3.2 Greenhouse Gas Emissions

This section describes the existing conditions related to greenhouse gas (GHG) emissions, identifies associated regulatory requirements, and evaluates potential impacts related to GHG emissions associated with implementation of the proposed Transportation Element and ECAS Update Project (project).

3.2.1 Existing Conditions

3.2.1.1 Climate Change Overview

Climate change refers to any significant change in measures of climate, such as temperature, precipitation, or wind patterns, lasting for an extended period of time (decades or longer). The Earth's temperature depends on the balance between energy entering and leaving the planet's system. Many factors, both natural and human, can cause changes in Earth's energy balance, including variations in the Sun's energy reaching Earth, changes in the reflectivity of Earth's atmosphere and surface, and changes in the greenhouse effect, which affects the amount of heat retained by Earth's atmosphere (EPA 2017a).

The greenhouse effect is the trapping and build-up of heat in the atmosphere (troposphere) near the Earth's surface. The greenhouse effect traps heat in the troposphere through a threefold process as follows: short-wave radiation emitted by the Sun is absorbed by the Earth, the Earth emits a portion of this energy in the form of long-wave radiation, and GHGs in the upper atmosphere absorb this long-wave radiation and emit it into space and toward the Earth. The greenhouse effect is a natural process that contributes to regulating the Earth's temperature and creates a pleasant, livable environment on the Earth. Human activities that emit additional GHGs to the atmosphere increase the amount of infrared radiation that gets absorbed before escaping into space, thus enhancing the greenhouse effect and causing the Earth's surface temperature to rise.

The scientific record of the Earth's climate shows that the climate system varies naturally over a wide range of time scales and that, in general, climate changes prior to the Industrial Revolution in the 1700s can be explained by natural causes, such as changes in solar energy, volcanic eruptions, and natural changes in GHG concentrations. Recent climate changes, in particular the warming observed over the past century, however, cannot be explained by natural causes alone. Rather, it is extremely likely that human activities have been the dominant cause of that warming since the mid-twentieth century and is the most significant driver of observed climate change (IPCC 2013; EPA 2017a). Human influence on the climate system is evident from the increasing GHG concentrations in the atmosphere, positive radiative forcing, observed warming, and improved understanding of the climate system (IPCC 2013). The atmospheric concentrations of GHGs have increased to levels unprecedented in the last 800,000 years, primarily from fossil fuel emissions and secondarily from emissions associated with land use changes (IPCC 2013). Continued emissions of GHGs will cause further warming and changes in all components of the climate system.

3.2.1.2 Greenhouse Gases

A GHG is any gas that absorbs infrared radiation in the atmosphere; in other words, GHGs trap heat in the atmosphere. As defined in California Health and Safety Code Section 38505(g), for purposes of administering many of the state's primary GHG emissions reduction programs, GHGs include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen

trifluoride (NF_3) (see also 14 CCR 15364.5).[1] Some GHGs, such as CO_2, CH_4, and N_2O, are emitted into the atmosphere through natural processes and human activities. Of these gases, CO_2 and CH_4 are emitted in the greatest quantities from human activities. Manufactured GHGs, which have a much greater heat-absorption potential than CO_2, include fluorinated gases, such as HFCs, PFCs, and SF_6, which are associated with certain industrial products and processes. The following paragraphs provide a summary of the most common GHGs and their sources.[2]

Carbon Dioxide. CO_2 is a naturally occurring gas and a by-product of human activities and is the principal anthropogenic GHG that affects the Earth's radiative balance. Natural sources of CO_2 include respiration of bacteria, plants, animals, and fungus; evaporation from oceans; volcanic out-gassing; and decomposition of dead organic matter. Human activities that generate CO_2 are from the combustion of fuels such as coal, oil, natural gas, and wood and changes in land use.

Methane. CH_4 is produced through both natural and human activities. CH_4 is a flammable gas and is the main component of natural gas. Methane is produced through anaerobic (without oxygen) decomposition of waste in landfills, flooded rice fields, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion.

Nitrous Oxide. N_2O is produced through natural and human activities, mainly through agricultural activities and natural biological processes, although fuel burning and other processes also create N_2O. Sources of N_2O include soil cultivation practices (microbial processes in soil and water), especially the use of commercial and organic fertilizers, manure management, industrial processes (such as in nitric acid production, nylon production, and fossil-fuel-fired power plants), vehicle emissions, and using N_2O as a propellant (such as in rockets, racecars, and aerosol sprays).

Fluorinated Gases. Fluorinated gases (also referred to as F-gases) are synthetic powerful GHGs emitted from many industrial processes. Fluorinated gases are commonly used as substitutes for stratospheric ozone-depleting substances (e.g., CFCs, hydrochlorofluorocarbons [HCFCs], and halons). The most prevalent fluorinated gases include the following:

- **Hydrofluorocarbons:** HFCs are compounds containing only hydrogen, fluorine, and carbon atoms. HFCs are synthetic chemicals used as alternatives to ozone-depleting substances in serving many industrial, commercial, and personal needs. HFCs are emitted as by-products of industrial processes and are used in manufacturing.
- **Perfluorocarbons:** PFCs are a group of human-made chemicals composed of carbon and fluorine only. These chemicals were introduced as alternatives, with HFCs, to the ozone depleting substances. The two main sources of PFCs are primary aluminum production and semiconductor manufacturing. Since PFCs have stable molecular structures and do not break down through the chemical processes in the lower atmosphere, these chemicals have long lifetimes, ranging between 10,000 and 50,000 years.

[1] Climate forcing substances include GHGs and other substances such as black carbon and aerosols. This discussion focuses on the seven GHGs identified in the California Health and Safety Code Section 38505, because impacts associated with other climate forcing substances are not evaluated herein.

[2] The descriptions of GHGs are summarized from the Intergovernmental Panel on Climate Change's Second Assessment Report and Fourth Assessment Report (IPCC 1995, 2007), the California Air Resources Board's Glossary of Terms Used in GHG Inventories (CARB 2018), and the U.S. Environmental Protection Agency's Glossary of Climate Change Terms (EPA 2016).

- **Sulfur Hexafluoride:** SF_6 is a colorless gas soluble in alcohol and ether and slightly soluble in water. SF_6 is used for insulation in electric power transmission and distribution equipment, semiconductor manufacturing, the magnesium industry, and as a tracer gas for leak detection.
- **Nitrogen Trifluoride:** NF_3 is used in the manufacture of a variety of electronics, including semiconductors and flat panel displays.

Chlorofluorocarbons. CFCs are synthetic chemicals that have been used as cleaning solvents, refrigerants, and aerosol propellants. CFCs are chemically unreactive in the lower atmosphere (troposphere) and the production of CFCs was prohibited in 1987 due to the chemical destruction of stratospheric O_3.

Hydrochlorofluorocarbons. HCFCs are a large group of compounds, whose structure is very close to that of CFCs—containing hydrogen, fluorine, chlorine, and carbon atoms—but including one or more hydrogen atoms. Like HFCs, HCFCs are used in refrigerants and propellants. HCFCs were also used in place of CFCs for some applications; however, their use in general is being phased out.

Black Carbon. Black carbon is a component of fine particulate matter, which has been identified as a leading environmental risk factor for premature death. It is produced from the incomplete combustion of fossil fuels and biomass burning, particularly from older diesel engines and forest fires. Black carbon warms the atmosphere by absorbing solar radiation, influences cloud formation, and darkens the surface of snow and ice, which accelerates heat absorption and melting. Black carbon is a short-lived species that varies spatially, which makes it difficult to quantify the global warming potential. Diesel particulate matter emissions are a major source of black carbon and are toxic air contaminants that have been regulated and controlled in California for several decades to protect public health. In relation to declining diesel particulate matter from the California Air Resources Board's (CARB's) regulations pertaining to diesel engines, diesel fuels, and burning activities, CARB estimates that annual black carbon emissions in California have reduced by 70% between 1990 and 2010, with 95% control expected by 2020 (CARB 2014).

Water Vapor. The primary source of water vapor is evaporation from the ocean, with additional vapor generated by sublimation (change from solid to gas) from ice and snow, evaporation from other water bodies, and transpiration from plant leaves. Water vapor is the most important, abundant, and variable GHG in the atmosphere and maintains a climate necessary for life.

Ozone. Tropospheric O_3, which is created by photochemical reactions involving gases from both natural sources and human activities, acts as a GHG. Stratospheric O_3, which is created by the interaction between solar ultraviolet radiation and molecular oxygen (O_2), plays a decisive role in the stratospheric radiative balance. Depletion of stratospheric O_3, due to chemical reactions that may be enhanced by climate change, results in an increased ground-level flux of ultraviolet-B radiation.

Aerosols. Aerosols are suspensions of particulate matter in a gas emitted into the air through burning biomass (plant material) and fossil fuels. Aerosols can warm the atmosphere by absorbing and emitting heat and can cool the atmosphere by reflecting light.

3.2.1.3 Global Warming Potential

Gases in the atmosphere can contribute to climate change both directly and indirectly. Direct effects occur when the gas itself absorbs radiation. Indirect radiative forcing occurs when chemical transformations of the substance

produce other GHGs, when a gas influences the atmospheric lifetimes of other gases, and/or when a gas affects atmospheric processes that alter the radiative balance of the Earth (e.g., affect cloud formation or albedo) (EPA 2020). The Intergovernmental Panel on Climate Change (IPCC) developed the global warming potential (GWP) concept to compare the ability of each GHG to trap heat in the atmosphere relative to another gas. The GWP of a GHG is defined as the ratio of the time-integrated radiative forcing from the instantaneous release of 1 kilogram of a trace substance relative to that of 1 kilogram of a reference gas (IPCC 2014). The reference gas used is CO_2; therefore, GWP-weighted emissions are measured in metric tons of CO_2 equivalent (MT CO_2e).

The ECAS Update applies the IPCC's Fifth Assessment Report GWPs, which assumes that the GWP for CH_4 is 28 (so emissions of 1 MT of CH_4 are equivalent to emissions of 28 MT of CO_2), and the GWP for N_2O is 265 (IPCC 2014).

3.2.1.4 Sources of Greenhouse Gas Emissions

Per the U.S. Environmental Protection Agency (EPA) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2018 (EPA 2020), total United States GHG emissions were approximately 6,676.6 million metric tons (MMT) CO_2e in 2018 (EPA 2020). The primary GHG emitted by human activities in the United States was CO_2, which represented approximately 81.3% of total GHG emissions (5,428.1 MMT CO_2e). The largest source of CO_2, and of overall GHG emissions, was fossil-fuel combustion, which accounted for approximately 92.8% of CO_2 emissions in 2018 (5,031.8 MMT CO_2e). Relative to 1990, gross United States GHG emissions in 2018 are higher by 3.7%, down from a high of 15.2% above 1990 levels in 2007. GHG emissions decreased from 2017 to 2018 by 2.9% (188.4 MMT CO_2e) and overall, net emissions in 2018 were 10.2% below 2005 levels (EPA 2020).

