentially utilize newer, more energy efficient locomotive technology.

Build Alternative

Construction-Period Energy Usage

The Build Alternative would result in construction energy usage for the manufacture of materials, construction activities and equipment associated with implementation of the proposed rail improvements, travel of construction workers, and potential traffic delays and/or detours (rail and auto) as a result of construction.

Energy-related consumption factors for construction activities are presented in **Table 3.4-1.** Construction-related energy consumption for locomotives varies between 12 and 60 million BTUs, depending on the location of construction (i.e. urban/rural and elevated/at-grade).

The energy used during construction would be any additional energy consumption beyond what is associated with the No Build Alternative. This would constitute irretrievable energy expenditure. Specific design and construction plans are needed to calculate the construction-related energy consumption associated with each physical improvement.

Operational Energy Consumption

The Build Alternative will result in operating two additional trains per day, which will result in additional energy consumption.

Implementation of new service would likely result in increased ridership. It is expected that some, if not all of the additional passengers would have traveled via personal automobile or bus. Reviewing the ridership forecasts from the Coast Daylight SDP can provide a quantitative basis for calculating the energy consumption from VMT reduction due to increased passenger rail ridership. **Table 3.4-2** below from the Coast Daylight SDP presents annual ridership forecasts for 2020 and 2040.

Table 3.4-2. 2020 and 2040 Annual forecasts for Coast Daylight Service Options

	Forecast Year 2020		Forecast Year 2040	
	Baseline	Build	Baseline	Build
	Annual ridership			
Coast Daylight				
Markets North of San Luis Obispo	0	87,000	0	217,000
Markets Through San Luis Obispo	0	37,000	0	57,000
Total	0	124,000	0	274,000
Coast Starlight				
Markets North of San Luis Obispo	74,000	73,000	103,000	107,000
Markets Through San Luis Obispo	28,000	32,000	37,000	43,000
Total	102,000	105,000	140,000	150,000

Source: Caltrans Division of Rail, 2013b

The SDP forecasts increased ridership with the advent of new service, which could in turn potentially result in an overall decrease in automobile VMT. As shown in **Table 3.4-2**, the SDP projects that Coast Daylight service would generate about 124,000 annual person trips by 2020. This averages to about 300 person trips per day. The SDP roughly quantifies the increase in rail ridership into a projected reduction of about 11,000 daily VMT for the Central Coast/Monterey Bay region as a whole. The projected expansion of Coast Daylight service by the year 2040 would further reduce VMT in the Central Coast/Monterey Bay region by an additional 15,000 daily miles (26,000 daily miles total). It is expected that a portion of these passengers would be using the rail service in place of vehicle, bus, or air travel, thus reducing transportation-related energy consumption. These VMT reductions comprise relatively small amounts of total regional VMT and are thus expected to translate to small reductions in energy consumption.

Table 3.4-3 presents energy use associated with various types of passenger travel from 2011.

Table 3.4-3. Passenger Travel and Energy Use, 2011

	Vehicle Miles (millions)	Passenger Miles (millions)	Load factor (persons/ vehicle	Energy Intensities (Btu per vehicle mile)	Energy Intensities (Btu per passenger mile)	Energy Use (trillion Btu)
Cars	1,561,400	2,420,325	1.55	5,214	3,364	8,140.0
Transit Buses	2,425	21,574	8.9	37,718	4,240	91.5
Air (certified route)	5,542	566,622	102.2	269,681	2,638	1,494.7
Intercity Rail (Amtrak)	296	6,670	22.5	49,080	2,214	15.5

Source: USDOE, 2013.

As shown in **Table 3.4-3**, travel by rail is the most energy efficient mode of long-distance, intercity transportation. Intercity rail, such as Amtrak, consumes about 1,000 to 2,000 BTUs per passenger mile less than bus or automobile. This would result in substantial BTU savings per passenger mile, which over the life of the project would result in notable energy savings relative to the No Build Alternative.

Travel by airplane is also more energy efficient on a mile-by-mile basis when compared to automobiles and buses; however, air service is not a viable mode of transportation between Salinas and San Luis Obispo. Moreover, intrastate and other "short-hop" flights are generally considered less efficient on a fuel-per-mile basis, owing to substantial fuel requirements associated with take-off.

It should be noted that the rail would be more energy efficient only when sufficient number of passengers use the train. An empty train would not reduce energy consumption. The addition of the Coast Daylight service would have the potential to reduce automobile and bus VMT and energy consumption, but it would also increase rail VMT and associated energy consumption. The displacement of automobile VMT to increased ridership on the railway would result in reduced transportation-related energy consumption. However, rail trips would occur regardless of whether a person would choose to travel by car or by rail. Thus, there would only be a decrease in energy consumption if the traveler chooses to travel by rail instead of automobile.

Physical Improvements

Track Upgrades

Construction-Period Energy Usage

Construction of the track retrofits and upgrades would require manufacturing of steel to replace all lumber ties that are currently in place along the alignment. Manufacturing the steel and other materials for these track upgrades would increase indirect energy use.

Moderate energy consumption would also result from the use of powered construction equipment and travel of workers to work sites. Diesel powered trucks and/or locomotives would be needed to bring equipment and supplies to active construction areas. Additional temporary energy consumption would result from idling or slowed locomotives due to construction related interruptions to the existing railway.

