

Memo

The logo for ASCENT, featuring the word "ASCENT" in a bold, sans-serif font, tilted slightly upwards to the right, set against a dark grey rectangular background.

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Date: August 8, 2023

To: City of Irvine – CAAP Project Team

From: Poonam Boparai, Fred Hochberg, Hannah Kornfeld, and Andrew Martin (Ascent)

Subject: Greenhouse Gas Emissions Forecasts Report for the City of Irvine Climate Action and Adaptation Plan

INTRODUCTION

The City of Irvine (City) is developing a Climate Action and Adaptation Plan (CAAP) to reduce greenhouse gas (GHG) emissions and prepare the city for the impacts of climate change. This technical memorandum provides the results of these forecasts, and describes the methods, assumptions, emissions factors, and data sources used to prepare them. The GHG emissions forecasts provide a foundation for the forthcoming steps of the City's climate action planning process, including establishing City-specific targets for reducing emissions levels, calculating additional reductions in emissions levels needed to meet the City's targets (also referred to as the emissions "gap"), and formulating and quantifying measures the City can take to meet its targets and close the gap.

ORGANIZATION OF THIS MEMORANDUM

This memorandum consists of two parts:

- ▶ **Section 1: Summary of Inventory Results** presents an overview of the City's 2019 GHG emissions inventories for community-wide activities and municipal operations.
- ▶ **Section 2: Greenhouse Gas Emissions Forecasts** summarizes the forecasted GHG emissions under "business-as-usual" (BAU) and legislative-adjusted BAU scenarios for years 2030, 2035, 2040, and 2045. The first scenario, called the BAU scenario, does not account for GHG emissions reductions resulting from laws and regulations adopted by local, regional, State, or federal agencies; it illustrates how much emissions would increase due to population and economic growth if no actions to reduce emissions were taken. The second scenario, a legislative-adjusted BAU scenario, shows emissions reductions from laws and regulations enacted by regional, State, and federal agencies; it does not reflect City actions to reduce GHG emissions. Further reductions in GHG emissions from City actions will be evaluated as a next step in the process of preparing the CAAP.

1 SUMMARY OF INVENTORY RESULTS

1.1 2019 COMMUNITY-WIDE INVENTORY

According to the *Greenhouse Gas Emissions Inventory Report for the City of Irvine Climate Action and Adaptation Plan* (2019 Inventory Report), the community generated approximately 2,247,593 metric tons of carbon dioxide equivalent (MTCO₂e) in 2019. Figure 1 and Table 1 present 2019 community-wide emissions by sector.

The largest emissions-generating sectors include on-road transportation and nonresidential and residential building energy. The 2019 emissions level serves as the baseline to forecast emissions and set reduction targets in the CAAP. GHG emissions from stationary sources regulated by State and federal agencies (e.g., sources covered by the Cap-and-Trade program) and outside the City's jurisdiction and influence (e.g., UC Irvine, County-operated landfill) are discussed in the 2019 Inventory Report but not reflected in the community-wide emissions total for 2019.

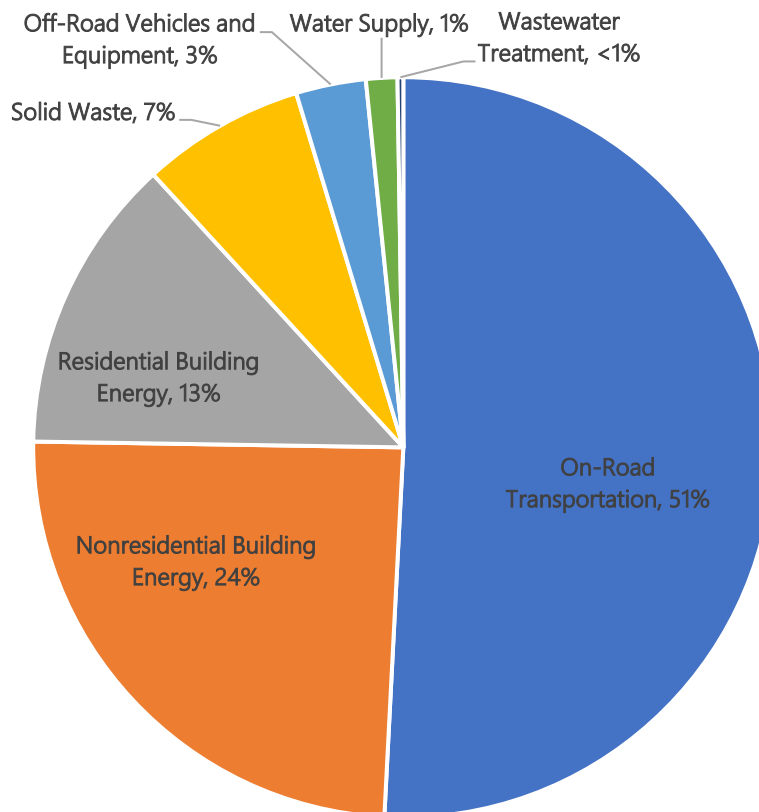


Figure 1. 2019 Community-wide GHG Emissions Inventory in the City of Irvine

Note: Totals are rounded to the nearest percent.

Table 1. 2019 Community-wide GHG Emissions Inventory in the City of Irvine

Sector	GHG Emissions (MTCO ₂ e)	Percent of Total
On-Road Transportation	1,140,206	51
Nonresidential Building Energy	550,138	24
Residential Building Energy	291,405	13
Solid Waste	160,626	7
Off-Road Vehicles and Equipment	68,756	3
Water Supply	30,798	1
Wastewater Treatment	5,665	<1
Total	2,247,593	100

Notes: Totals may not sum exactly due to independent rounding to the nearest percent. GHG = greenhouse gases; MTCO₂e = metric tons of carbon dioxide equivalent; NA = not applicable.

Source: Ascent Environmental 2023.

1.2 2019 MUNICIPAL OPERATIONS INVENTORY RESULTS

Based on the modeling conducted, the City's municipal operations generated approximately 18,566 MTCO₂e in 2019. The employee commute and buildings and facilities sectors generated approximately 81 percent of total emissions. The 2019 inventory serves as the municipal operations GHG emissions baseline for the CAAP to forecast emissions and set emissions reductions targets. Table 2 and Figure 2 present the results of the City's 2019 municipal operations GHG emissions inventory by sector, and a description of each emissions sector, including key sources of emissions, is provided in further detail in *Greenhouse Gas Emissions Inventory Report for the City of Irvine Climate Action and Adaptation Plan*.

Table 2. 2019 City of Irvine Municipal Operations GHG Emissions Inventory

Sector	GHG Emissions (MTCO ₂ e)	Percent of Total
Buildings and Facilities	12,003	65
Employee Commute	3,032	16
Wastewater Treatment	1,144	6
Vehicle Fleet	1,127	6
Streetlights and Traffic Signals	1,097	6
Solid Waste	159	1
Water Supply	4	<1
Total	18,566	100

Notes: Totals may not sum exactly due to independent rounding. GHG = greenhouse gases; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Ascent Environmental 2023.