According to California's 2000–2018 GHG emissions inventory (2020 edition), California emitted 425 MMT CO_2e in 2018, including emissions resulting from out-of-state electrical generation (CARB 2020a). The sources of GHG emissions in California include transportation, industry, electric power production from both in-state and out-of-state sources, residential and commercial activities, agriculture, high GWP substances, and recycling and waste. The California GHG emission source categories and their relative contributions in 2018 are presented in Table 3.2-1

Table 3.2-1. Greenhouse Gas Emissions Sources in California

Source Category	Annual GHG Emissions (MMT CO_2e)	Percent of Total[a]
Transportation	169.50	40%
Industrial	89.18	21%
Electric power[b]	63.11	15%
Commercial and residential	41.37	10%
Agriculture	32.57	8%
High global-warming potential substances	20.46	5%
Recycling and waste	9.09	2%
Total	**425.28**	**100%**

Source: CARB 2020a.
Notes: GHG = greenhouse gas; MMT CO_2e = million metric tons of carbon dioxide equivalent per year.
Emissions reflect the 2018 California GHG inventory.
[a] Percentage of total has been rounded, and total may not sum due to rounding.
[b] Includes emissions associated with imported electricity, which account for 24.57 MMT CO_2e annually.

Between 2000 and 2018, per-capita GHG emissions in California have dropped from a peak of 14.0 MT per person in 2001 to 10.7 MT per person in 2018, representing a 24% decrease (CARB 2020b). In 2016, statewide GHG emissions dropped below the 2020 GHG Limit of 431 MMT CO_2e and have remained below the Limit since that time (CARB 2020b).

3.2.1.5 City of Vacaville GHG Inventory

A baseline GHG inventory was developed for the City for the year 2019 as part of the ECAS Update. The baseline GHG inventory represents a snapshot of the communitywide GHG emissions generated in Vacaville in 2019. Municipal GHG emissions are included in the communitywide GHG emissions, although they represent a small portion of Vacaville's total inventory. The following text summarizes existing communitywide GHG emissions through development of the 2019 baseline inventory resulting from the following GHG emissions-generating source categories: transportation, residential energy use (electricity and natural gas), non-residential energy use (electricity and natural gas), water treatment, delivery, and wastewater, solid waste disposal, and off-road emissions (e.g., construction equipment and lawnmowers).

Transportation

Transportation sources of GHG emissions are a result of fuel combustion from the burning of fossil fuels, including gasoline and diesel, and from on-road mobile sources (e.g. passenger vehicles and trucks). Transportation emissions are based on trips generated by land uses within Vacaville. Transportation emissions include:

- 100% of trips that both begin and end within Vacaville.
- 50% of the trip length for trips from Vacaville to somewhere else (internal-external trips) and trips from somewhere else to Vacaville (external-internal trips).
- No pass-through trips that either begin or end in Vacaville, such as cars driving from San Francisco to Sacramento on Interstate 80.

The associated baseline vehicle miles traveled (VMT) generated by land uses within Vacaville was compiled through interpolation of baseline year 2008 VMT and Fehr & Peers projected 2035 VMT. GHG emissions from those VMT was estimated using CARB's Mobile Source Emissions Inventory Model, EMFAC (EMFAC2017) program and are estimated to be 609,843 MT CO_2e as shown in Table 3.2.2.

Residential Energy

Residential land uses generate GHG emissions primarily from purchased electricity and natural gas used for heating and cooking. Pacific Gas and Electric Company (PG&E) provided residential purchased energy use and natural gas use for 2019. GHG emissions from residential energy are estimated to be 93,272 MT CO_2e as shown in Table 3.2.2.

Non-Residential Energy

The non-residential category includes GHG emissions associated with commercial, office, and industrial land uses. Non-residential land uses generate GHG emissions primarily from purchased electricity and natural gas used for heating and cooking (e.g. restaurants). PG&E provided data on non-residential purchased electricity use for 2019. PG&E natural gas data provided for year 2010 was scaled to year 2019 based on county level natural gas consumption in years 2010 and 2019 provided by the California Energy Commission. GHG emissions from non-residential energy are estimated to be 96,316 MT CO_2e as shown in Table 3.2.2.

Water and Wastewater

Water demand and wastewater generation in Vacaville result in indirect GHG emissions from the energy required to convey, treat, and distribute potable water, and from emissions of CH_4 and N_2O from wastewater treatment that are not captured within the wastewater treatment system. Wastewater treatment processes produce "fugitive" GHG emissions. Under anaerobic conditions, microorganisms biodegrade soluble organic material in wastewater during both nitrification and denitrification and generate emissions of N_2O. Water and wastewater emissions were estimated based on the City's clean water supply and wastewater treatment annual throughputs, associated processes, and energy requirements. Clean water supply includes water supply and conveyance, water treatment and water distribution, and each process requires electricity. Wastewater for the City is treated at the City's Easterly Wastewater Treatment Plant. Wastewater treatment electricity consumption was based on actual electricity metered for the Wastewater Treatment Plant from December 2018 to December 2019. Wastewater fugitive GHG emissions were estimated to occur with aerobic and anaerobic processes and were estimated based on the wastewater nitrogen load conversion to N_2O, where N_2O was converted to CO_2e based on the IPCC Global Warming Potential for N_2O. GHG emissions from water and wastewater are estimated to be 3,355 MT CO_2e as shown in Table 3.2.2.

Solid Waste

Treatment and disposal of solid waste produces a significant amount of CH_4. Most operating landfills in California also implement a landfill gas recovery system as a common way to reduce methane emissions from solid waste disposal. Although solid waste disposal sites produce biogenic carbon dioxide, biogenic sources of GHG emissions are not included as part of a communitywide GHG inventory. Local Governments for Sustainability's Clearpath waste calculator was used to calculate 2019 annual GHG emissions from solid waste. GHG emissions from solid waste are estimated to be 28,335 MT CO_2e as shown in Table 3.2.2.

Off-Road Equipment

Off-road equipment GHG emissions sources include the combustion of fossil fuels for off-road stationary equipment, such as landscaping and construction equipment. This category represents GHG emissions from off-road equipment exhaust from the following types of equipment used within Vacaville: landscaping equipment, including blowers, mowers, and other landscaping tools; light commercial and industrial equipment, including generators, pressure washers, welders, and pumps; and off-road construction equipment such as bulldozers, cranes, backhoes, and water trucks. GHG emissions from off-road equipment was based on the 2015 ECAS 2008 baseline inventory, which was based on the Solano Transportation Authority 2011 GHG inventory for the seven cities within the county, including Vacaville, and scaled by service population to estimate year 2019 GHG emissions. GHG emissions from off-road equipment are estimated to be 13,077 MT CO2e as shown in Table 3.2.2.

Summary

Vacaville's communitywide GHG emissions in 2019 were estimated to be 840,888 MT CO_2e. The 2019 baseline inventory in both MT CO_2e and percentage of overall CO_2e for each inventory category are shown in Table 3.2.2.

Table 3.2.2. 2019 Baseline GHG Emissions Inventory

Category	MT CO_2e	Percent
Transportation	609,843	72%

Residential Energy	93,272	11%
Non-Residential Energy	96,316	11%
Water/Wastewater	3,355	0.4%
Solid Waste Disposal	28,335	3%
Off-Road Equipment	13,077	2%
Total	**844,198**	**100%**

Notes: GHG = greenhouse gas; MT CO_2e = metric tons of carbon dioxide equivalent.
Totals may not sum due to rounding.

3.2.1.6 Potential Effects of Climate Change

Globally, climate change has the potential to affect numerous environmental resources through uncertain impacts related to future air temperatures and precipitation patterns. The 2014 IPCC Fifth Assessment Report Synthesis Report (IPCC 2014) indicated that warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. Signs that global climate change has occurred include warming of the atmosphere and ocean, diminished amounts of snow and ice, rising sea levels, and ocean acidification (IPCC 2014).

In California, climate change impacts have the potential to affect sea-level rise, agriculture, snowpack and water supply, forestry, wildfire risk, public health, frequency of severe weather events, and electricity demand and supply. The primary effect of global climate change has been a rise in average global tropospheric temperature. Reflecting the long-term warming trend since pre-industrial times, observed global mean surface temperature for the decade 2006–2015 was 0.87°C (likely between 0.75°C and 0.99°C) higher than the average over the 1850–1900 period (IPCC 2018). Scientific modeling predicts that continued emissions of GHGs at or above current rates would induce more extreme climate changes during the twenty-first century than were observed during the twentieth century. Human activities are estimated to have caused approximately 1.0°C (1.8°F) of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C (1.4°F to 2.2°F) (IPCC 2018). Global warming is likely to reach 1.5°C (2.7°F) between 2030 and 2052 if it continues to increase at the current rate (IPCC 2018).

Although climate change is driven by global atmospheric conditions, climate change impacts are felt locally. A scientific consensus confirms that climate change is already affecting California. The Office of Environmental Health Hazard Assessment identified various indicators of climate change in California, which are scientifically based measurements that track trends in various aspects of climate change. Many indicators reveal discernible evidence that climate change is occurring in California and is having significant, measurable impacts in the state. Changes in the state's climate have been observed including an increase in annual average air temperature with record warmth from 2012 to 2016, more frequent extreme heat events, more extreme drought, a decline in winter chill, an increase in cooling degree days and a decrease in heating degree days, and an increase in variability of statewide precipitation (OEHHA 2018).

Warming temperatures and changing precipitation patterns have altered California's physical systems—the ocean, lakes, rivers and snowpack—upon which the state depends. Winter snowpack and spring snowmelt runoff from the Sierra Nevada and southern Cascade Mountains provide approximately one-third of the state's annual water supply. Impacts of climate on physical systems have been observed such as high variability of snow-water content (i.e., amount of water stored in snowpack), decrease in spring snowmelt runoff, glacier change (loss in area), rise in sea levels, increase in average lake water temperature and coastal ocean temperature, and a decrease in dissolved oxygen in coastal waters (OEHHA 2018).

Impacts of climate change on biological systems, including humans, wildlife, and vegetation, have also been observed including climate change impacts on terrestrial, marine, and freshwater ecosystems. As with global observations, species responses include those consistent with warming: elevational or latitudinal shifts in range, changes in the timing of key plant and animal life cycle events, and changes in the abundance of species and in community composition. Humans are better able to adapt to a changing climate than plants and animals in natural ecosystems. Nevertheless, climate change poses a threat to public health as warming temperatures and changes in precipitation can affect vector-borne pathogen transmission and disease patterns in California as well as the variability of heat-related deaths and illnesses. In addition, since 1950, the area burned by wildfires each year has been increasing.

The California Natural Resources Agency (CNRA) has released four California Climate Change Assessments (2006, 2009, 2012, and 2018), which have addressed the following: acceleration of warming across the state, more intense and frequent heat waves, greater riverine flows, accelerating sea level rise, more intense and frequent drought, more severe and frequent wildfires, more severe storms and extreme weather events, shrinking snowpack and less overall precipitation, and ocean acidification, hypoxia, and warming. To address local and regional governments' need for information to support action in their communities, the Fourth Assessment (CNRA 2018) includes reports for nine regions of the state, including the Sacramento Valley Region, which includes the City of Vacaville. General climate changes for the Sacramento Valley Region include the following (CNRA 2018):

- Warming air and water temperatures
- More extreme heat-waves
- Drier landscapes
- Less snow
- Variable precipitation and seasonal shifts
- More intense droughts and floods with less predictability
- Higher Delta water levels compounded by subsidence
- Increased risk of wildfire
- Loss of ecosystem habitat

For the purposes of climate change assessment, while the City of Vacaville is located within the Sacramento Valley Region, the City was on the border with the San Francisco Bay Area Region, as defined by the CNRA. Accordingly, a summary of the key findings for the San Francisco Bay Area Region is provided below for additional context (CNRA 2018):

- The impacts of climate change are already being felt in the San Francisco Bay Area and Northern California.
- These changes are projected to increase significantly in the coming decades over the region.
- Changes in temperature, precipitation, and sea level rise will produce substantial impacts on Bay Area social systems and the built environment.
- Climate change will produce substantial impacts on Bay Area natural and managed resource systems.
- A growing number of Bay Area local governments, regional agencies, nonprofits, and private sector stakeholders are taking actions that advance climate adaptation and resilience.