Operational Energy Usage

Upgraded tracks would result in greater efficiencies by reducing friction and vibrations. Furthermore, proposed steel rail ties are recognized to require less maintenance, thereby resulting in reduced energy consumption from maintenance vehicles and equipment.

Signal Upgrades/New Powered Switches

Construction-Period Energy Usage

Construction of the signal upgrades and new powered switches would result in minimal indirect energy consumption. Manufacturing the materials needed and delivering them to the construction site would require energy use; however, the quantity needed is dependent on the number of signals that would be replaced/upgraded, which is currently unknown. Some energy consumption would occur associated with worker travel to and from the construction sites, but extensive use of heavy machinery to install these improvements is not anticipated.

Operational Energy Usage

The signal upgrades and new powered switches will improve operational service and reliability. Under the current Track Warrant Control (TWC) portions of the alignment, train operators must wait for permission from UPRR dispatchers before moving from block to block, slowing train speeds and resulting in periods of idling. CTC manages this centrally via remotely controlled signals and switches, reducing the amount of time trains spend idling, ultimately increasing the efficiency of the railway infrastructure.[9] These upgrades would likely improve the safety, efficiency, and reliability of service, which could result in greater ridership due to improved service, as well as allow for denser rail use (more trains on the railroad due to greater traffic control and efficiency). This could result in more energy consumption with more trains using the rail, but operations would run more efficiently and thus consumption could be offset by increased ridership (less individual VMT), and less time spend idling on the rail.

Curve/Track Realignments

Construction-Period Energy Usage

Construction of the curve and track realignments would result in increased indirect energy consumption from materials manufacturing. Operation of potential construction equipment, construction worker travel, as well as delays and detours during construction of the track realignments would also lead to additional energy consumption. Some of this increased energy consumption could be offset by improved service efficiency and subsequent increased ridership and related reduction in VMT. Given that the curve realignment designs are schematic, specific energy reduction resulting from improved service cannot be quantified.

Operational Energy Usage

Operational energy use may increase from improved train speeds along the Corridor resulting from track straightening. If one or more curve realignments ultimately reduce the length of the railway, this could offset some of the increased energy consumption related to higher speeds. Furthermore, increased train speeds could serve to improve train service, resulting in increased ridership and reduced consumption from personal automobiles.

Sidings/Siding Extensions and New Second Mainline

Construction-Period Energy Usage

Construction of new sidings, siding extensions, and the new second mainline would increase indirect energy consumption from new materials manufacturing. Operation of required construction equipment and construction worker travel would also lead to additional energy consumption. Some of this increased energy consumption could be offset by improved service efficiency and subsequent increased ridership and related reduction in VMT.

[9] Caltrans Division of Rail, 2013b, p. 9-4

Operational Energy Usage

Operational efficiency would increase with new and improved siding extensions and the new second mainline. There would be fewer passenger train delays as the new sidings would accommodate longer freight trains. Increased freight train delays could occur, resulting in increased freight rail energy consumption due to idling. However, overall less train idling could potentially occur due to more optimal locations of siding and increased train speeds. Operation of the new second mainline, along with improved signaling, would increase train speeds and result in increased locomotive efficiencies (in mpg), and could potentially reduce overall operational energy consumption. Personal automobile VMT and associated energy consumption would likely be reduced by improving the passenger rail service, and result in increased rail ridership.

New Stations

Construction-Period Energy Usage

Construction of the new passenger stations in Soledad and King City would increase indirect energy consumption resulting from manufacturing, operation of required construction equipment, and construction worker travel. However, the stations themselves would consist of a platform and minimal amenities, thus requiring nominal construction materials. Some of this increased energy consumption could be offset by increased ridership and related reduction in automobile VMT.

Operational Energy Usage

Operation of the new passenger stations would consume some energy, mostly to operate ticket stations, restrooms, and other general daily building energy needs. Both stations are anticipated to be simple, thus energy requirements will likely be low. Additional train stations would introduce new stops along the alignment, and could be expected to use more energy to accelerate and decelerate in these locations. Increased accessibly to the new stations would likely increase ridership, and could offset some of the added energy consumption by reducing personal vehicle VMT.

3.4.5 AVOIDANCE, MINIMIZATION, AND MITIGATION STRATEGIES

Avoidance, minimization, and mitigation measures would be developed and implemented as specific improvements are implemented to reduce potential energy related impacts. Such strategies may include the following:

MIN-TRA-1. Develop and implement a construction energy conservation plan.

MIN-TRA-2. Explore the opportunity to use newer, more energy efficient construction equipment and materials.

MIN-TRA-3. Consider, as feasible, acquisition of energy-efficient rolling stock to provide new passenger service.

MIN-TRA-4. Implement a program to encourage construction workers to carpool or use public transportation to get to and from active work sites.

MIN-TRA-5. As feasible, minimize grade changes in steep terrain areas to reduce the use of diesel fuel.

MIN-TRA-6. Encourage the development of intermodal transit connections to reduce automobile VMT associated with the railway.

3.4.6 SUBSEQUENT ANALYSIS

As specific components of the Build Alternative are further designed, a more refined analysis of operation and construction energy usage should be conducted. Evaluation and identification of appropriate mitigation measures will be conducted during project-level review where the impacts to energy usage would be substantial.