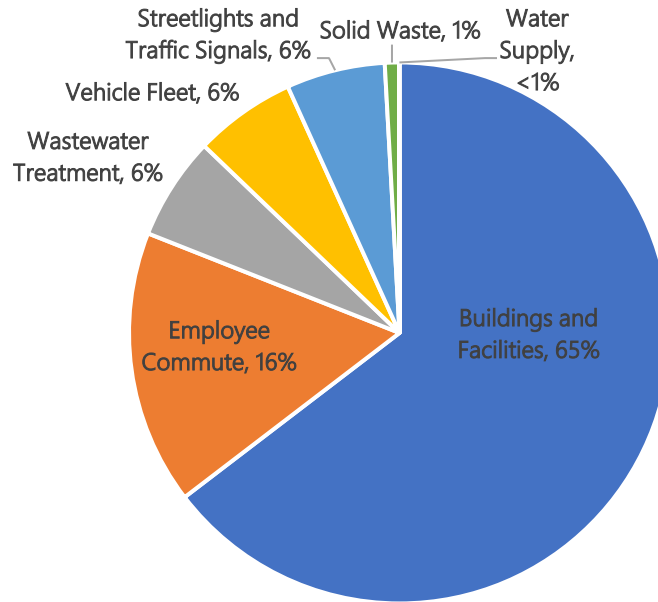


Figure 2. 2019 City of Irvine Municipal Operations GHG Emissions Inventory

2 GREENHOUSE GAS EMISSIONS FORECASTS

2.1 COMMUNITY FORECAST RESULTS

The BAU GHG emissions forecasts provide an assessment of how emissions generated by community activities will change over time without further local, State, or federal action. In addition to accounting for the city's growth under a BAU scenario, an adjusted BAU forecast was prepared, which includes adopted legislative and regulatory actions at the State and federal levels that would affect emissions without any local action (referred to hereafter as 'legislative-adjusted BAU'). These include regulatory requirements to increase vehicle fuel efficiency and increase renewable energy sources in grid electricity portfolios. It is important to note that the legislative-adjusted BAU emissions forecasts only include emissions reductions associated with implementation of adopted federal and State legislation and regulations and do not include goals established by executive orders or targets established by federal or State agencies. These forecasts provide the City with the information needed to focus efforts on emissions sectors and sources that have the greatest opportunities for GHG emissions reductions.

The GHG emissions forecasts for 2030, 2035, 2040, and 2045 are aligned with the reduction targets for statewide emissions levels established in State law, including the 2030 target set forth in Senate Bill (SB) 32 and the 2045 target set forth in Assembly Bill (AB) 1279:

- ▶ SB 32 (2016)
 - reduce statewide GHG emissions to 40% below 1990 levels by 2030.
- ▶ AB 1279 (2022):
 - achieve net zero GHG emissions statewide as soon as possible, but no later than 2045, and maintain net negative emissions thereafter; and
 - ensure that by 2045, statewide anthropogenic greenhouse gas emissions are reduced to at least 85% below the 1990 levels.

Both the BAU and legislative-adjusted BAU emissions forecasts were based on population and employment from the City's land use database and the California State University, Fullerton, Center for Demographic Research Orange County Projections. Population and employment are expected to increase by 21 and 28 percent, respectively, from 2019 to 2045. These growth factors were used to forecast emissions for most sectors. Additional information regarding the growth factors used for each sector is included in the following sections. Annual vehicle miles traveled (VMT) projections were developed using the origin-destination method using data from the Irvine Transportation Analysis Model (ITAM) Traffic Model 2021. Annual VMT by 2045 is projected to increase by 3.2 percent from 2019. VMT projections were used to scale emissions from the on-road transportation sector. Table 3 shows growth in population, employment, and annual VMT from 2019 to 2045.

Table 3. City of Irvine Community Demographic and Vehicle Miles Traveled Forecasts

Forecast Factor	2019	2030	2035	2040	2045
Population	291,124	317,246	329,119	340,993	352,866
Employment	250,954	280,541	293,989	307,438	320,886
Annual VMT	2,910,428,375	2,950,103,309	2,968,137,370	2,986,171,431	3,004,205,493

Notes: VMT = vehicle miles traveled.

Source: City of Irvine 2021; California State University, Fullerton 2018.

Table 4 shows baseline emissions in 2019 and BAU emissions forecasts for 2030, 2035, 2040, and 2045. Results for 2035 and 2040 were derived from the results for 2030 and 2045 using linear interpolation.

Table 4. City of Irvine Community GHG Emissions Inventory and BAU Forecasts (MTCO_{2e})

Sector	2019	2030	2035	2040	2045
On-Road Transportation	1,140,206	1,155,749	1,162,814	1,169,879	1,176,944
Nonresidential Building Energy	550,138	549,886	576,246	602,607	628,967
Residential Building Energy	291,405	298,338	309,504	320,670	331,836
Solid Waste	160,626	175,038	181,590	188,141	194,692
Off-Road Vehicles and Equipment	68,756	76,077	82,144	88,210	94,276
Water Supply	30,798	43,202	44,819	46,435	48,052
Wastewater Treatment	5,665	6,159	6,395	6,631	6,866
Total	2,247,593	2,304,450	2,363,511	2,422,573	2,481,634
Percent Change from 2019 Levels	—	3%	5%	8%	10%

Notes: Total may not sum exactly due to independent rounding. BAU = business-as-usual; GHG = greenhouse gas; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: Ascent Environmental 2023.

Legislative-adjusted BAU emissions forecasts were prepared using the same demographic and VMT data that were used for the BAU forecasts, while accounting for regional, State, and federal laws and regulations that would affect local emissions. These forecasts provide the City with an understanding of future community emissions to inform the identification of emissions reduction measures developed to meet GHG targets. A summary of the legislative reductions applied is provided in Table 5.