3.2.2 Regulatory Setting

3.2.2.1 International

United Nations Framework Convention on Climate Change, Kyoto Protocol, and Paris Agreement

In 1992, numerous countries joined an international treaty—the United Nations Framework Convention on Climate Change (UNFCCC)—as a framework for international cooperation to combat climate change by limiting average global temperature increases and the resulting climate change, and coping with associated impacts. Currently, there are 197 Parties (196 States and 1 regional economic integration organization) in the UNFCCC (UNFCCC 2019).

By 1995, countries launched negotiations to strengthen the global response to climate change, and, 2 years later, adopted the Kyoto Protocol, which was the first international agreement to regulate GHG emissions. The Kyoto Protocol legally binds developed country Parties to emission reduction targets. The Protocol's first commitment period started in 2008 and ended in 2012. The second commitment period began on January 1, 2013, and will end in 2020. More than 160 countries signed the Kyoto Protocol (UNFCCC 2019). In 2001, President George W. Bush indicated that he would not submit the treaty to the U.S. Senate for ratification, which effectively ended the United States' involvement in the Kyoto Protocol.

The 2015 Paris Agreement, adopted in Paris on December 12, 2015, marks the latest step in the evolution of the United Nations' climate change regime and builds on the work undertaken under the UNFCCC. The Paris Agreement charts a new course in the global effort to combat climate change. The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C (UNFCCC 2019). The Paris Agreement also aims to strengthen the ability of countries to deal with the impacts of climate change. The Paris Agreement requires all Parties to put forward their best efforts through nationally determined contributions and to strengthen these efforts in the years ahead.

The Paris Agreement entered into force on November 4, 2016, thirty days after the date on which at least 55 Parties to the Convention accounting in total for at least an estimated 55 % of the total global GHG emissions have deposited their instruments of ratification, acceptance, approval or accession with the Depositary (UNFCCC 2019). On June 2, 2017 President Donald Trump announced his intention to withdraw from the Paris Agreement, which was formally recognized on November 4, 2019. President Joe Biden re-joined the Paris Agreement on January 21, 2021, which was accepted by the United Nations; the United States will be formally re-entered into the Paris Agreement on February 29, 2021.

3.2.2.2 Federal

Massachusetts v. EPA

In *Massachusetts v. EPA* (April 2007), the U.S. Supreme Court directed the EPA administrator to determine whether GHG emissions from new motor vehicles cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision. In December 2009, the administrator signed a final rule with the following two distinct findings regarding GHGs under Section 202(a) of the federal Clean Air Act:

- The administrator found that elevated concentrations of GHGs—CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6—in the atmosphere threaten the public health and welfare of current and future generations. This is the "endangerment finding."
- The administrator further found the combined emissions of GHGs—CO_2, CH_4, N_2O, and HFCs—from new motor vehicles and new motor vehicle engines contribute to the GHG air pollution that endangers public health and welfare. This is the "cause or contribute finding."

These two findings were necessary to establish the foundation for regulation of GHGs from new motor vehicles as air pollutants under the Clean Air Act.

Energy Independence and Security Act of 2007

The Energy Independence and Security Act of 2007 (December 2007), among other key measures, would do the following, which would aid in the reduction of national GHG emissions (EPA 2007):

- Increase the supply of alternative fuel sources by setting a mandatory Renewable Fuel Standard requiring fuel producers to use at least 36 billion gallons of biofuel in 2022.
- Set a target of 35 miles per gallon for the combined fleet of cars and light trucks by model year 2020, and directs National Highway Traffic Safety Administration (NHTSA) to establish a fuel economy program for medium- and heavy-duty trucks and create a separate fuel economy standard for work trucks.
- Prescribe or revise standards affecting regional efficiency for heating and cooling products and procedures for new or amended standards, energy conservation, energy-efficiency labeling for consumer electronic products, residential boiler efficiency, electric motor efficiency, and home appliances.

Federal Vehicle Standards

In response to the U.S. Supreme Court ruling previously discussed, the Bush Administration issued Executive Order (EO) 13432 in 2007 directing the EPA, the Department of Transportation, and the Department of Energy to establish regulations that reduce GHG emissions from motor vehicles, non-road vehicles, and non-road engines by 2008. In 2009, the NHTSA issued a final rule regulating fuel efficiency and GHG emissions from cars and light-duty trucks for model year 2011, and in 2010, the EPA and NHTSA issued a final rule regulating cars and light-duty trucks for model years 2012–2016 (75 FR 25324–25728).

In 2010, President Barack Obama issued a memorandum directing the Department of Transportation, Department of Energy, EPA, and NHTSA to establish additional standards regarding fuel efficiency and GHG reduction, clean fuels, and advanced vehicle infrastructure. In response to this directive, EPA and NHTSA proposed stringent, coordinated federal GHG and fuel economy standards for model years 2017–2025 light-duty vehicles. The proposed standards projected to achieve 163 grams per mile of CO_2 in model year 2025, on an average industry fleet-wide basis, which is equivalent to 54.5 miles per gallon if this level were achieved solely through fuel efficiency. The final rule was adopted in 2012 for model years 2017–2021 (77 FR 62624–63200). On January 12, 2017, the EPA finalized its decision to maintain the current GHG emissions standards for model years 2022–2025 cars and light trucks (EPA 2017b).

In addition to the regulations applicable to cars and light-duty trucks described above, in 2011, the EPA and NHTSA announced fuel economy and GHG standards for medium- and heavy-duty trucks for model years 2014–2018 (76 FR 57106–57513). The standards for CO_2 emissions and fuel consumption are tailored to three main vehicle categories: combination tractors, heavy-duty pickup trucks and vans, and vocational vehicles. According to the EPA, this regulatory program will reduce GHG emissions and fuel consumption for the affected vehicles by 6%–23% over the 2010 baselines.

In August 2016, the EPA and NHTSA announced the adoption of the phase two program related to the fuel economy and GHG standards for medium- and heavy-duty trucks. The phase two program will apply to vehicles with model year 2018 through 2027 for certain trailers, and model years 2021 through 2027 for semi-trucks, large pickup trucks, vans, and all types and sizes of buses and work trucks. The final standards are expected to lower CO_2 emissions by approximately 1.1 billion MT and reduce oil consumption by up to 2 billion barrels over the lifetime of the vehicles sold under the program (EPA and NHTSA 2016).

In August 2018, EPA and NHTSA proposed to amend certain fuel economy and GHG standards for passenger cars and light trucks and establish new standards for model years 2021 through 2026. Compared to maintaining the post-2020 standards now in place, the 2018 proposal would increase U.S. fuel consumption by about half a million barrels per day (2%–3% of total daily consumption, according to the Energy Information Administration) and would impact the global climate by 3/1000th of one degree Celsius by 2100 (EPA and NHTSA 2018). California and other states have stated their intent to challenge federal actions that would delay or eliminate GHG reduction measures and have committed to cooperating with other countries to implement global climate change initiatives.

On September 27, 2019, the EPA and NHTSA published the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One: One National Program (84 FR 51310), which became effective November 26, 2019. The Part One Rule revokes California's authority to set its own GHG emissions standards and set zero-emission vehicle mandates in California. On March 31, 2020, the EPA and NHTSA issued the Part Two Rule, which will go into effect 60 days after being published in the Federal Register. The Part Two Rule sets CO_2 emissions standards and corporate average fuel economy standards for passenger vehicles and light-duty trucks for model years 2021 through 2026. On January 20, 2021, President Joe Biden issued an Executive Order (EO) on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis, which includes review of Part One Rule by April 2021 and review of the Part Two Rule by July 2021 (The White House 2021).

Clean Power Plan and New Source Performance Standards for Electric Generating Units

On October 23, 2015, EPA published a final rule (effective December 22, 2015) establishing the Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units (80 FR 64510–64660), also known as the Clean Power Plan. These guidelines prescribe how states must develop plans to reduce GHG emissions from existing fossil-fuel-fired electric generating units. The guidelines establish CO_2 emission performance rates representing the best system of emission reduction for two subcategories of existing fossil-fuel-fired electric generating units: (1) fossil-fuel-fired electric utility steam-generating units, and (2) stationary combustion turbines. Concurrently, the EPA published a final rule (effective October 23, 2015) establishing Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units (80 FR 64661–65120). The rule prescribes CO_2 emission standards for newly constructed, modified, and reconstructed affected fossil-fuel-fired electric utility generating units. The U.S. Supreme Court stayed implementation of the Clean Power Plan pending resolution of several lawsuits.

3.2.2.3 State

The statewide GHG emissions regulatory framework is summarized below by category: state climate change targets, building energy, renewable energy and energy procurement, mobile sources, solid waste, water, and other state regulations and goals. The following text describes EOs, legislation, regulations, and other plans and policies that would directly or indirectly reduce GHG emissions and/or address climate change issues.

State Climate Change Targets

The state has taken a number of actions to address climate change. These include EOs, legislation, and CARB plans and requirements. These are summarized below.

EO S-3-05. EO S-3-05 (June 2005) established the following statewide goals: GHG emissions should be reduced to 2000 levels by 2010, GHG emissions should be reduced to 1990 levels by 2020, and GHG emissions should be reduced to 80% below 1990 levels by 2050.

Assembly Bill (AB) 32. In furtherance of the goals established in EO S-3-05, the legislature enacted AB 32. The bill is referred to as the California Global Warming Solutions Act of 2006 (September 27, 2006). AB 32 provided initial direction on creating a comprehensive multiyear program to limit California's GHG emissions at 1990 levels by 2020 and initiate the transformations required to achieve the state's long-range climate objectives.

CARB's 2007 Statewide Limit. In 2007, in accordance with California Health and Safety Code, Section 38550, CARB approved a statewide limit on the GHG emissions level for year 2020 consistent with the determined 1990 baseline (427 MMT CO_2e).

CARB's Climate Change Scoping Plan. One specific requirement of AB 32 is for CARB to prepare a scoping plan for achieving the maximum technologically feasible and cost-effective GHG emission reductions by 2020 (Health and Safety Code, Section 38561[a]), and to update the plan at least once every 5 years. In 2008, CARB approved the first scoping plan. The Climate Change Scoping Plan: A Framework for Change (Scoping Plan) included a mix of recommended strategies that combined direct regulations, market-based approaches, voluntary measures, policies, and other emission reduction programs calculated to meet the 2020 statewide GHG emission limit and initiate the transformations needed to achieve the state's long-range climate objectives. The key elements of the Scoping Plan include the following (CARB 2008):

1. Expanding and strengthening existing energy efficiency programs as well as building and appliance standards.
2. Achieving a statewide renewable energy mix of 33%.
3. Developing a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system and caps sources contributing 85% of California's GHG emissions.
4. Establishing targets for transportation-related GHG emissions for regions throughout California, and pursuing policies and incentives to achieve those targets.
5. Adopting and implementing measures pursuant to existing state laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard (LCFS) (17 CCR, Section 95480 et seq.).
6. Creating targeted fees, including a public goods charge on water use, fees on high GWP gases, and a fee to fund the administrative costs of the State of California's long-term commitment to AB 32 implementation.

