2.21 Energy

2.21.1 Regulatory Setting

NEPA (42 USC Part 4332) requires the identification of all potentially significant impacts to the environment, including energy impacts.

The CEQA Guidelines section 15126.2(b) and Appendix F, Energy Conservation, require an analysis of a project’s energy use to determine if the project may result in significant environmental effects due to wasteful, inefficient, or unnecessary use of energy or wasteful use of energy resources.

2.21.2 Affected Environment

2.21.2.1 State

California contains abundant sources of nonrenewable and renewable energy. Nonrenewable resources include large crude oil and natural gas deposits that are located within six geological basins in the Central Valley and along the coast. Much of these reserves are concentrated in the southern San Joaquin Basin. Regarding renewable resources, the state leads the nation in net electricity generation from solar, geothermal, and biomass. California has considerable solar potential, especially in the southeastern deserts; and several of the world's largest solar thermal plants are located in California's Mojave Desert. Although California’s wind power potential is widespread, especially along the eastern and southern mountain ranges, much of the state is excluded from development of this resource because it is in wilderness areas, parks, or urban areas.

The transportation sector is responsible for the most energy consumption of any sector within the state. More motor vehicles are registered in California than in any other state, and commute times in California rank among some of the longest in the country.

2.21.2.2 Regional

The U.S. Census Bureau estimates that the Orange County population was approximately 3.2 million in 2017. The existing population is heavily dependent on automobile travel due to the suburban development throughout most of the County. The majority of energy consumed in the County is from transportation fuels. The annual VMT in Orange County is 27,364,374,953, according to the California ARB EMFAC model. It is anticipated that the population will continue to be dependent on automobile travel in future years, although the OCTA plans to increase transit options in the region. For example, the OC Streetcar is anticipated to begin operations in 2021.

2.21.2.3 Local

Within the project limits, SR 55 currently has three to five general purpose lanes and a HOV lane in each direction, with auxiliary lanes between ramps at various locations. Based on information obtained from the Orange County Transportation Analysis Model (Version 4.0), the existing/baseline annual VMT is 716,385,439 with 94 percent non-trucks and 6 percent trucks.

This results in an annual fuel consumption of approximately 21,113,570 gallons per year of gasoline and 2,339,648 gallons per year of diesel fuel. Existing traffic management systems include metered ramps and changeable message boards. No new highway lighting is proposed for the project. Currently, lighting exists at near interchanges and on- and off-ramps. The existing pavement surface is considered to be in good condition, which contributes to energy efficiencies.

2.21.3 Environmental Consequences

Transportation energy is generally described in terms of direct and indirect energy. In the context of transportation, direct energy involves all energy consumed by vehicle propulsion (e.g., automobiles, trains, and airplanes). This energy consumption is a function of traffic characteristics such as VMT, speed, vehicle mix, and thermal value of the consumed fuel. Some projects may also include features such as new or replacement roadway lighting or other features requiring electricity which is an ongoing and permanent source of direct energy consumption. The one-time energy expenditure involved in constructing a project is also considered direct energy. Indirect energy includes maintenance activities which would result in long-term indirect energy consumption by equipment required to operate and maintain the roadway.