Table 5. Legislative Reductions Summary

Source	Legislative Reduction	Description	Sectors Applied
Regional	Orange County Power Authority (OCPA)	In the forecast years (i.e. all future years after 2019), approximately 62 percent of City of Irvine customers will take service on OCPA's Renewable Choice plan (100 percent renewable), 15 percent on the Smart Choice Plan (69 percent renewable), and 1 percent on the Basic Choice plan (38 percent renewable). In total, this represents 77 percent of City of Irvine customers being served by OCPA, with the remaining 23 percent served by Southern California Edison. (Kramer 2023 and City of Irvine 2023: 2). Totals may not sum exactly due to independent rounding.	Building Energy
State	California's Building Energy Efficiency Standards (2022 Title 24, Part 6)	Effective January 1, 2023, requires new residential and nonresidential buildings in California to comply with energy efficiency standards established by CEC. The 2022 standards establish energy performance requirements that encourage energy efficient approaches to building decarbonization by emphasizing electric heat pumps for space heating and water heating and extending the benefits of photovoltaic and battery storage systems and other demand flexible technology to work in combinations with heat pumps.	Building Energy
State	IRP (Integrated Resource Planning)	California Public Utilities Commission proceeding requiring California energy utilities to submit resource plans that reduce their carbon emissions below their share of 38 million metric tons (MMT) of total statewide electric sector emissions by 2030 and 30 MMT by 2035 (CPUC 2022: 8). ¹	Building Energy, Transportation
State	SB 100	Requires that all retail electricity sold in California must come from renewable or zero-carbon resources by 2045.	Building Energy, Transportation
State	SB 1020 (Clean Energy, Jobs, and Affordability Act of 2022)	Requires that eligible renewable energy resources and zero-carbon resources supply 90% of all retail sales of electricity to California end-use customers by December 31, 2035, 95% of all retail sales of electricity to California end-use customers by December 31, 2040, 100% of all retail sales of electricity to California end-use customers by December 31, 2045, and 100% of electricity procured to serve all state agencies by December 31, 2035.	Building Energy
State	Advanced Clean Car Standards I and II	Requires all new passenger cars, trucks and SUVs sold in California to meet increasingly stringent requirements regarding zero emissions technologies and emissions standards.	On-Road Vehicles
State	Truck and Bus Regulation	Requires diesel trucks and buses that operate in California to be upgraded to reduce GHG emissions.	On-Road Vehicles
Federal	Fuel Efficiency Standards for Medium- and Heavy-Duty Vehicles	Establishes fuel efficiency standards for medium- and heavy-duty engines and vehicles.	On-Road Vehicles
Federal	EPA Off-Road Compression-Ignition Engine Standards	Establishes standards for phasing of EPA diesel engine tiers for off-road compression-ignition equipment.	Off-Road Vehicles and Equipment

Notes: CAFE = Corporate Average Fuel Economy; CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas; OCPA = Orange County Power Authority; SB = Senate Bill.

Source: Ascent Environmental in 2023.

¹ IRP also requires that utilities submit a second, lower-carbon resource plan to meet statewide carbon goals. This second plan uses targets of 30 and 25 MMT in 2030 and 2035, respectively. However, this analysis uses the 38 MMT in 2030 and 30 MMT in 2035 plan, as stated in Table 5, as a more conservative estimate of possible electric sector emissions reductions.

The city’s legislative-adjusted BAU emissions would decrease by approximately 60 percent between 2019 and 2045, as shown below in Table 6 and Figure 3. Results for 2035 and 2040 were derived from the results for 2030 and 2045 using linear interpolation. Figure 3 also shows the emissions trend that would occur without anticipated legislative reductions, accounting only for population, employment, and VMT changes (i.e., BAU emissions). Without the legislative reductions, emissions would be approximately 178 percent higher in 2045 compared to 2045 emissions levels in the legislative-adjusted BAU forecast. Emissions forecasts for each sector are discussed in detail in the following sections.

Table 6. City of Irvine Community GHG Emissions Inventory and Legislative-Adjusted BAU Forecasts (MTCO₂e)

Sector	2019	2030	2035	2040	2045
On-Road Transportation	1,140,206	793,628	602,306	410,984	219,662
Nonresidential Building Energy	550,138	271,904	243,504	215,105	186,705
Residential Building Energy	291,405	210,707	203,991	197,276	190,561
Solid Waste	160,626	175,038	181,590	188,141	194,692
Off-Road Vehicles and Equipment	68,756	76,077	82,144	88,210	94,276
Water Supply	30,798	9,973	6,649	3,324	0
Wastewater Treatment	5,665	6,173	6,399	6,625	6,851
Total	2,247,593	1,543,501	1,326,583	1,109,665	892,747
Percent Change from 2019 Levels	—	-31%	-41%	-51%	-60%

Notes: Total may not sum exactly due to independent rounding. BAU = business-as-usual; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Ascent Environmental 2023.

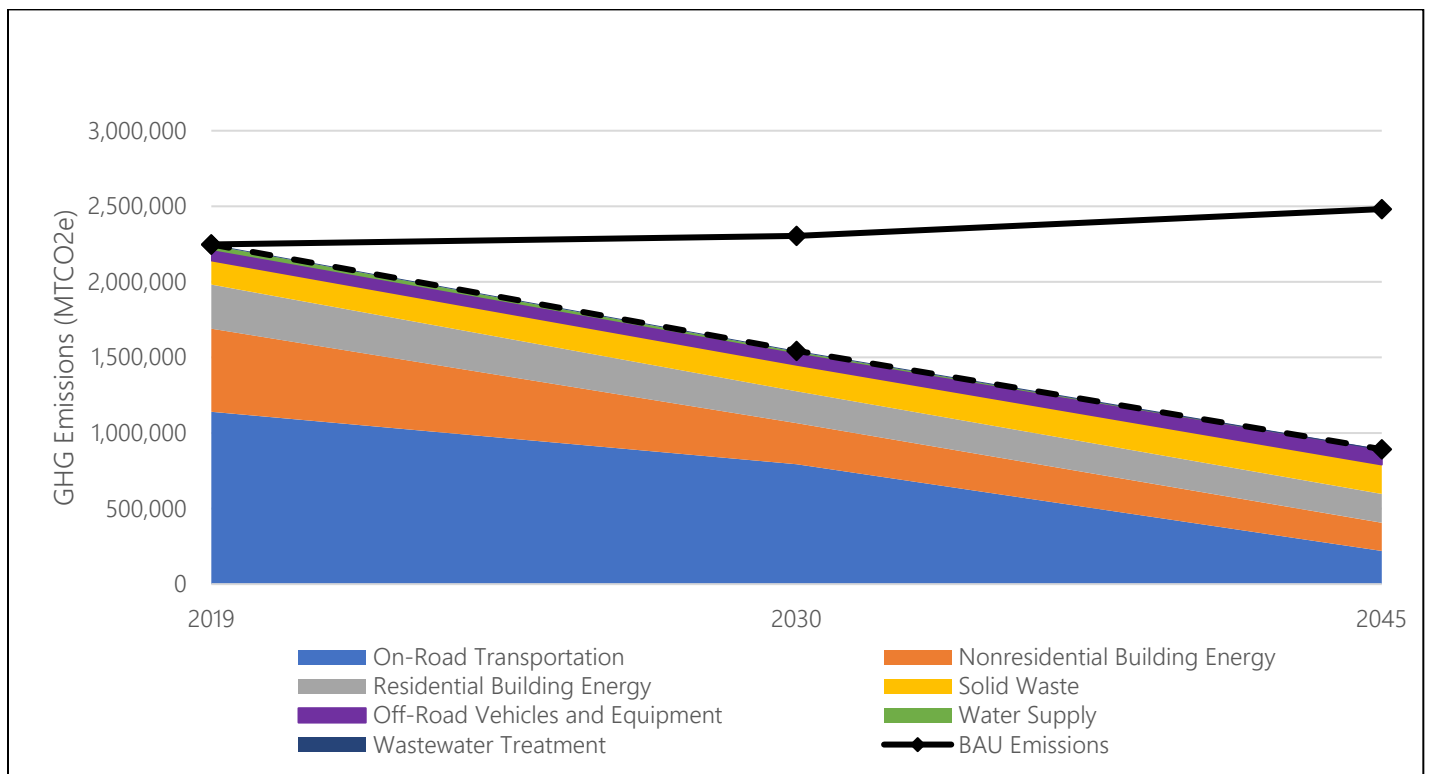


Figure 3 City of Irvine Community GHG Emissions Inventory and Forecasts

2.1.1 Building Energy

BUILDING ENERGY ASSUMPTIONS

Building energy emissions in the city result directly from onsite combustion of natural gas and indirectly from electricity consumption. The combustion of fossil fuels (i.e., diesel, liquid propane gas [LPG], and natural gas) in backup generators also contributes to the city’s building energy emissions. Southern California Edison (SCE) is the electricity provider and Southern California Gas Company (SoCalGas) is the natural gas provider in the city. Orange County Power Authority (OCPA) is a community choice aggregation agency established to source clean and renewable electricity in Orange County including the City of Irvine.