The Scoping Plan also identified local governments as essential partners in achieving California's goals to reduce GHG emissions because they have broad influence and, in some cases, exclusive authority over activities that contribute to significant direct and indirect GHG emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations. Specifically, the Scoping Plan encouraged local governments to adopt a reduction goal for municipal operations and for community emissions to reduce GHGs by approximately 15% from then levels (2008) by 2020. Many local governments developed community-scale local GHG reduction plans based on this Scoping Plan recommendation.

In 2014, CARB approved the first update to the Scoping Plan. The First Update to the Climate Change Scoping Plan: Building on the Framework (First Update) defined the state's GHG emission reduction priorities for the next 5 years and laid the groundwork to start the transition to the post-2020 goals set forth in EO S-3-05 and EO B-16-2012. The First Update concluded that California is on track to meet the 2020 target but recommended a 2030 mid-term GHG reduction target be established to ensure a continuum of action to reduce emissions (CARB 2014). The First Update recommended a mix of technologies in key economic sectors to reduce emissions through 2050 including energy demand reduction through efficiency and activity changes; large-scale electrification of on-road vehicles, buildings, and industrial machinery; decarbonizing electricity and fuel supplies; and the rapid market penetration of efficient and clean energy technologies. As part of the First Update, CARB recalculated the state's 1990 emissions level, using more recent GWPs identified by the IPCC, from 427 MMT CO_2e to 431 MMT CO_2e (CARB 2014).

In 2015, as directed by EO B-30-15, CARB began working on an update to the Scoping Plan to incorporate the 2030 target of 40% below 1990 levels by 2030 to keep California on its trajectory toward meeting or exceeding the long-term goal of reducing GHG emissions to 80% below 1990 levels by 2050 as set forth in EO S-3-05. The governor called on California to pursue a new and ambitious set of strategies, in line with the five climate change pillars from his inaugural address, to reduce GHG emissions and prepare for the unavoidable impacts of climate change. In the summer of 2016, the legislature affirmed the importance of addressing climate change through passage of SB 32 (Chapter 249, Statutes of 2016).

In December 2017, CARB adopted the 2017 Climate Change Scoping Plan Update (2030 Scoping Plan) (CARB 2017). The 2030 Scoping Plan builds on the successful framework established in the initial Scoping Plan and First Update, while identifying new, technologically feasible and cost-effective strategies that will serve as the framework to achieve the 2030 GHG target and define the state's climate change priorities to 2030 and beyond. The strategies' known commitments include implementing renewable energy and energy efficiency (including the mandates of SB 350), increased stringency of the LCFS, measures identified in the Mobile Source and Freight Strategies, measures identified in the proposed Short-Lived Climate Pollutant Plan, and increased stringency of SB 375 targets. To fill the gap in additional reductions needed to achieve the 2030 target, it recommends continuing the cap-and-trade program and a measure to reduce GHGs from refineries by 20%.

For local governments, the 2030 Scoping Plan replaced the initial Scoping Plan's 15% reduction goal with a recommendation to aim for a communitywide goal of no more than 6 MT CO_2e per capita by 2030 and no more than 2 MT CO_2e per capita by 2050, which are consistent with the state's long-term goals. These goals are also consistent with the Under 2 MOU (Under 2 2016) and the Paris Agreement, which are developed around the scientifically based levels necessary to limit global warming below 2°C. The 2030 Scoping Plan recognized the benefits of local government GHG planning (e.g., through climate action plans (CAPs)) and provide more information regarding tools CARB is working on to support those efforts. It also recognizes the CEQA streamlining provisions for project-level review where there is a legally adequate CAP.

The Scoping Plan recommends strategies for implementation at the statewide level to meet the goals of AB 32, SB 32, and the EOs and establishes an overall framework for the measures that will be adopted to reduce California's GHG emissions. A project is considered consistent with the statutes and EOs if it meets the general policies in reducing GHG emissions to facilitate the achievement of the state's goals and does not impede attainment of those goals. As discussed in several cases, a given project need not be in perfect conformity with each and every planning policy or goals to be consistent. A project would be consistent if it will further the objectives and not obstruct their attainment.

CARB's Regulations for the Mandatory Reporting of Greenhouse Gas Emissions. CARB's Regulation for the Mandatory Reporting of Greenhouse Gas Emissions (17 CCR 95100–95157) incorporated by reference certain

requirements that EPA promulgated in its Final Rule on Mandatory Reporting of Greenhouse Gases (Title 40, CFR, Part 98). Specifically, Section 95100(c) of the Mandatory Reporting Regulation incorporated those requirements that EPA promulgated in the Federal Register on October 30, 2009; July 12, 2010; September 22, 2010; October 28, 2010; November 30, 2010; December 17, 2010; and April 25, 2011. In general, entities subject to the Mandatory Reporting Regulation that emit over 10,000 MT CO_2e per year are required to report annual GHGs through the California Electronic GHG Reporting Tool. Certain sectors, such as refineries and cement plants, are required to report regardless of emission levels. Entities that emit more than the 25,000 MT CO_2e per-year threshold are required to have their GHG emission report verified by a CARB-accredited third party.

EO B-18-12. EO B-18-12 (April 2012) directed state agencies, departments, and other entities under the governor's executive authority to take action to reduce entity-wide GHG emissions by at least 10% by 2015 and 20% by 2020, as measured against a 2010 baseline. EO B-18-12 also established goals for existing state buildings for reducing grid-based energy purchases and water use.

SB 605 and SB 1383. SB 605 (2014) requires CARB to complete a comprehensive strategy to reduce emissions of short-lived climate pollutants in the state, and SB 1383 (2016) requires CARB to approve and implement that strategy by January 1, 2018. SB 1383 also establishes specific targets for the reduction of short-lived climate pollutants (40% below 2013 levels by 2030 for CH_4 and HFCs, and 50% below 2013 levels by 2030 for anthropogenic black carbon), and provides direction for reductions from dairy and livestock operations and landfills. Accordingly, and as mentioned above, CARB adopted its Short-Lived Climate Pollutant Reduction Strategy in March 2017. The Short-Lived Climate Pollutant Reduction Strategy establishes a framework for the statewide reduction of emissions of black carbon, CH_4, and fluorinated gases.

EO B-30-15. EO B-30-15 (April 2015) identified an interim GHG reduction target in support of targets previously identified under EO S-3-05 and AB 32. EO B-30-15 set an interim target goal of reducing GHG emissions to 40% below 1990 levels by 2030 to keep California on its trajectory toward meeting or exceeding the long-term goal of reducing GHG emissions to 80% below 1990 levels by 2050 as set forth in EO S-3-05. To facilitate achieving this goal, EO B-30-15 called for CARB to update the Scoping Plan to express the 2030 target in terms of MMT CO_2e. The EO also called for state agencies to continue to develop and implement GHG emission reduction programs in support of the reduction targets.

Senate Bill (SB) 32 and AB 197. SB 32 and AB 197 (enacted in 2016) are companion bills. SB 32 codified the 2030 emissions reduction goal of EO B-30-15 by requiring CARB to ensure that statewide GHG emissions are reduced to 40% below 1990 levels by 2030. AB 197 established the Joint Legislative Committee on Climate Change Policies, consisting of at least three members of the Senate and three members of the Assembly, in order to provide ongoing oversight over implementation of the state's climate policies. AB 197 also added two members of the Legislature to the CARB Board as nonvoting members; requires CARB to make available and update (at least annually via its website) emissions data for GHGs, criteria air pollutants, and TACs from reporting facilities; and requires CARB to identify specific information for GHG emissions reduction measures when updating the Scoping Plan.

EO B-55-18. EO B-55-18 (September 2018) establishes a new statewide goal "to achieve carbon neutrality as soon as possible, and no later than 2045, and achieve and maintain net negative emissions thereafter." This EO directs CARB to "work with relevant state agencies to ensure future Scoping Plans identify and recommend measures to achieve the carbon neutrality goal."

Building Energy

Title 24, Part 6. Title 24 of the California Code of Regulations was established in 1978 and serves to enhance and regulate California's building standards. While not initially promulgated to reduce GHG emissions, Part 6 of Title 24 specifically established Building Energy Efficiency Standards that are designed to ensure new and existing buildings in California achieve energy efficiency and preserve outdoor and indoor environmental quality. These energy efficiency standards are reviewed every few years by the Building Standards Commission and the California Energy Commission (CEC) (and revised if necessary) (California Public Resources Code, Section 25402[b][1]). The regulations receive input from members of industry, as well as the public, with the goal of "reducing of wasteful, uneconomic, inefficient, or unnecessary consumption of energy" (California Public Resources Code, Section 25402). These regulations are carefully scrutinized and analyzed for technological and economic feasibility (California Public Resources Code, Section 25402[d]) and cost effectiveness (California Public Resources Code, Sections 25402[b][2] and [b][3]). As a result, these standards save energy, increase electricity supply reliability, increase indoor comfort, avoid the need to construct new power plants, and help preserve the environment.

The 2019 Title 24 standards are the currently applicable building energy efficiency standards, and became effective on January 1, 2020. The 2019 Title 24 Building Energy Efficiency Standards will further reduce energy used and associated GHG emissions compared to prior standards. In general, single-family residences built to the 2019 standards are anticipated to use approximately 7% less energy due to energy efficiency measures than those built to the 2016 standards; once rooftop solar electricity generation is factored in, single-family residences built under the 2019 standards will use approximately 53% less energy than those under the 2016 standards (CEC 2018). Nonresidential buildings built to the 2019 standards are anticipated to use an estimated 30% less energy than those built to the 2016 standards (CEC 2018).

Title 24, Part 11. In addition to the CEC's efforts, in 2008, the California Building Standards Commission adopted the nation's first green building standards. The California Green Building Standards Code (Part 11 of Title 24) is commonly referred to as California's Green Building Standards (CALGreen), and establishes minimum mandatory standards and voluntary standards pertaining to the planning and design of sustainable site development, energy efficiency (in excess of the California Energy Code requirements), water conservation, material conservation, and interior air quality. The CALGreen standards took effect in January 2011 and instituted mandatory minimum environmental performance standards for all ground-up, new construction of commercial, low-rise residential and state-owned buildings and schools and hospitals. The 2019 CALGreen standards are the current applicable standards. For nonresidential projects, some of the key mandatory CALGreen 2019 standards involve requirements related to bicycle parking, designated parking for clean air vehicles, electric vehicle (EV) charging stations, shade trees, water-conserving plumbing fixtures and fittings, outdoor potable water use in landscaped areas, recycled water supply systems, construction waste management, excavated soil and land clearing debris, and commissioning (24 CCR Part 11).