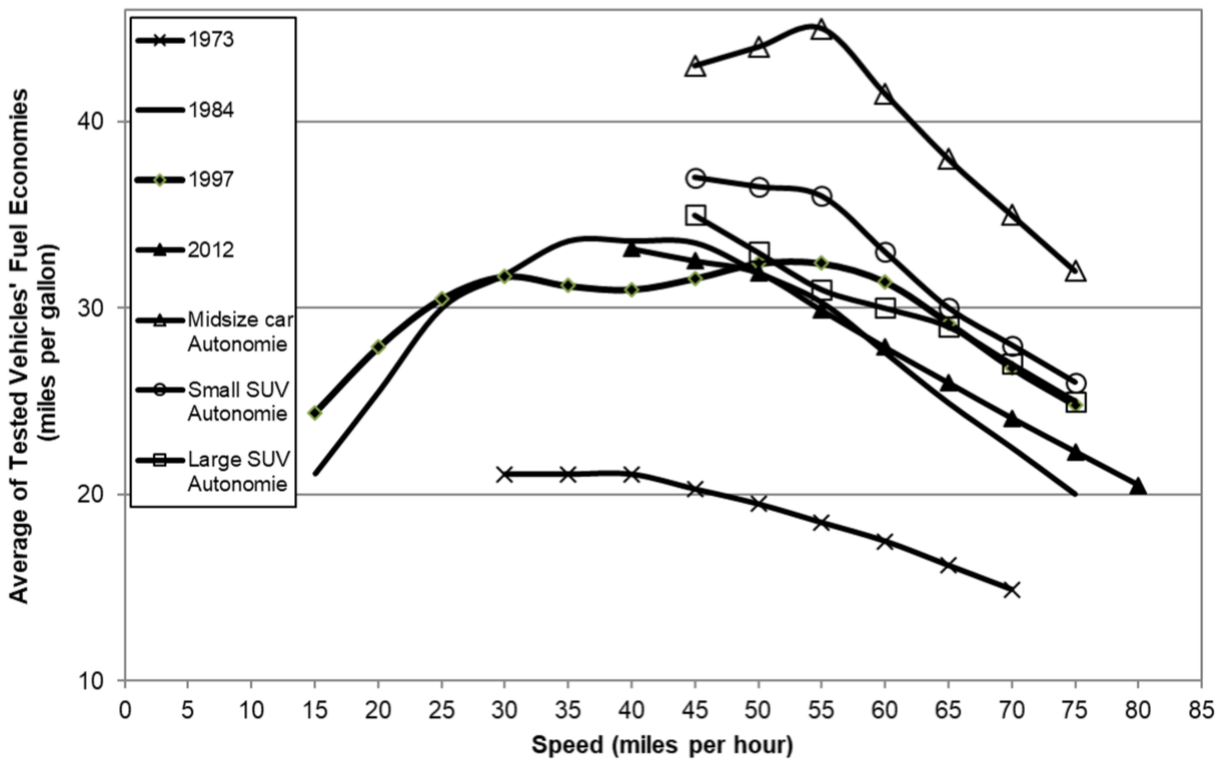
The following analysis includes the direct energy use during construction and long-term use of the facility, as well as indirect energy usage in terms of ongoing maintenance. This analysis is subject to the rule of reason and focuses on energy use that is caused by the project—a full "lifecycle" analysis that would account for energy used in building materials and consumer products is not required for the project.

2.21.3.1 Energy Use

Direct Energy (Mobile Sources)

The objective of the project is to reduce traffic congestion, improve mobility, and improve traffic operations in the study area. The project alternatives propose to accomplish this objective through operational improvements and/or capacity enhancement (i.e., general purpose lane) on the SR 55 study corridor. Congestion relief and capacity-increasing projects affect the capability of a roadway facility to address existing and future traffic demand. This results in changes to direct energy consumption (i.e., fuel usage) from vehicles using the facility. Another important consideration is that for operation of a project over the long term, newer and more fuel-efficient vehicles will enter the fleet, resulting in an overall lower potential for an increase in energy consumption due to vehicle traffic. This relationship is illustrated in Figure 2.21-1.

Figure 2.21-1. Fuel Economy by Speed (Based on Studies from 1973, 1984, 1997, 2012, and Autonomies Modeling)



Source: Oak Ridge National Laboratory 2016

Direct energy use in terms of diesel fuel and gasoline consumption from mobile sources was estimated using CT-EMFAC. CT-EMFAC is an emission model developed by the California Department of Transportation (Caltrans) that calculates project-level emissions and fuel consumption using data from the ARB EMFAC model. Table 2.21-1 shows that under the Existing/Baseline condition in 2017, annual VMT within the project area is approximately 716,385,439 and annual fuel consumption includes 2,339,648 gallons of diesel fuel and 21,113,570 gallons of gasoline. With substantial improvements in engine fuel efficiency anticipated, fuel consumption per vehicle mile will decrease in the future. In 2035, implementation of the project would marginally decrease regional gasoline and diesel consumption because of improved traffic operations. By 2055, implementation of the project would increase annual gasoline and diesel fuel consumption by less than 1 percent relative to the No Build condition.