Electricity Emissions Factors

Emissions factors for electricity vary depending on the utility (SCE or OCPA), the carbon content of the different portfolios that each utility offers its customers, and year. To calculate City’s overall electric emissions factor for a given year, a weighted average of OCPA emissions and SCE emissions was taken, accounting for participation rates and portfolio offerings across those two utilities shown in Table 5 of this memorandum. This weighted average emissions factor was then applied to all electric usage. Table 7 below shows how this calculation was performed.

Table 7: Calculation of Weighted Emissions Electric Emissions Factor

Year	Participation rates by utility and power portfolio					MT CO ₂ e / MWh by utility and power portfolio				
	SCE	OCPA Basic	OCPA Smart	OCPA 100%	Total	SCE	OCPA Basic	OCPA Smart	OCPA 100%	Weighted Average
2019	100%	0%	0%	0%	100%	0.208	NA	NA	NA	0.208
2030	23%	1%	15%	62%	100%	0.141	0.244	0.094	0	0.048
2045	23%	1%	15%	62%	100%	0	0	0	0	0

Notes: Total may not sum exactly due to independent rounding. MTCO₂e = metric tons of carbon dioxide equivalent. MWh = megawatt-hour. NA = Not Applicable.

Source: Ascent Environmental 2023.

SCE’s emissions factor for 2019 was derived from its Power Content Label, which shows 16.1 percent natural gas and 32.6 percent from unspecified sources of power (unspecified power is electricity that has been purchased through open market transactions and is not traceable to a specific generation source: SCE 2019). In total, this implies that SCE’s portfolio is 48.7 percent carbon-emitting power.² This 48.7 percent was then multiplied by California Air Resources Board (CARB) emissions factor for Mandatory Reporting of Greenhouse Gases (MRR) of 0.428 MT CO₂e/MWh, which reflects the emissions from unspecified power, and additionally is similar to the emission factor from an average single-cycle natural gas power plant (CARB 2018: 16).

Emissions factors for 2030 were derived from SCE and OCPA’s IRP electricity resource plans as described in Table 5. In the case of SCE, its 2030 IRP plan shows 67 percent GHG-free power (SCE 2022). This corresponds to 33 percent emitting power from natural gas or unspecified power and thus 0.141 MT CO₂e/MWh based on the CARB emissions factor of 0.428 MT CO₂e/MWh shown above.

² This memorandum uses “carbon-emitting power” as a shorthand to refer to the sum of power generated by natural gas-fired generators and unspecified power.

In the case of OCPA, a separate emission factor for each portfolio (Basic, Smart, and 100%) was calculated. A percentage of carbon-free power for each portfolio was estimated by taking OCPA’s overall ratio of carbon-free energy to renewable energy in 2030 in its IRP plan (113 percent, per OCPA 2022) and multiplying that ratio by each portfolio’s percentages of renewable content. This percentage of carbon-free power was then subtracted from 100 percent to yield a percentage of carbon-emitting power. Finally, this percent of carbon-emitting power was multiplied by 0.428 MT CO₂e/MWh to yield an emissions factor. Table 8 below shows the results of this calculation.

Table 8: Derivation of 2030 OCPA emissions factors

	Basic	Smart	100% Renewable
Percent Renewable	38%	69%	100%
Percent Carbon-Free	43%	78%	100%
Percent Carbon-Emitting Power	57%	22%	0%
Emissions Factor (MT CO ₂ e / MWh)	0.244	0.094	0

Source: Ascent Environmental 2023.

Natural Gas Emissions Factors

Natural gas emissions are based on emissions factors obtained from The Climate Registry’s (TCR’s) 2020 Default Emission Factors, which are estimated to be 11.7 pounds of carbon dioxide equivalent per therm (lb CO₂e/therm) for stationary combustion in buildings and 11.6 lb CO₂e/therm for electricity generation in backup generators (TCR 2020). Emissions factors associated with natural gas combustion are not anticipated to change over time, as there are no legislative actions that would reduce the carbon intensity of natural gas.

Diesel Emissions Factors

Emissions from diesel fuel used to power backup generators are based on emissions factors from TCR, which are estimated to be 22.6 pounds of carbon dioxide equivalent per gallon (lb CO₂e/gal). Emissions factors associated with diesel combustion are not anticipated to change over time, as there are no legislative actions that would reduce the carbon intensity of diesel.

Gasoline Emissions Factors

Emissions from gasoline fuel used to power backup generators are based on emissions factors also from TCR, which are estimated to be 19.3 lb CO₂e/gal. Emissions factors associated with gasoline combustion are not anticipated to change over time, as there are no legislative actions that would reduce the carbon intensity of gasoline.

Energy Efficiency and Fuel Source

Future energy use was adjusted to reflect increased emissions-intensity stringency under California’s Building Energy Efficiency Standards (California Code of Regulations Title 24 Part 6, hereafter referred to as “Title 24”). Title 24 standards apply to new residential and nonresidential construction. The 2019 Title 24 standards apply to projects constructed after January 1, 2020, and the 2022 Title 24 standards will apply after January 1, 2023. To estimate adjusted future energy consumption resulting from Title 24 requirements in new construction, electricity- and natural gas-specific adjustment factors were calculated using the difference in the average energy use in residential and nonresidential buildings between those built to 2019 Title 24 standards and those built to 2022 Title 24 standards. Adjustment factors were calculated using data available from the California Energy Commission (CEC) that were developed for the 2022 Title 24 standards. In addition to accounting for Title 24 requirements by land use type (i.e., residential and nonresidential), CEC also developed estimates for energy usage rates by climate zone, and the city’s climate zone (Zone 8) was used for the residential buildings analysis. Climate zone-specific data for nonresidential buildings were unavailable; therefore, nonresidential adjustment factors relied on statewide averages.

The adjustment factors (specific to both building type and energy type) were applied to the BAU growth in energy use to estimate the energy consumption and associated GHG emissions of future development with legislative adjustments. It is important to note that although average electricity use in new residential buildings is anticipated to rise (due to an increase in electrical demand associated with electric appliances installed instead of natural gas appliances), emissions from new residential buildings are expected to be lower than they would be under 2019 Title 24 as a result of overall lower building emissions intensities (due to lower emissions factors associated with electricity compared to natural gas).