The CALGreen standards also include voluntary efficiency measures that are provided at two tiers and implemented at the discretion of local agencies and applicants. CALGreen's Tier 1 standards call for a 15% improvement in energy requirements, stricter water conservation, 65% diversion of construction and demolition waste, 10% recycled content in building materials, 20% permeable paving, 20% cement reduction, and cool/solar-reflective roofs. CALGreen's more rigorous Tier 2 standards call for a 30% improvement in energy requirements, stricter water conservation, 80% diversion of construction and demolition waste, 15% recycled content in building materials, 30% permeable paving, 25% cement reduction, and cool/solar-reflective roofs.

Title 20. Title 20 of the California Code of Regulations requires manufacturers of appliances to meet state and federal standards for energy and water efficiency. The CEC certifies an appliance based on a manufacturer's demonstration that the appliance meets the standards. New appliances regulated under Title 20 include refrigerators, refrigerator-freezers, and freezers; room air conditioners and room air-conditioning heat pumps; central air conditioners; spot air conditioners; vented gas space heaters; gas pool heaters; plumbing fittings and plumbing fixtures; fluorescent lamp ballasts; lamps; emergency lighting; traffic signal modules; dishwaters; clothes washers and dryers; cooking products; electric motors; low-voltage dry-type distribution transformers; power supplies; televisions and consumer audio and video equipment; and battery charger systems.

SB 1. SB 1 (August 2006, "Go Solar California" or "Million Solar Roofs") established a $3 billion rebate program to support the goal of the state to install rooftop solar energy systems with a generation capacity of 3,000 megawatts through 2016. The goals included establishing solar energy systems as a viable mainstream option for both homes and businesses within 10 years of adoption, and placing solar energy systems on 50% of new homes within 13 years of adoption.

AB 1470 (Solar Water Heating). This bill established the Solar Water Heating and Efficiency Act of 2007. The bill includes findings and declarations of the legislature relating to the promotion of solar water heating systems and other technologies that reduce natural gas demand.

Renewable Energy and Energy Procurement

SB 1078. SB 1078 (September 2002) established the Renewables Portfolio Standard (RPS) program, which required an annual increase in renewable generation by the utilities equivalent to at least 1% of sales, with an aggregate goal of 20% by 2017. This goal was subsequently accelerated, requiring utilities to obtain 20% of their power from renewable sources by 2010 (EO S-14-08 and EO S-21-09).

SB 1368. SB 1368 (September 2006) required the CEC to develop and adopt regulations for GHG emission performance standards for the long-term procurement of electricity by local publicly owned utilities.

AB 1109. Enacted in 2007, AB 1109 required the CEC to adopt minimum energy efficiency standards for general-purpose lighting, to reduce electricity consumption by 50% for indoor residential lighting and 25% for indoor commercial lighting.

EO S-14-08. EO S-14-08 (November 2008) focused on the contribution of renewable energy sources to meet the electrical needs of California while reducing the GHG emissions from the electrical sector. This EO required that all retail suppliers of electricity in California serve 33% of their load with renewable energy by 2020.

EO S-21-09 and SB X1-2. EO S-21-09 (September 2009) directed CARB to adopt a regulation consistent with the goal of EO S-14-08 by July 31, 2010. On September 23, 2010, CARB initially approved regulations to implement a Renewable Electricity Standard. However, this regulation was not finalized because of subsequent legislation (SB X1-2, Simitian, Statutes of 2011) signed by Governor Brown in April 2011.

SB X1-2 expanded the RPS by establishing a renewable energy target of 20% of the total electricity sold to retail customers in California per year by December 31, 2013, and 33% by December 31, 2020, and in subsequent years. Under the bill, a renewable electrical generation facility is one that uses biomass, solar thermal, photovoltaic, wind, geothermal, fuel cells using renewable fuels, small hydroelectric generation (30 megawatts or less), digester gas, municipal solid waste conversion, landfill gas, ocean wave, ocean thermal, or tidal current, and that meets other specified requirements with respect to its location. SB X1-2 applies to all electricity retailers in the state including publicly owned utilities, investor-owned utilities, electricity service providers, and community choice aggregators.

SB 350. SB 350 (October 2015, Clean Energy and Pollution Reduction Act) further expanded the RPS by establishing a goal of 50% of the total electricity sold to retail customers in California per year by December 31, 2030. In addition, SB 350 included the goal to double the energy efficiency savings in electricity and natural gas final end uses (e.g., heating, cooling, lighting, or class of energy uses on which an energy-efficiency program is focused) of retail customers through energy conservation and efficiency. The bill also requires the California Public Utilities Commission, in consultation with the CEC, to establish efficiency targets for electrical and gas corporations consistent with this goal. Regarding mobile sources, as one of its elements, SB 350 establishes a statewide policy for widespread electrification of the transportation sector, recognizing that such electrification is required for achievement of the state's 2030 and 2050 reduction targets (see California Public Utilities Code, Section 740.12).

SB 100. SB 100 (2018) increased the standards set forth in SB 350 establishing that 44% of the total electricity sold to retail customers in California per year by December 31, 2024; 52% by December 31, 2027; and 60% by December 31, 2030, be secured from qualifying renewable energy sources. SB 100 states that it is the policy of the state that eligible renewable energy resources and zero-carbon resources supply 100% of the retail sales of electricity to California. This bill requires that the achievement of 100% zero-carbon electricity resources do not increase the carbon emissions elsewhere in the western grid and that the achievement not be achieved through resource shuffling.

Mobile Sources

State Vehicle Standards (AB 1493 and EO B-16-12). AB 1493 (July 2002) was enacted in a response to the transportation sector accounting for more than half of California's CO_2 emissions. AB 1493 required CARB to set GHG emission standards for passenger vehicles, light-duty trucks, and other vehicles determined by the state board to be vehicles that are primarily used for noncommercial personal transportation in the state. The bill required that CARB set GHG emission standards for motor vehicles manufactured in 2009 and all subsequent model years. CARB adopted the standards in September 2004. EO B-16-12 (March 2012) required that state entities under the governor's direction and control support and facilitate the rapid commercialization of zero-emissions vehicles. It ordered CARB, CEC, California Public Utilities Commission, and other relevant agencies to work with the Plug-in Electric Vehicle Collaborative and the California Fuel Cell Partnership to establish benchmarks to help achieve benchmark goals by 2015, 2020, and 2025. On a statewide basis, EO B-16-12 established a target reduction of GHG emissions from the transportation sector equaling 80% less than 1990 levels by 2050. This directive did not apply to vehicles that have special performance requirements necessary for the protection of the public safety and welfare. As explained under the "Federal Vehicle Standards" description above, EPA and NHTSA approved the SAFE Vehicles Rule Part One and Two, which revoked California's authority to set its own GHG emissions standards and set zero-emission vehicle mandates in California. As the EPA rule is the subject of pending legal challenges and President Biden issued an EO to review Part One and Part Two, the ECAS Update utilized the best available information at this time, as set forth in EMFAC.

Heavy Duty Diesel. CARB adopted the final Heavy Duty Truck and Bus Regulation, Title 13, Division 3, Chapter 1, Section 2025, on December 31, 2014, to reduce particulate matter and NO_x emissions from heavy-duty diesel vehicles. The rule requires particulate matter filters be applied to newer heavier trucks and buses by January 1, 2012, with older vehicles required to comply by January 1, 2015. The rule will require nearly all diesel trucks and buses to be compliant with the 2010 model year engine requirement by January 1, 2023. CARB also adopted an Airborne Toxic Control Measure to limit idling of diesel-fueled commercial vehicles on December 12, 2013. This rule requires diesel-fueled vehicles with gross vehicle weights greater than 10,000 pounds to idle no more than 5 minutes at any location (13 CCR 2485).

EO S-1-07. EO S-1-07 (January 2007, implementing regulation adopted in April 2009) sets a declining LCFS for GHG emissions measured in CO_2e grams per unit of fuel energy sold in California. The target of the LCFS is to reduce the carbon intensity of California passenger vehicle fuels by at least 10% by 2020 (17 CCR 95480 et seq.). The carbon intensity measures the amount of GHG emissions in the lifecycle of a fuel, including extraction/feedstock production, processing, transportation, and final consumption, per unit of energy delivered.

SB 375. SB 375 (September 2008) addresses GHG emissions associated with the transportation sector through regional transportation and sustainability plans. SB 375 requires CARB to adopt regional GHG reduction targets for the automobile and light-truck sector for 2020 and 2035 and to update those targets every 8 years. SB 375 requires each of the state's 18 regional metropolitan planning organizations to prepare a Sustainable Communities Strategy (SCS) as part of their Regional Transportation Plan (RTP) that will achieve the GHG reduction targets set by CARB. If a metropolitan planning organization is unable to devise an SCS to achieve the GHG reduction target, the metropolitan planning organization must prepare an alternative planning strategy demonstrating how the GHG reduction target would be achieved through alternative development patterns, infrastructure, or additional transportation measures or policies.

Pursuant to Government Code, Section 65080(b)(2)(K), a SCS does not (1) regulate the use of land; (2) supersede the land use authority of cities and counties; or (3) require that a city's or county's land use policies and regulations, including those in a general plan, be consistent with it. Nonetheless, SB 375 makes regional and local planning agencies responsible for developing those strategies as part of the federally required metropolitan transportation planning process and the state-mandated housing element process.

On September 23, 2010, CARB adopted the first set of SB 375 GHG reduction targets for the regional Metropolitan Planning Organizations (MPOs) and established updated regional targets on March 22, 2018. CARB set an initial target of 7% per capita GHG reduction by 2020 and a 15% per capita GHG reduction by 2035 for the Metropolitan Transportation Commission (MTC)/Association of Bay Area Governments (ABAG) MPO through September 30, 2018. Updated targets beginning October 1, 2018 include 10% per capita GHG reduction by 2020 and a 19% per capita GHG reduction by 2035 for MTC/ABAG. The MTC, which is the MPO for the Bay Area, as well as the ABAG, adopted the Plan Bay Area 2040 in July 2017 (MTC and ABAG 2017), which is the RTP/SCS for the Bay Area. The Plan Bay Area 2040 is a long-range plan for transportation projects within the planning area and established 13 performance targets to achieve the following goals/outcomes: Climate Protection, Adequate Housing, Healthy and Safe Communities, Open Space and Agricultural Preservation, Equitable Access, Economic Vitality, and Transportation System Effectiveness. Two of these targets are mandatory to comply with SB 375, and the Plan Bay Area 2040 exceeds the 15% reduction per capita in GHG emissions from light-trucks and cars by 2035 (Climate Protection Goal), and plans to house 100% of the region's projected growth (from a 2010 baseline year) by income level without displacing current low-income residents and with no increase in in-commuters (Adequate Housing Goal).

Advanced Clean Cars Program and Zero-Emissions Vehicle Program. The Advanced Clean Cars Program (January 2012) is a new emissions-control program for model years 2015 through 2025. The program combines the control of smog- and soot-causing pollutants and GHG emissions into a single coordinated package. The package includes elements to reduce smog-forming pollution, reduce GHG emissions, promote clean cars, and provide the fuels for clean cars (CARB 2012). To improve air quality, CARB has implemented new emission standards to reduce smog-forming emissions beginning with 2015 model year vehicles. It is estimated that in 2025, cars will emit 75% less smog-forming pollution than the average new car sold today. To reduce GHG emissions, CARB, in conjunction with the EPA and the NHTSA, adopted new GHG standards for model year 2017 to 2025 vehicles; the new standards are estimated to reduce GHG emissions by 34% in 2025. The Zero-Emissions Vehicle Program will act as the

focused technology of the Advanced Clean Cars Program by requiring manufacturers to produce increasing numbers of zero-emissions vehicles and plug-in hybrid electric vehicles in the 2018 to 2025 model years.