Table 2.21-1: Annual VMT, Vehicle Percentages, and Operational Fuel Consumption

Analysis Year	Annual VMT	Vehicle Percentages (non-truck/truck)	Annual Fuel Consumption (gallons) Diesel	Annual Fuel Consumption (gallons) Gasoline
Existing/Baseline (2017)	716,385,439	94.0/6.0	2,339,648	21,113,570
Opening (2035) No Build	766,074,394	94.0/6.0	2,228,825	13,552,055
Opening (2035) Alt. 1	764,926,731	94.0/6.0	2,207,993	13,419,458
Design (2055) No Build	835,905,372	94.0/6.0	2,394,240	13,898,371
Design (2055) Alt. 1	841,700,065	94.0/6.0	2,398,483	13,974,103

Direct Energy (Electricity)

The majority of electricity used for the project would be associated with lighting. In the existing condition, SR 55 is lit where required to promote safe driving practices. The project does not include new light fixtures and the replacement or reduction of existing fixtures. New lighting associated with this section of SR 55 is anticipated to be included under a separate project as part of the median improvements along SR 55. Operation of the Build Alternative would maintain freeway lighting consistent with pre-construction conditions.

Direct Energy (Construction)

Construction energy effects involve the one-time, non-recoverable energy costs associated with construction of roadways and structures. Site preparation and roadway construction typically involves clearing, cut-and-fill activities, grading, removing or improving existing roadways, building bridges, and paving roadway surfaces. Construction-related effects on energy from most highway projects would be greatest during the site preparation and concrete paving phases because the excavation, handling, and transport of materials requires equipment and truck fuels.

The Section 2.13, Air Quality, includes a quantification of construction-related carbon dioxide equivalent (CO_2e) emissions using the Road Construction Emissions Model. These emissions were used to estimate construction energy from CO_2e emission factors derived for the ARB greenhouse gas (GHG) emissions inventory. For gasoline fuel, approximately 25.4 pounds of CO_2e are generated per gallon combusted, and for diesel fuel approximately 29.8 pounds of CO_2e are generated per gallon combusted. The fuel consumption was estimated from the equipment and vehicles that would be employed in construction activities. Diesel engines are installed in heavy-duty off-road construction equipment and on-road haul trucks. Gasoline engines are typically found in passenger vehicles that would be used for construction worker daily commutes. Table 2.21-2 presents the direct, one-time expenditure of fuel consumption associated with construction activities. Construction would require approximately 310,629 gallons of diesel and 37,432 gallons of gasoline.

Table 2.21-2: Construction Fuel Consumption

Construction Phase	Duration (Months)	Fuel Consumption (gallons) Diesel	Fuel Consumption (gallons) Gasoline
Grubbing/Land Clearing	3.6	17,307	2,348
Grading/Excavation	14.4	170,314	17,756
Drainage/Utilities/Sub-Grade	12.6	95,159	13,047
Paving	5.4	27,849	4,281
Total	**36.0**	**310,629**	**37,432**

Indirect Energy (Maintenance)

Maintenance comprises energy for the day-to-day upkeep of equipment and systems, as well as the energy embedded in any replacement equipment, materials, and supplies. The energy needed to maintain the project improvements would not be measurably greater than the energy used to maintain the existing SR 55 roadway within the project limits. For example, project operations would not require Caltrans to purchase additional maintenance vehicles.