BUILDING ENERGY RESULTS

Emissions from future electricity, natural gas, and backup generator (i.e., diesel, natural gas, and gasoline) use were estimated by multiplying anticipated energy use by forecasted emissions factors. Future energy use was forecasted in two parts. First, energy use was scaled by population and employment growth factors detailed above. Second, energy emissions factors were adjusted as described in the previous section. Natural gas, diesel, and gasoline emissions factors were not adjusted, as the emissions intensity of these energy sources is anticipated to stay constant. The assumptions for future electricity emissions factors are described below. Table 9 summarizes the scaling factors and legislative reductions used to forecast building use by energy type.

Table 9. Building Energy Emissions Forecast Methods by Energy Type

Energy Type	Forecast Methods	
	Scale Factor	Applied Legislative Reductions
Electricity	Scaled by population growth for residential building energy; scaled by employment growth for nonresidential building energy.	Emissions factors derived from SCA and OCPA IRP plans. Accounts for Title 24 energy efficiency gains in new construction based on the best available data for average building energy efficiency.
Natural Gas		Accounts for Title 24 energy efficiency gains in new construction based on the best available data for average building energy efficiency.
Backup Generators	Scaled by employment growth.	None.

Notes: OCPA = Orange County Power Authority; RPS = Renewables Portfolio Standard; SCE = Southern California Edison.

Source: Ascent Environmental 2023.

RESIDENTIAL BUILDING ENERGY

Between 2019 and 2045, emissions from residential building energy would decrease by approximately 35 percent from 291,405 to 190,561 MTCO_{2e} with legislative adjustments, despite overall population growth of approximately 25 percent over the same time. Table 10 shows the 2019 inventory and legislative-adjusted BAU forecasted emissions from the residential building energy sector by energy type for 2030, 2035, 2040, and 2045. Results for 2035 and 2040 were derived from the results for 2030 and 2045 using linear interpolation.

Table 10. Residential Building Energy GHG Emissions Inventory and Legislative-Adjusted BAU Emissions Forecasts (Annual MTCO_{2e})

Energy Type	2019	2030	2035	2040	2045
Electricity	116,584	29,451	19,634	9,817	0
Natural Gas	174,820	181,255	184,357	187,459	190,561
Total	291,405	210,707	203,991	197,276	190,561

Notes: Totals may not sum exactly due to independent rounding. BAU = business-as-usual; GHG = greenhouse gas; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: Ascent Environmental 2023.

NONRESIDENTIAL BUILDING ENERGY

Between 2019 and 2045, emissions from nonresidential building energy would decrease by approximately 66 percent from 550,139 to 187,371 MTCO_{2e} with legislative adjustments, despite overall employment growth of approximately 33 percent over the same time. Increased natural gas and backup generator emissions would be offset by reduced emissions from electricity in 2045. Table 11 shows the 2019 inventory and legislative-adjusted BAU forecasted emissions for the nonresidential building energy sector by energy type for 2030, 2035, 2040, and 2045. Results for 2035 and 2040 were derived from the results for 2030 and 2045 using linear interpolation.

Table 11. Nonresidential Building Energy GHG Emissions Inventory and Legislative-Adjusted BAU Forecasts (Annual MTCO_{2e})

Energy Type	2019	2030	2035	2040	2045
Electricity	385,130	98,767	65,845	32,922	0
Natural Gas	160,501	170,317	174,705	179,092	183,480
Backup Generators	4,507	3,401	3,564	3,728	3,891
Total	550,139	272,486	244,114	215,743	187,371

Notes: Totals may not sum exactly due to independent rounding. BAU = business-as-usual; GHG = greenhouse gas; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: Ascent Environmental 2023.

2.1.2 Transportation

ON-ROAD TRANSPORTATION

Between 2019 and 2045, GHG emissions from on-road vehicles would decrease by approximately 81 percent from 1,140,206 to 219,662 MTCO_{2e}, accounting for an increase in VMT of approximately 4 percent, and future vehicle emissions factors modeled in California Air Resources Board's (CARB's) Emissions FACTor (EMFAC2021) model. VMT projections were developed using the origin-destination method and data from the ITAM model. With respect to the legislative adjustments included in this forecast, State and federal laws and regulations incorporated in the on-road transportation sector include the Pavley Clean Car Standards Advanced Clean Car I and II (ACC I and II) Standards, and fuel efficiency standards for medium- and heavy-duty vehicles. Pavley Clean Car Standards and fuel efficiency standards are included in EMFAC2021's emissions factor estimates and forecasts. Vehicle fleet assumptions were adjusted to account for the effect of Advanced Clean Car II (ACC II) Standards, including assumed new sales of battery electric vehicles and plug-in hybrids (CARB 2022: 5). The Low Carbon Fuel Standard was excluded in EMFAC2021 forecasts because the emissions benefits originate from upstream fuel production and do not directly reduce vehicle tailpipe emissions that affect the city's GHG emissions forecasts. Table 12 summarizes the scaling factors and legislative reductions used to forecast on-road transportation emissions.

Table 12. On-Road Transportation Emissions Forecast Methods

Source	Forecast Methods	
	Scale Factor	Applied Legislative Reductions
On-Road Transportation	Scaled by VMT estimates provided by Iteris.	EMFAC2021 forecasts vehicle fleet distributions by vehicle type and the emissions factors anticipated for each vehicle category based on both vehicle emissions testing and approved legislative reductions. EMFAC2021's forecasts incorporate the effects of federal standards and fuel efficiency standards for medium- and heavy-duty vehicles, as well as truck and bus regulations. Vehicle fleet assumptions were adjusted to account for the effect of Advanced Clean Car II (ACC II) Standards, including assumed new sales of battery electric vehicles and plug-in hybrids

Notes: ACC II= Advanced Clean Cars CAFE = Corporate Average Fuel Economy; EMFAC2021 = California Air Resources Board's Emission Factor 2021 model.

Source: Ascent Environmental 2022.

Table 13 shows the 2019 inventory and legislative-adjusted BAU forecasted emissions from on-road transportation for 2030, 2035, 2040, and 2045.

Table 13. On-Road Transportation GHG Emissions Inventory and Legislative-Adjusted BAU Forecasts (Annual MTCO_{2e})

Source	2019	2030	2035	2040	2045
On-Road Transportation	1,140,206	793,628	602,306	410,984	219,662

Notes: BAU = business-as-usual; GHG = greenhouse gas; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: Ascent Environmental 2023.

OFF-ROAD VEHICLES AND EQUIPMENT

Between 2019 and 2045, emissions associated with off-road vehicles and equipment used in the city would increase by 37 percent from 68,756 to 94,276 MTCO_{2e}, with legislative adjustments applied and overall growth in various demographics. Emissions were obtained primarily from CARB's latest off-road emissions model, OFFROAD2021, as well as from CARB's OFFROAD2007 model. With respect to the legislative adjustments in the off-road vehicle sector, OFFROAD2021 was used, which incorporates regulatory actions such as reformulated fuels and more stringent emissions standards. However, some off-road vehicle and equipment sources that are included in the OFFROAD2007 model are excluded from OFFROAD2021. For these sectors, emissions were obtained from OFFROAD2007. In addition, OFFROAD2021 provides CO₂ emissions but does not provide emissions from CH₄ and N₂O. Ratios of CH₄ and N₂O to CO₂ reported in OFFROAD2007 were calculated and applied to CO₂ data from OFFROAD2021 to calculate CH₄ and N₂O emissions, as recommended by CARB.