AB 1236. AB 1236 (October 2015) required a city, county, or city and county to approve an application for the installation of EV charging stations, as defined, through the issuance of specified permits, unless the city or county makes specified written findings based upon substantial evidence in the record that the proposed installation would have a specific, adverse impact upon the public health or safety, and there is no feasible method to satisfactorily mitigate or avoid the specific, adverse impact. The bill provided for appeal of that decision to the planning commission, as specified. The bill provided that the implementation of consistent statewide standards to achieve the timely and cost-effective installation of EV charging stations is a matter of statewide concern. The bill required EV charging stations to meet specified standards. The bill required a city, county, or city and county with a population of 200,000 or more residents to adopt an ordinance, by September 30, 2016, that created an expedited and streamlined permitting process for EV charging stations, as specified. The bill also required a city, county, or city and county with a population of less than 200,000 residents to adopt this ordinance by September 30, 2017.

Solid Waste

AB 939, AB 341, and AB 1826. In 1989, AB 939, known as the Integrated Waste Management Act (California Public Resources Code, Sections 40000 et seq.), was passed because of the increase in waste stream and the decrease in landfill capacity. The statute established the California Integrated Waste Management Board, which oversees a disposal reporting system. AB 939 mandated a reduction of waste being disposed where jurisdictions were required to meet diversion goals of all solid waste through source reduction, recycling, and composting activities of 25% by 1995 and 50% by the year 2000.

AB 341 (Chapter 476, Statutes of 2011) amended the California Integrated Waste Management Act of 1989 to include a provision declaring that it is the policy goal of the state that not less than 75% of solid waste generated be source-reduced, recycled, or composted by the year 2020, and annually thereafter. In addition, AB 341 required the California Department of Resources Recycling and Recovery (CalRecycle) to develop strategies to achieve the state's policy goal. CalRecycle conducted several general stakeholder workshops and several focused workshops and in August 2015 published a discussion document titled AB 341 Report to the Legislature, which identifies five priority strategies that CalRecycle believes would assist the state in reaching the 75% goal by 2020, legislative and regulatory recommendations, and an evaluation of program effectiveness (CalRecycle 2012).

AB 1826 (Chapter 727, Statutes of 2014, effective 2016) requires businesses to recycle their organic waste (i.e., food waste, green waste, landscape and pruning waste, nonhazardous wood waste, and food-soiled paper waste that is mixed in with food waste) depending on the amount of waste they generate per week. This law also requires local jurisdictions across the state to implement an organic waste recycling program to divert organic waste generated by businesses, including multifamily residential dwellings that consist of five or more units. The minimum threshold of organic waste generation by businesses decreases over time, which means an increasingly greater proportion of the commercial sector will be required to comply.

Water

EO B-29-15. In response to the ongoing drought in California, EO B-29-15 (April 2015) set a goal of achieving a statewide reduction in potable urban water usage of 25% relative to water use in 2013. The term of the EO extended through February 28, 2016, although many of the directives have become permanent water-efficiency standards and requirements. The EO includes specific directives that set strict limits on water usage in the state. In response to EO B-

29-15, the California Department of Water Resources has modified and adopted a revised version of the Model Water Efficient Landscape Ordinance that, among other changes, significantly increases the requirements for landscape water use efficiency and broadens its applicability to include new development projects with smaller landscape areas.

EO B-37-16. Issued May 2016, EO B-37-16 directed the State Water Resources Control Board (SWRCB) to adjust emergency water conservation regulations through the end of January 2017 to reflect differing water supply conditions across the state. The SWRCB also developed a proposal to achieve a mandatory reduction of potable urban water usage that builds off the mandatory 25% reduction called for in EO B-29-15. The SWRCB and Department of Water Resources will develop new, permanent water use targets that build upon the existing state law requirements that the state achieve 20% reduction in urban water usage by 2020. EO B-37-16 also specifies that the SWRCB permanently prohibit water-wasting practices such as hosing off sidewalks, driveways, and other hardscapes; washing automobiles with hoses not equipped with a shut-off nozzle; using non-recirculated water in a fountain or other decorative water feature; watering lawns in a manner that causes runoff, or within 48 hours after measurable precipitation; and irrigating ornamental turf on public street medians.

Other State Actions

Senate Bill 97. SB 97 (August 2007) directed the Governor's Office of Planning and Research to develop guidelines under the California Environmental Quality Act (CEQA) for the mitigation of GHG emissions. In 2008, the Office of Planning and Research issued a technical advisory as interim guidance regarding the analysis of GHG emissions in CEQA documents. The advisory indicated that the lead agency should identify and estimate a project's GHG emissions, including those associated with vehicular traffic, energy consumption, water usage, and construction activities (OPR 2008). The advisory further recommended that the lead agency determine significance of the impacts and impose all mitigation measures necessary to reduce GHG emissions to a level that is less than significant. CNRA adopted the CEQA Guidelines amendments in December 2009, which became effective in March 2010.

Under the amended CEQA Guidelines, a lead agency has the discretion to determine whether to use a quantitative or qualitative analysis or apply performance standards to determine the significance of GHG emissions resulting from a particular project (14 CCR 15064.4[a]). The CEQA Guidelines require a lead agency to consider the extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions (14 CCR 15064.4[b]). The CEQA Guidelines also allow a lead agency to consider feasible means of mitigating the significant effects of GHG emissions, including reductions in emissions through the implementation of project features or off-site measures. The adopted amendments do not establish a GHG emission threshold, but instead allow a lead agency to develop, adopt, and apply its own thresholds of significance or those developed by other agencies or experts. CNRA also acknowledges that a lead agency may consider compliance with regulations or requirements implementing AB 32 in determining the significance of a project's GHG emissions (CNRA 2009a).

With respect to GHG emissions, the CEQA Guidelines state in Section 15064.4(a) that lead agencies should "make a good faith effort, to the extent possible on scientific and factual data, to describe, calculate or estimate" GHG emissions. The CEQA Guidelines note that an agency may identify emissions by either selecting a "model or methodology" to quantify the emissions or by relying on "qualitative analysis or other performance-based standards" (14 CCR 15064.4[a]). Section 15064.4(b) states that the lead agency should consider the following when assessing the significance of impacts from GHG emissions on the environment: (1) the extent a project may increase or reduce GHG emissions as compared to the existing environmental setting; (2) whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project; and (3) the

extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions (14 CCR 15064.4[b]).

EO S-13-08. EO S-13-08 (November 2008) is intended to hasten California's response to the impacts of global climate change, particularly sea-level rise. Therefore, the EO directs state agencies to take specified actions to assess and plan for such impacts. The final 2009 California Climate Adaptation Strategy report was issued in December 2009 (CNRA 2009b), and an update, Safeguarding California: Reducing Climate Risk, followed in July 2014 (CNRA 2014). To assess the state's vulnerability, the report summarizes key climate change impacts to the state for the following areas: agriculture, biodiversity and habitat, emergency management, energy, forestry, ocean and coastal ecosystems and resources, public health, transportation, and water. Issuance of the Safeguarding California: Implementation Action Plans followed in March 2016 (CNRA 2016). In January 2018, the CNRA released the Safeguarding California Plan: 2018 Update, which communicates current and needed actions that state government should take to build climate change resiliency.

3.2.2.4 Regional and Local

Beyond the State's legislative framework to reduce GHG emissions, the region has established regulations and policies to protect public health and contribute to GHG emission reductions. Vacaville primarily falls within the Yolo-Solano Air Quality Management District (YSAQMD) and a portion of the southeast corner of Vacaville is within the Bay Area Air Quality Management District (BAAQMD). For environmental analysis, the City looks to the YSAQMD guidance.

Yolo-Solano Air Quality Management District

The YSAQMD is the regional agency responsible for protecting human health and property from the harmful effects of air pollution for all of Yolo County and northeastern Solano County. The YSAQMD is responsible for achieving and maintaining healthful air quality for its residents by establishing programs, plans, and regulations enforcing air pollution control rules in order to attain all State and Federal ambient air quality standards and to minimize public exposure to airborne toxins and nuisance odors. The YSAQMD has not adopted a GHG reduction plan or published guidance for local agencies to address GHG emissions. However, the YSAQMD has adopted and implemented air quality plans and actions that have co-benefits related to reducing GHG emissions. In the past, the YSAQMD has unofficially recommended referring to the neighboring BAAQMD or the Sacramento Metropolitan Air Quality Management District guidance, specifically as it relates to environmental analysis under CEQA.

Bay Area Air Quality Management District

The BAAQMD is the regional agency responsible for the regulation and enforcement of federal, state, and local air pollution control regulations in the San Francisco Bay Area Air Basin. The BAAQMD has adopted the Spare the Air: Cool The Climate Final 2017 Clean Air Plan, which provides a regional climate protection strategy that will put the Bay Area on a pathway to achieve the 2030 and 2050 GHG reduction targets (BAAQMD 2017). To protect the climate, the 2017 Clean Air Plan defines a vision for transitioning the region to a post-carbon economy needed to achieve ambitious GHG reduction targets for 2030 and 2050, and provides a regional climate protection strategy that will put the Bay Area on a pathway to achieve those GHG reduction targets.

The BAAQMD has also published guidance on the criteria for a "qualified" GHG emissions reduction strategy, which allows future developments to potentially "tier" off the plan by avoiding the need for project-specific GHG emissions analyses under CEQA. Put simply, tiering means that, for the purpose of analyzing GHG emissions impacts, projects

that conform to the qualified GHG emissions reduction plan have already received CEQA analysis and may simply conclude that the project impacts are less than significant. The BAAQMD permits this tiering consistent with the State CEQA Guidelines Section 15183.5. Beyond these criteria, BAAQMD requires that qualified GHG emissions reduction strategies address certain key emissions sectors, including residential, commercial, industrial, transportation and land use, waste, agriculture (if pertinent), and water and wastewater treatment. Qualified GHG emissions reduction strategies must evaluate the specific current emissions for each of these sectors, as well as projected emissions under both a business-as-usual (BAU) scenario and under the proposed strategy. Qualified GHG emissions reduction strategies must reasonably demonstrate that the proposed strategy would lead to decreases in GHG emissions consistent with the goals and targets of State laws, such as AB 32 and SB 32. The proposed ECAS has been prepared in accordance with these guidelines from BAAQMD.

In addition to its Climate Protection Program, with measures to help meet GHG reductions, the BAAQMD also requires that all pollution sources warranting an air quality permit estimate what their GHG emissions would be and pay a fee based on the MT CO_2e emissions. Consistent with SB 375, the BAAQMD, ABAG, MTC, and the Bay Area Conservation and Development Commission established One Bay Area, an initiative to coordinate regional GHG emission reduction efforts. One Bay Area's Plan Bay Area has an SCS, which links land use and transportation to GHG emission reduction goals. Vacaville's plans, projects, and development must be consistent with Plan Bay Area for the City to be eligible for transportation and land use grant funding.