Consistency with Energy Conservation Plans

The project would be consistent with regional and State energy conservation plans. Planning documents with relevant energy assessments include the 2016 RTP/SCS Draft Environmental Impact Report (EIR) published by the SCAG (2015b) and the 2018 Integrated Energy Policy Report (IERP) published by the California Energy Commission (CEC 2018). The 2016 RTP/SCS includes a comprehensive assessment of regional energy consumption primarily focused on residential and commercial electricity, natural gas, and water use. The 2016 RTP Draft EIR (SCAG 2015b) includes a brief analysis of transportation fuel consumption. SCAG concluded in the Draft EIR that the 2016 RTP/SCS would have a less than significant impact on increasing petroleum and non-renewable fuel usage because fuel consumption is expected to result in a 26.7 percent net reduction in the SCAG region from the 9.3 billion gallons consumed in 2012 to the projected 6.8 billion gallons consumed in 2040. As shown above in Table 2.21-1, transportation fuel use would be less in the project opening and design years than existing/baseline condition. Furthermore, transportation fuel use in 2035 would be less with the project than without the project. A slight increase in fuel use would occur in 2055 due to increased VMT, although the additional transportation fuel use would represent a less than 1 percent increase in fuel use from the No Build Alternative. The project would be consistent with the energy findings in the 2016 RTP/SCS and would not interfere with implementation of the 2016 RTP/SCS.

The 2018 IERP (CEC 2018) includes key goals to guide the State's energy policy, including reducing petroleum use in cars and trucks by up to 50 percent. The discussion related to this goal broadly focuses on increasing the number of zero- or near-zero emission vehicles operating on the roadway network. It is also noteworthy that improving driving conditions reduces petroleum use. The Traffic Operations Report (July 2018) concludes that AM and PM peak period vehicle delays would decrease by 19 percent and 6percent, respectively, in 2035. The AM and PM peak period vehicle delays would decrease by 14 percent and 4 percent, respectively, in 2055. The congestion improvement would reduce vehicle idling and associated fuel consumption. This would be consistent with the goal of reducing petroleum use in cars and trucks by up to 50 percent and the project would not interfere with implementation of the 2018 IERP.

Energy Findings

Regarding long-term and permanent energy consumption, operational activities would primarily require energy for transportation fuel, electricity for lighting, and maintenance activities. The consumption of transportation fuel would be the dominant energy use. As indicated above, implementation of the project would marginally decrease regional fuel consumption in 2035 and would increase regional mobile source fuel consumption by less than 1 percent in 2055. The project does not include a substantial number of new light fixtures, and the replacement of existing fixtures would incorporate the use of energy-efficient lighting. The project would not significantly increase regional energy consumption, and the project would not interfere with the implementation of energy conservation plans. Therefore, the project would not result in an inefficient, wasteful, and unnecessary consumption of energy.

Regarding short-term and temporary energy consumption, construction activities would primarily consume diesel and gasoline through operation of heavy-duty construction equipment, material deliveries, and debris hauling. As indicated above, energy use associated with proposed project construction is estimated to result in the short-term consumption of 310,629 gallons from diesel-powered equipment and 37,432 gallons from gasoline-powered equipment. This represents a small demand on local and regional fuel supplies that would be easily accommodated, and this demand would cease once construction is complete. Moreover, construction-related energy consumption would be temporary and no permanent new source of energy demand would result from project construction activities. While construction would result in a short-term increase in energy use, construction-related fuel use would have no noticeable effect on peak or baseline demands for energy, and construction design features would help conserve energy. For example, recycled materials will be used where feasible. Recycled products typically have lower manufacturing and transport energy costs since they do not utilize raw materials, which must be mined and transported to a processing facility. Therefore, construction activities would not result in an inefficient, wasteful, and unnecessary consumption of energy.

2.21.4 Avoidance, Minimization, and/or Mitigation Measures

The project will incorporate the project features in Section3.2, Climate Change to help avoid and/or minimize potential impacts. No additional avoidance, minimization, and/or mitigation measures other than the project features identified in Section 3.2 are required.