Orange County-level emissions from off-road vehicles and equipment were scaled using changes in city-specific demographic factors. Table 12 summarizes the scaling factors and legislative reductions used to forecast off-road vehicle and equipment emissions.

Table 12. Off-Road Vehicles and Equipment Forecast Methods by Source

Source	Forecast Methods	
	Scale Factor	Applied Legislative Reductions
Construction and Mining	Service Population	OFFROAD2021 emissions factor considerations include EPA off-road compression-ignition engine standards implementation schedule.
Entertainment Equipment	Employment	
Industrial Equipment	Employment	
Lawn and Garden Equipment	Population	
Light Commercial Equipment	Employment	
Portable Equipment	Employment	
Recreational Equipment	Population	
Transport Refrigeration Units	Service Population	

Notes: EPA = U.S. Environmental Protection Agency; OFFROAD2021 = California Air Resources Board's OFFROAD2021 model.

Source: Ascent Environmental 2022.

Table 13 shows the 2019 inventory and legislative-adjusted BAU forecasted emissions from the off-road vehicles and equipment sector for 2030, 2035, 2040, and 2045.

Table 13. Off-Road Vehicles and Equipment GHG Emissions Inventory and Legislative-Adjusted BAU Forecasts (Annual MTCO_{2e})

Source	2019	2030	2035	2040	2045
Construction and Mining	19,536	21,614	23,051	24,668	26,519
Entertainment Equipment	267	295	317	341	368
Industrial Equipment	25,201	27,892	29,972	32,233	34,753
Lawn and Garden Equipment	708	776	822	874	935
Light Commercial Equipment	5,330	5,899	6,339	6,817	7,350
Portable Equipment	14,647	16,212	17,421	18,734	20,199
Recreational Equipment	267	293	310	329	352
Transport Refrigeration Units	2,799	3,097	3,303	3,534	3,800
Total	68,756	76,077	81,534	87,531	94,276

Notes: Totals may not sum exactly due to independent rounding. BAU = business-as-usual; GHG = greenhouse gas; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: Ascent Environmental 2023.

2.1.3 Solid Waste

Between 2019 and 2045, solid waste emissions generated from community activities in the city would increase by approximately 21 percent from 160,626 to 194,692 MTCO_{2e}, accounting for overall population growth of approximately 25 percent over the same time. Solid waste sector emissions include CH₄ emissions from the decay of waste generated annually, which were scaled by population growth within the city between 2019 and 2045. No additional legislative reductions could be applied to this sector, so legislative-adjusted BAU emissions are equivalent to BAU emissions. Table 14 shows the 2019 inventory and legislative-adjusted BAU forecasted emissions from the solid waste sector for 2030, 2035, 2040, and 2045.

Table 14. Solid Waste GHG Emissions Inventory and Legislative-Adjusted BAU Forecasts (Annual MTCO_{2e})

Source	2019	2030	2035	2040	2045
Community-Generated Solid Waste	160,626	175,038	181,590	188,141	194,692

Notes: BAU = business-as-usual; GHG = greenhouse gas; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: Ascent Environmental 2023.

2.1.4 Water Supply

Between 2019 and 2045, water supply emissions generated from community activities in the city would be reduced to zero due to 100 percent RPS by 2045. It was assumed that certain proportions of water used within the city was extracted, conveyed, treated, and distributed within and outside the city boundary. For the water supply from local sources within the city, the electricity usage associated with extracting, conveying, treating, and distributing water is captured in the building energy sector because these activities take place within the city. Therefore, the electricity usage and emissions associated with extracting, conveying, treating, and distributing water from outside the city boundary was applied to the water sector. Electricity usage associated with water consumption is subject to RPS targets, pursuant to SB 100 requirements. Table 15 summarizes the scaling factor and legislative reduction used to forecast water supply emissions.

Table 15. Water Supply Forecast Methods and Legislative Reductions by Source

Source	Forecast Methods	
	Scale Factor	Applied Legislative Reductions
Water Consumption	Scaled by population growth.	Assumes electricity use for extraction, conveyance, distribution, and treatment follows the 2045 carbon-free electricity requirements.

Source: Ascent Environmental in 2022.

Table 16 shows the 2019 inventory and legislative-adjusted BAU forecasted emissions from the water supply sector for 2030, 2035, 2040, and 2045. Weighted average electric emissions factors shown in Table 7 were used to derive these figures. Results for 2035 and 2040 were derived from the results for 2030 and 2045 using linear interpolation.

Table 16. Water Supply GHG Emissions Inventory and Legislative-Adjusted BAU Forecasts (Annual MTCO_{2e})

Source	2019	2030	2035	2040	2045
Water Supply	30,798	9,973	6,649	3,324	0

Notes: BAU = business-as-usual; MTCO_{2e}/year = metric tons of carbon dioxide equivalent per year.

Source: Ascent Environmental in 2023.

2.1.5 Wastewater Treatment

Between 2019 and 2045, community wastewater treatment emissions would increase by 21 percent from 5,665 to 6,851 MTCO_{2e}. This change reflects an increase in wastewater generation resulting from population growth within the city of approximately 21 percent over the same time. Wastewater treatment-related emissions are generated from centralized wastewater treatment plants (WWTPs) providers for the city. Table 17 shows the 2019 inventory and legislative-adjusted BAU forecasted emissions from wastewater treatment sources for 2030, 2035, 2040, and 2045.

Table 17. Wastewater Treatment GHG Emissions Inventory and Legislative-Adjusted BAU Forecasts (Annual MTCO_{2e})

Source	2019	2030	2035	2040	2045
Centralized WWTPs	5,665	6,173	6,399	6,625	6,851

Notes: BAU = business-as-usual; GHG = greenhouse gas; MTCO_{2e} = metric tons of carbon dioxide equivalent; WWTP = wastewater treatment plant.

Source: Ascent Environmental 2023.

2.2 MUNICIPAL OPERATIONS FORECAST RESULTS

Estimated municipal operations BAU emissions forecasts were based on predicted growth in City employment between 2019 and 2045. Municipal employment is expected to increase by 21 percent between 2019 and 2045. Change in municipal employment was the sole factor used to forecast BAU emissions for 2030, 2035, 2040, and 2045 for all sectors in the municipal operations inventory. Table 18 shows 2019 municipal employment and anticipated change in municipal employment for the forecast years.

Table 18. City of Irvine Municipal Operations Demographic Forecasts

Forecast Factor	2019	2030	2035	2040	2045
City Employment	1,586	1,728	1,793	1,858	1,922

Source: Ascent Environmental 2023.

Table 19 shows 2019 baseline emissions and BAU emissions forecasts for 2030, 2035, 2040, and 2045.