Association of Bay Area Governments

SB 375 requires MPOs to prepare an SCS in their RTP. In the Bay Area, the MTC and the ABAG are jointly responsible for developing and adopting an SCS that integrates transportation, land use, and housing to meet GHG reduction targets set by CARB. The Plan Bay Area 2040 was adopted by MTC and ABAG on July 26, 2017, and represents a limited and focused update that builds on the growth pattern and strategies developed in the original Plan Bay Area (2013). The Plan Bay Area 2040 exceeds the 15% reduction per capita in GHG emissions from light-trucks and cars by 2035 (climate protection goal). MTC and ABAG are currently preparing the Plan Bay Area 2050, which is expected to be adopted in fall 2021 (MTC and ABAG 2021).

3.2.3 Thresholds of Significance

3.2.3.1 Significance Criteria

The significance criteria used to evaluate the project's impacts related to GHG emissions are based on CEQA Guidelines Appendix G. According to Appendix G, a significant impact related to GHG emissions would occur if the project would:

1. Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment.
2. Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

Global climate change is a cumulative impact; a project's potential impact is determined through evaluation of its incremental contribution combined with the cumulative increase of all other sources of GHGs. There are currently no established thresholds for assessing whether the GHG emissions of a project, such as the proposed project, would be considered a cumulatively considerable contribution to global climate change. In addition, while GHG impacts are recognized exclusively as cumulative impacts (CAPCOA 2008), GHG emissions impacts must also be

evaluated at a project level under CEQA and mitigated to the extent feasible, if potential significant impacts are identified.

The CEQA Guidelines do not prescribe specific methodologies for performing an assessment, do not establish specific thresholds of significance, and do not mandate specific mitigation measures. Rather, the CEQA Guidelines emphasize the lead agency's discretion to determine the appropriate methodologies and thresholds of significance consistent with the manner in which other impact areas are handled in CEQA (CNRA 2009a). The State of California has not adopted emission-based thresholds for GHG emissions under CEQA. The Governor's Office of Planning and Research's Technical Advisory, titled Discussion Draft CEQA and Climate Change Advisory (OPR 2018), states that:

> [N]either the CEQA statute nor the CEQA Guidelines prescribe thresholds of significance or particular methodologies for performing an impact analysis. This is left to lead agency judgment and discretion, based upon factual data and guidance from regulatory agencies and other sources where available and applicable. Even in the absence of clearly defined thresholds for GHG emissions, such emissions must be disclosed and mitigated to the extent feasible whenever the lead agency determines that the project contributes to a significant, cumulative climate change impact.

Furthermore, the advisory document indicates that "in the absence of regulatory standards for GHG emissions or other scientific data to clearly define what constitutes a 'significant impact,' individual lead agencies may undertake a project-by-project analysis, consistent with available guidance and current CEQA practice." Section 15064.7(c) of the CEQA Guidelines specifies that "when adopting thresholds of significance, a lead agency may consider thresholds of significance previously adopted or recommended by other public agencies, or recommended by experts, provided the decision of the lead agency to adopt such thresholds is supported by substantial evidence."

The YSAQMD has not adopted GHG emission significance criteria for CEQA purposes and neither the BAAQMD nor the Sacramento Metropolitan Air Quality Management District have established relevant numeric GHG thresholds that would be applicable to the project.

As such, the potential for the project to result in a significant impact under CEQA is evaluated based on the CEQA Appendix G thresholds, including the potential for the project to: (1) generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment; or (2) conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

3.2.3.2 Future Tiering of Discretionary Development from the Qualified ECAS

CEQA Guidelines Section 15183.5 allows the GHG impacts of future projects to be evaluated using an adopted GHG emissions reduction plan, like the ECAS, provided that the plan meets specific requirements. Specifically, Section 15183.5(a) and (b) state:

> "(a) Lead agencies may analyze and mitigate the significant effects of greenhouse gas emissions at a programmatic level, such as in a general plan, a long range development plan, or a separate plan to reduce greenhouse gas emissions. Later project-specific environmental documents may tier from and/or incorporate by reference that existing programmatic review. Project-specific environmental documents may rely on an EIR containing a programmatic analysis of GHG emissions."

> "(b) Plans for the Reduction of GHG Emissions. Public agencies may choose to analyze and mitigate significant greenhouse gas emissions in a plan for the reduction of greenhouse gas emissions or similar document. A plan to reduce greenhouse gas emissions may be used in a cumulative impacts analysis as set forth below. Pursuant to sections 15064(h)(3) and 15130(d), a lead agency may determine that a project's incremental contribution to a cumulative effect is not cumulatively considerable if the project complies with the requirements in a previously adopted plan or mitigation program under specified circumstances."

The six requirements specified in the State CEQA Guidelines for GHG reduction plan elements are listed below as well as the ECAS's compliance:

> (1) Quantify greenhouse gas emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area.

The ECAS Update includes a baseline (existing) inventory for 2019, which builds off the previous 2008 inventory; a BAU inventory for 2035; and an adjusted business-as-usual (ABAU) GHG inventory for 2035. The ECAS also includes a projected inventory for 2035 assuming implementation of the ECAS strategies, measures, and actions.

> (2) Establish a level, based on substantial evidence, below which the contribution to GHG emissions from activities covered by the plan would not be cumulatively considerable.

The ECAS Update establishes a GHG emissions target of 470,861 MT CO_2e in 2035 as presented in Section 2.6. This target aligns with the Statewide GHG emissions target of 40% below 1990 levels by 2030 per SB 32 and demonstrates substantial progress towards meeting the EO S-3-05 target of 80% below 1990 levels by 2050.

> (3) Identify and analyze the GHG emissions resulting from specific actions or categories of actions anticipated within the geographic area.

The ECAS Update identifies and analyzes GHG emissions from various emission source sectors relevant to the City including transportation, residential and non-residential energy, water and wastewater, solid waste, and off-road equipment.

> (4) Specify measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level.

The ECAS Update includes specific measures to achieve the overall communitywide reduction target.

> (5) Establish a mechanism to monitor the plan's progress toward achieving the level and to require amendment if the plan is not achieving specified levels.

The ECAS includes periodic implementation and monitoring direction.

> (6) Be adopted in a public process following environmental review.

This Supplemental EIR serves as the environmental review for the proposed ECAS consistent with the requirements of CEQA, including opportunities for public review and comment.

3.2.4 Impact Analysis

3.2.4.1 Methodology

The evaluation of Impact GHG-1, regarding if the project would generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment, is based on a qualitative analysis of the project. Neither the Transportation Element Update or ECAS Update are anticipated to generate measurable GHG emissions and instead, would result in GHG emissions reductions communitywide. Accordingly, there is no project-generated GHG emission calculation methodology to disclose. The ECAS Update provides a complete discussion of calculations used for the inventories (existing, 2035 BAU, and 2035 ABAU) and GHG reduction strategies. The year 2035 was selected to extend the useable life of the ECAS Update and to align with the City's VMT guidance as part of the City's Transportation Element Update.

For definition clarity, the baseline GHG inventory represents a snapshot of the communitywide GHG emissions generated in Vacaville in 2019. The BAU is a projection of future GHG emissions, showing how GHG emissions would change over time if no action is taken at the Federal, State, or local level to reduce them. Accordingly, in the BAU scenario, changes in GHG emissions are caused by changes in demographic trends including population, employment, service population, dwelling units, non-residential square footage, and VMT which are all anticipated to increase from 2019 to 2035. The ABAU refers to a scenario that assumes adopted Federal- and State-mandated GHG emission reduction measures, such as vehicle GHG emission reductions and energy efficiency, would be implemented. These Federal- and State-mandated GHG emission reductions would occur regardless of any reduction measures that the City does or does not implement in this ECAS Update, so they are included in the ABAU forecast.

The evaluation of Impact GHG-2, regarding the potential for the project to conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs, includes a similar qualitative analysis of the potential for the project to support achieving GHG reduction goals in applicable statewide plans and other applicable GHG policies or regulations.

3.2.4.2 Project Impacts

Impact GHG-1. The project would not generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment.

As part of the ECAS Update, the City has prepared GHG emission inventories for the baseline year of 2019, which builds off of the 2015 ECAS baseline year of 2008. The ECAS Update also estimates projected BAU emissions in 2035 and an ABAU scenario for 2035. The VMT forecast for 2035 from the Transportation Element Update was used as the basis for the 2035 mobile source emission calculations. In summary, estimated communitywide GHG emissions for Vacaville in 2019 were 844,198 MT CO_2e, projected communitywide GHG emissions for Vacaville under the BAU scenario in 2035 are 1,033,227 MT CO_2e, and projected communitywide GHG emissions under the ABAU scenario in 2035 are 756,194 MT CO_2e. Key state actions designed to reduce GHG emissions that are quantified in the ECAS in the ABAU scenario include RPS that reduce energy related emissions and regulations included in EMFAC2017 to reduce vehicle GHG emissions from the transportation sector (including Advanced Clean Cars and Pavley).

The largest GHG emission source category for both the 2019 baseline year and 2035 ABAU is the transportation category, representing 72% of the total GHG emissions in 2019 and 67% of total GHG emissions under the 2035 ABAU. The second largest GHG emission source is the energy sector for both the 2019 baseline year and 2035 ABAU. In 2019, combined residential and non-residential energy represents 22% of total GHG emissions, and under the 2035 ABAU, combined residential and non-residential energy represents 27% of total GHG emissions. For the 2035 ABAU, solid waste accounted for 4%, off-road equipment accounted for 2%, and water/wastewater accounted for the remaining 0.5% of total GHG emissions.

The ECAS sets a substantial GHG reduction target for 2035 to align with statewide emissions reduction goals. The ECAS Update GHG reduction target is 470,861 MT CO_2e to meet the State's 2030 GHG reduction target of 40% below 1990 levels by 2030 (SB 32) and demonstrate substantial progress towards meeting the State's 2050 GHG reduction target of 80% below 1990 levels by 2050 (EO S-3-05). The additional reductions needed at the local level are estimated based on the emission reductions necessary between the "gap" of the ABAU inventory of 756,194 MT CO_2e and the inventory goal of 470,861 MT CO_2e. After accounting for Federal and State regulatory measure GHG reductions, the local gap is estimated to be approximately 285,333 MT CO_2e by 2035.

The key outcome of the ECAS Update is to reduce GHG emissions where possible to successfully meet the previously mentioned State regulations. While the State uses mandates and actions to reduce a portion of these GHG emissions, reducing the remaining emissions is the responsibility of Vacaville. As the gap between the 2035 ABAU and target is 285,333 MT CO_2e, Vacaville needs to use its own strategies to reduce 285,333 MT CO_2e by 2035.

As noted above, transportation is the largest producer of emissions, but reductions are limited due to car-oriented land uses and infrastructure. The major ECAS strategies for transportation include the adoption of electric vehicles and reduction of VMT through transit improvements and other incentives to reduce miles driven. Major energy reductions are possible in the energy sectors. These ECAS reductions are attributed to the electrification of buildings coupled with the adoption of community choice power, which offers cleaner electricity than Pacific Gas and Electric Company. Emissions from electricity used in water and wastewater processes would also be reduced by this community choice power provider. Solid waste emissions would be reduced during ECAS implementation through the development and implementation of a solid waste reduction plan. This solid waste plan will improve composting capacity citywide and allow for carbon-containing waste to be diverted from landfills. Off-road equipment reductions will result by replacing applicable construction equipment with equipment run by renewable fuels as required by the ECAS. Carbon storage is included in the ECAS strategies and would offer a net gain in carbon storing capacity citywide. Planting trees and spreading compost on City-owned open spaces would improve carbon storage and would be reductions in carbon emissions.