Table 19. City of Irvine Municipal Operations GHG Emissions Inventory and BAU Forecasts (Annual MTCO_{2e})

Sector	2019	2030	2035	2040	2045
Buildings and Facilities	12,003	13,080	13,570	14,059	14,549
Employee Commute	3,032	3,304	3,427	3,551	3,674
Wastewater Treatment	1,144	1,246	1,386	1,340	1,386
Vehicle Fleet	1,127	1,228	1,274	1,320	1,366
Streetlights and Traffic Signals	1,097	1,195	1,240	1,285	1,329
Solid Waste	159	174	180	187	193
Water Supply	4	5	5	5	5
Total	18,566	20,232	21,083	21,747	22,504
<i>Percent Change from 2019 Levels</i>	—	9%	14%	17%	21%

Notes: Total may not sum exactly due to independent rounding. BAU = business-as-usual; GHG = greenhouse gas; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: Ascent Environmental 2023.

Legislative-adjusted BAU emissions forecasts provide an assessment of how the City's municipal operations emissions would change over time without further action from the City. The legislative-adjusted BAU forecast accounts for laws and regulations at the regional, State, and federal levels that would affect emissions, such as regulatory requirements to increase vehicle fuel efficiency and building energy efficiency. These forecasts provide the City with the information needed to focus efforts on certain municipal operations emissions sectors and sources that have the most GHG reduction opportunities. Annual municipal employment change was the sole scaling factor applied to all sectors. A summary of legislative reductions applied is provided in Table 5. Municipal operations legislative-adjusted BAU emissions would decrease by approximately 76 percent between 2019 and 2045, as shown in Table 20 and Figure 4.

Table 20. City of Irvine Municipal Operations GHG Emissions Inventory and Legislative-Adjusted BAU Forecasts (Annual MTCO_{2e})

Sector	2019	2030	2035	2040	2045
Buildings and Facilities	12,003	1,950	1,987	2,023	2,060
Employee Commute	3,032	2,192	1,618	1,045	471
Wastewater Treatment	1,144	1,246	1,386	1,340	1,386
Vehicle Fleet	1,127	912	732	552	372
Streetlights and Traffic Signals	1,097	0	0	0	0
Solid Waste	159	174	180	187	193
Water Supply	4	2	2	1	0
Total	18,566	6,477	5,905	5,147	4,482
<i>Percent Change from 2019 Levels</i>		-65%	-68%	-72%	-76%

Notes: Total may not sum exactly due to independent rounding. BAU = business-as-usual; GHG = greenhouse gas; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: Ascent Environmental 2023.

Figure 4 also shows the emissions trend that would occur without anticipated legislative reductions, accounting only for changes in municipal employment (i.e., BAU emissions). Without the legislative reductions, emissions would be approximately 237 percent higher in 2045 compared to the legislative-adjusted BAU forecast. Emissions forecasts for each sector are discussed in detail in the following sections.

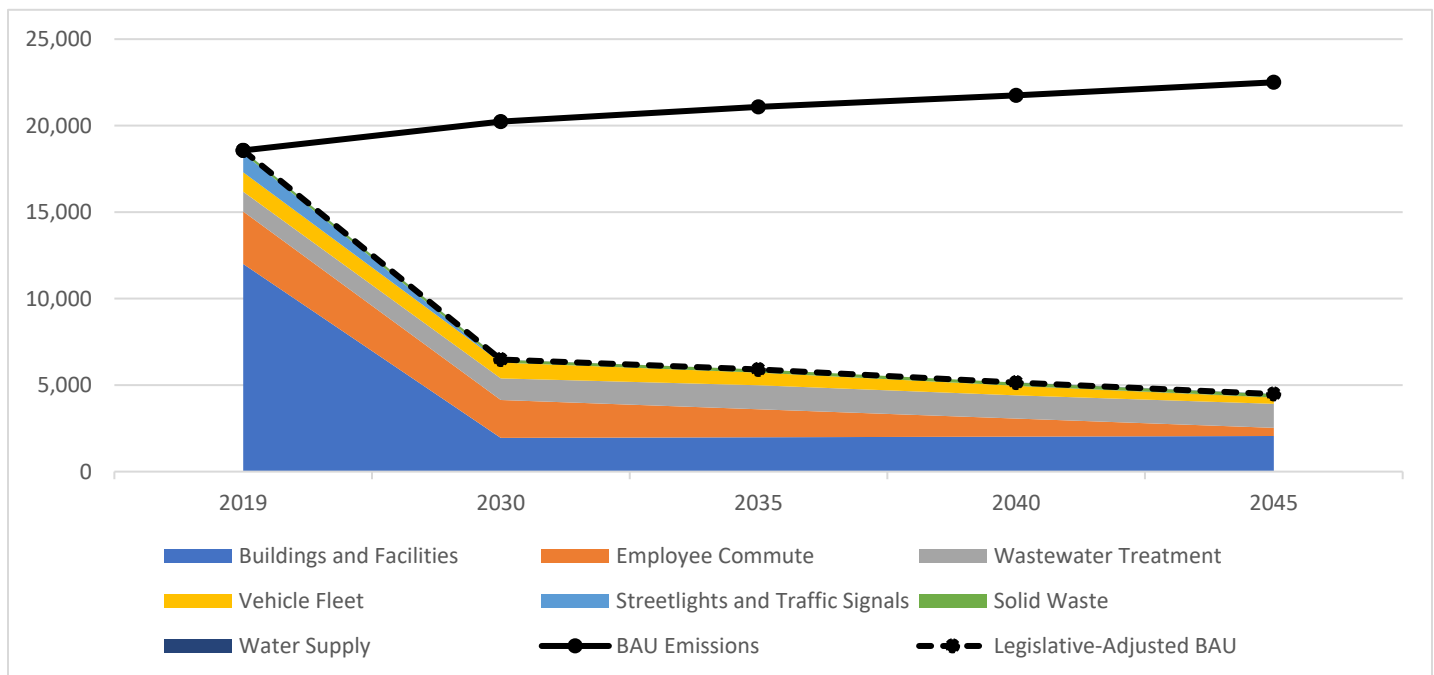


Figure 4 City of Irvine Municipal Operations GHG Emissions Inventory and Forecasts

2.2.1 Buildings and Facilities Energy

Emissions from future electricity, natural gas, and backup generator use in City buildings and facilities were estimated by multiplying anticipated energy use by forecasted emissions factors. Future energy use was forecasted in two parts, as described in Section 2.1.1. Table 21 summarizes the legislative reductions used to forecast buildings and facilities emissions by energy type.

Table 21. Buildings and Facilities Energy Emissions Forecast Legislative Reductions by Energy Type

Energy Type	Applied Legislative Reductions
Electricity	OCPA’s carbon-free option was applied to OCPA’s electricity emissions factors. Accounts for 2022 Building Energy Efficiency Standards Title 24 energy efficiency gains in new construction based on the best available data for average building energy efficiency.
Natural Gas	Accounts for 2022 Building Energy Efficiency Standards Title 24 energy efficiency gains in new construction based on the best available data for average building energy efficiency.
Backup Generators	None.

Notes: OCPA = Orange County Power Authority.