Emissions projected for 2035 under the BAU, ABAU, and with ECAS implementation, along with the 2019 baseline, are presented in Table 3.2.3. The 2035 ECAS column in Table 3.2.3 displays GHG emissions after local measures have been implemented.

Table 3.2.3. Summary of GHG Emission Inventories and Projections

Emissions Category	2019 Baseline (MT CO_2e)	2035 BAU (MT CO_2e)	2035 ABAU (MT CO_2e)	2035 ECAS (MT CO_2e)
Transportation	609,843	742,094	508,948	286,321
Residential Energy	93,272	113,456	95,097	23,260
Non-Residential Energy	96,316	130,027	105,080	23,331

Water/Wastewater	3,355	4,052	3,469	756
Solid Waste Disposal	28,335	29,831	29,831	14,166
Off-road Equipment	13,077	13,768	13,768	11,014
Carbon Storage	N/A	N/A	N/A	(4,802)
Total	**844,198**	**1,033,227**	**756,194**	**454,047**
Percent Change from 2035 BAU Baseline	*N/A*	*N/A*	*(27%)*	*(55%)*

Notes: GHG = greenhouse gas; BAU = Business-as-Usual; ABAU = Adjusted Business-as-Usual; ECAS = Energy and Conservation Action Strategy; MT CO_2e = metric tons of carbon dioxide equivalent.
Numbers noted in parenthesis represent a negative number.
Totals may not sum due to rounding.

As shown in Table 3.2.3, with implementation of the ECAS, Vacaville's GHG inventory is estimated to be 454,047 MT CO_2e in 2035; therefore, Vacaville will meet and exceed its target of 470,861 MT CO_2e in 2035 by 16,814 MT CO_2e.

The ECAS is anticipated to generate minimal short-term construction GHG emissions associated with GHG reduction strategies, measures, and actions such as vehicle charging stations and infrastructure, and electrification retrofits. While no measurable long-term, operational GHG emissions are anticipated, there are potential operational GHG-related emissions associated with ECAS strategies such as spreading compost using mechanical or petroleum-fueled agricultural equipment; however, many operational activities would be occasional rather than a routine, long-term source of GHG emissions. Of importance, the low-intensity construction and operational activities are anticipated to result in long-term benefits from reducing GHG emissions. Overall, the GHG reductions anticipated to be achieved through implementation of the ECAS are anticipated to offset any GHG emissions generated through ECAS strategies, measures, and actions.

As stated above, the ECAS target inventory goal of 470,861 MT CO_2e meets the State's SB 32 2030 GHG reduction target of 40% below 1990 levels by 2030 and demonstrates substantial progress towards meeting the State's EO S-3-05 2050 GHG reduction target of 80% below 1990 levels by 2050. Because the ECAS meets (and exceeds) the City-specific GHG target, the ECAS thereby meets the SB 32 2030 target and demonstrates substantial progress towards meeting the EO S-3-05 2050 target.

As discussed in Section 3.2.2.3, for local governments, the 2030 Scoping Plan includes a recommendation to aim for a communitywide goal of no more than 6 MT CO_2e per capita by 2030 and no more than 2 MT CO_2e per capita by 2050, which are consistent with the state's long-term goals. The interpolated per capita value between the Scoping Plan 2030 and 2050 goals for 2035 is 5 MT CO_2e per capita in 2035. After implementation of the ECAS, Vacaville's GHG emissions in 2035 is anticipated to be 454,047 MT CO_2e. The 2035 residential population for Vacaville is anticipated to be 101,950 persons (MTC and ABAG 2017). Accordingly, the 2035 per capita GHG emissions for the City is 4.45 MT CO_2e per capita (454,047 MT CO_2e ÷ 101,950 persons). As the City would achieve 4.45 MT CO_2e per capita in 2035 and the interpolated Scoping Plan 2035 target is 5 MT CO_2e per capita, the City would also support the communitywide goals of the 2030 Scoping Plan.

Of note, the ECAS takes into account communitywide emissions, which includes GHG emissions generated by residential and non-residential uses, and thus includes GHG emissions generated by residential population and employment. As such, a more appropriate measure of GHG emissions for the ECAS on an efficiency metric basis may be the service population rather than residential employment only (i.e., per capita). The anticipated service population for the City in 2035 is 134,980 persons (101,950 residential population + 33,030 employment) (MTC and ABAG 2017). Accordingly, the 2035 per service population GHG emissions for the City is 3.36 MT CO_2e per

service population (454,047 MT CO_2e ÷ 134,980 service population). While the per capita efficiency metric was provided above for comparison to the CARB 2030 Scoping Plan recommendation, the service population efficiency metric is provided for additional information and is not compared to a similar recommendation.

The ECAS acknowledges that additional actions beyond those identified will be necessary to achieve future, more stringent goals (such as carbon neutrality), and therefore provides a mechanism for implementing and monitoring the ECAS as well as adoption of a new ECAS in the future to incorporate new measures and technologies that will help the State and the City meet its ongoing goals.

In conclusion, adoption and implementation of the ECAS Update would result in a decrease in communitywide GHG emissions from the 2019 baseline, the 2035 BAU, and 2035 ABAU, and would exceed the City-specific GHG emissions target of 470,861 MT CO_2e, which meets the State's SB 32 2030 GHG reduction target and demonstrates substantial progress towards meeting the State's EO S-3-05 2050 GHG reduction target. As described above, construction and operations associated with implementation of the proposed ECAS strategies, measures, and actions may result in GHG emissions, but these emissions would be more than offset by the long-term reductions in GHG emissions that the actions would enable. Therefore, the project would result in a **less-than-significant impact** related to generation of GHG emissions.

Impact GHG-2. The project would not conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

The ECAS is a policy document that identifies strategies to reduce communitywide GHG emissions and help the City support the State in meeting its ambitious climate goals. The purpose of the ECAS is to meet the City's fair share of statewide GHG emission reductions as the 2015 ECAS did to meet AB 32 goals and the ECAS Update does to meet SB 32 goals and demonstrate substantial progress toward the State's longer-term targets, specifically EO S-3-05. The CAP is designed to be consistent with the reduction measures and recommendations contained in CARB's AB 32 Scoping Plan and the Second Scoping Plan Update, which was designed to meet the State's 2030 GHG target set forth in SB 32. As discussed above, the ECAS Update includes strategies, measures, and actions to reduce City GHG emissions from projected ABAU levels by 286,332 MT CO_2e to achieve the City GHG target of 470,861 MT CO_2e.

While the ABAU scenario in the ECAS Update conservatively did not take credit for all anticipated statewide reductions, many CARB Scoping Plan measures, such as Advanced Clean Cars and Renewables Portfolio Standard, were included in the ECAS. Other Scoping Plan measures, such as Low Carbon Fuel Standard, additional solar PV measures, and various water and energy efficiency measures, may result in additional reductions for the City and the project would not conflict with implementation of these measures.

As explained in Section 3.2.2.3, the initial Scoping Plan (2008) was designed to attain statewide 2020 GHG emissions targets; the First Update (2014) builds off of the 2008 Scoping Plan and laid the groundwork to start the transition to the post-2020 goals set forth in EO S-3-05 and EO B-16-2012. The Second Update, or the 2030 Scoping Plan (2017), also builds on the successful framework established in the initial Scoping Plan and First Update, while identifying new, technologically feasible and cost-effective strategies that will serve as the framework to achieve the 2030 GHG target and define the state's climate change priorities to 2030 and beyond. The ECAS Update is specifically developed for the City to help meet the statewide goals as interpolated for 2035 considering 2030 and 2050 GHG reduction targets in SB 32 and EO S-3-05, respectively. Overall, the project would reduce communitywide GHG emissions, which would further the objectives of the Scoping Plan and not obstruct implementation or attainment of the Scoping Plan goals. Furthermore, as explained above, with implementation of the ECAS Update,

the City would achieve 4.45 MT CO_2e per capita in 2035 and the interpolated Scoping Plan 2035 target is 5 MT CO_2e per capita; therefore, the City would also support the communitywide goals of the 2030 Scoping Plan. As the VMT estimated in the Transportation Element is included in the ECAS Update, that component of the project would also not conflict with the Scoping Plan. Accordingly, the City would not conflict with the CARB Scoping Plan or Updates and instead, identifies how the City would achieve consistency with the statewide GHG emissions limit.

As discussed in Section 3.2.2.4, the City is within the MTC/ABAG MPO, which adopted the Plan Bay Area in 2017. Plan Bay Area is a regional growth management strategy that targets per capita GHG reduction from passenger vehicles and light-duty trucks for the San Francisco Bay Area (ABAG and MTC 2017). The Plan Bay Area is not directly applicable to the project because the underlying purpose of the Plan Bay Area is to provide direction and guidance on future regional growth (i.e., the location of new residential and non-residential land uses) and transportation patterns throughout the region, as stipulated under SB 375. Within the Plan Bay Area, the core strategy includes "focused growth" in existing communities along existing transportation networks. The key to implementing the focused growth strategy are Priority Development Areas (PDAs) and Priority Conservative Areas (PCAs). In addition, the MTC and the ABAG Executive Board established seven goals and 13 performance targets to measure Plan Bay Area 2040's effectiveness in addressing the major challenges facing the region. Implementation of the ECAS would support the overarching intent of the Plan Bay Area through reducing GHG emissions within the City from both residential and non-residential development, including existing and future development. The ECAS specifically includes transportation related GHG reduction strategies that either reduce VMT (e.g., telecommuting and Transportation Demand Management) or reduce emissions associated with vehicle travel on the technology side (e.g., electrification of vehicles). The Transportation Element would also not conflict with the Plan Bay Area as all applicable City-generated vehicle GHG emissions were included in the ECAS Update and the ECAS serves to reduction emissions from the transportation sector. Therefore, the project would support and not conflict with applicable goals and strategies set forth in the Plan Bay Area.

In conclusion, the ECAS Update would not conflict with the statewide GHG reduction targets of AB 32, SB 32 (or EO B-30-15), or EO S-3-05, CARB's Scoping Plan, or MTC/ABAG Plan Bay Area. Instead, the project would support statewide and regional GHG emission reduction goals and efforts by attaining the City's fair share of GHG emission reductions and providing an implementation mechanism for GHG reduction strategies at the local level. Therefore, the project would not conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs and this impact would be **less than significant**.

3.2.5 Cumulative Impacts

Global climate change is a cumulative impact; a project's potential impact is determined through evaluation of its incremental contribution combined with the cumulative increase of all other sources of GHGs. Because of the inherently cumulative character of GHG impact analysis and the nature of the Transportation Element and ECAS Update project, analysis of cumulative impacts is incorporated into the analysis of Impacts GHG-1 and GHG-2. As discussed above, the cumulative GHG impacts of the proposed project would be less than significant.

3.2.6 Mitigation Measures

3.2.6.1 Proposed Mitigation Measures

The Transportation Element and ECAS Update addressed in this Supplemental EIR are not anticipated to result in significant impacts pursuant to CEQA related to GHG emissions, so no mitigation measures are warranted.

3.2.6.2 Significance after Mitigation

No mitigation measures are proposed, and potential impacts related to GHG emissions will be less than significant without mitigation.

3.2.7 References

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