Source: Ascent Environmental 2022.

Between 2019 and 2045, emissions from electricity, natural gas, and backup generators from municipal buildings and facilities would decrease by approximately 83 percent from 12,003 to 2,060 MTCO₂e, accounting for legislative adjustments and municipal employment changes. This change reflects increases in emissions from natural gas and backup generators combined with the City’s automatic enrollment in OCPA’s carbon-free option. Table 22 shows the 2019 inventory and legislative-adjusted BAU forecasted emissions for the municipal operations buildings and facilities energy sector by energy type for 2030, 2035, 2040, and 2045.

Table 22. Buildings and Facilities Energy GHG Emissions Inventory and Legislative-Adjusted BAU Forecasts (Annual MTCO₂e)

Energy Type	2019	2030	2035	2040	2045
Electricity	10,138	0	0	0	0
Natural Gas	1,862	1,947	1,983	2,020	2,056
Backup Generators	3	3	3	3	4
Total	12,003	1,950	1,987	2,023	2,060

Notes: Totals may not sum exactly due to independent rounding. BAU = business-as-usual; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Ascent Environmental 2023.

ELECTRICITY EMISSIONS FACTORS

As a result of the electricity emissions factors to be decreased to zero by 2030, GHG emissions from electricity consumption in the buildings and facilities sector would also be zero through 2045 without additional City action. Electricity emissions factors and changes through 2045 are described in Section 2.1.1.

NATURAL GAS EMISSIONS FACTORS

Natural gas emissions are based on data from TCR, as described in Section 2.1.1. Emissions factors associated with natural gas combustion are not anticipated to change over time, as there are no legislative actions that would reduce the energy intensity of natural gas.

DIESEL EMISSIONS FACTORS

Emissions from diesel fuel used to power backup generators are based on emissions factors from TCR, as described in Section 2.1.1. Emissions factors associated with diesel combustion are not anticipated to change over time, as there are no legislative actions that would reduce the energy intensity of diesel.

2.2.2 Streetlights and Traffic Signals

Between 2019 and 2045, emissions from streetlights and traffic signals would be reduced to zero, accounting for legislative adjustments and employment reductions. This reflects lower electricity emissions factors related the City's automatic enrollment of municipal accounts in OCPA's carbon-free option. Table 23 summarizes the legislative reductions used to forecast streetlight and traffic signal emissions.

Table 23. Streetlights and Facilities Emissions Forecast Legislative Reductions

Source	Applied Legislative Reductions
Electricity	OCPA's carbon-free option was applied to OCPA's electricity emissions factors.

Notes: OCPA = Orange County Power Authority.

Source: Ascent Environmental 2022.

Table 24 shows the 2019 inventory and legislative-adjusted BAU forecasted emissions for the streetlights and traffic signals sector for 2030, 2035, 2040, and 2045.

Table 24. Streetlights and Traffic Signals GHG Emissions Inventory and Legislative-Adjusted BAU Forecasts (Annual MTCO_{2e})

Source	2019	2030	2035	2040	2045
Streetlights and Traffic Signals	1,097	0	0	0	0

Notes: BAU = business-as-usual; GHG = greenhouse gas; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: Ascent Environmental 2023.

2.2.3 Employee Commute

Between 2019 and 2045, GHG emissions from employee commutes would decrease by approximately 85 percent from 3,032 to 471 MTCO_{2e}, accounting for future vehicle emissions factors modeled in CARB's EMFAC2021 model and municipal employment change. It was assumed that employees that commute to work all use light-duty vehicles. With respect to the legislative adjustments included in this forecast, State and federal laws and regulations incorporated in the employee commute sector include the Pavley Clean Car Standards and ACC II Standards. Pavley Clean Car Standards are already included in EMFAC2021's emissions factor estimates and forecasts. Additional calculations were performed to incorporate the effects of ACCII.

It should be noted that the Low Carbon Fuel Standard was excluded in EMFAC2021 forecasts because most of the emissions benefits originate from upstream fuel production and do not directly reduce emissions in the City's municipal operations GHG emissions forecasts. Table 25 summarizes the legislative reductions used to forecast employee commute emissions.

Table 25. Employee Commute Forecast Legislative Reductions

Source	Applied Legislative Reductions
Employee Commute	EMFAC2021 forecasts vehicle fleet distributions by vehicle type and the emissions factors anticipated for each vehicle category based on both vehicle emissions testing and approved legislative reductions. EMFAC2021's forecasts incorporate the effects of the CAFE standards. Separate calculations were performed to incorporate the effects of ACC II.

Notes: ACC II= Advanced Clelars II; CAFE = Corporate Average Fuel Economy; EMFAC2021 = California Air Resources Board's Emission FACTor 2021 model.

Source: Ascent Environmental 2022.

Table 26 shows the 2019 inventory and legislative-adjusted BAU forecasted emissions from municipal employee commutes for 2030, 2035, 2040, and 2045. Values for 2035 and 2040 were derived using linear interpolation.

Table 26. Employee Commute GHG Emissions Inventory and Legislative-Adjusted BAU Forecasts (Annual MTCO_{2e})

Source	2019	2030	2035	2040	2045
Employee Commute	3,032	2,192	1,618	1,045	471

Notes: BAU = business-as-usual; GHG = greenhouse gas; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: Ascent Environmental 2023.

2.2.4 Vehicle Fleet

Between 2019 and 2045, emissions associated with the City's municipal vehicle fleet would decrease by approximately 67 percent from 1,127 to 372 MTCO_{2e}, accounting for legislative adjustments and municipal employment change. Vehicle fleet fuel consumption data (i.e., gallons of gasoline and diesel fuel) for 2019 were provided by the City for all City-owned vehicles and equipment. Because additional vehicle fleet data were unavailable, total emissions for gasoline and diesel fuel were estimated using emissions factors obtained from TCR. With respect to the legislative adjustments in the vehicle fleet sector, improvements in fuel efficiency reported by CARB's EMFAC2021 model, as described in Section 2.1.2, were applied to BAU emissions forecasts. Effects of ACCII standards were incorporated using calculations performed separately. Table 27 summarizes the legislative reductions used to forecast vehicle fleet emissions.

Table 27. Vehicle Fleet Forecast Legislative Reductions

Source	Applied Legislative Reductions
Vehicle Fleet	EMFAC2021 forecasts vehicle fleet distributions by vehicle type and the emissions factors anticipated for each vehicle category based on both vehicle emissions testing and approved legislative reductions. EMFAC2021's forecasts incorporate the effects of the CAFE standards. Additional calculations were performed to incorporate the effects of ACCII.

Notes: ACC II= Advanced Clean Cars II; CAFE = Corporate Average Fuel Economy; EMFAC2021 = California Air Resources Board's Emission FACTor 2021 model.

Source: Ascent Environmental 2022.

Table 28 shows the 2019 inventory and legislative-adjusted BAU forecasted emissions from the vehicle fleet sector by fuel source for 2030, 2035, 2040, and 2045. Values for 2035 and 2040 were derived using linear interpolation.

Table 28. Vehicle Fleet GHG Emissions Inventory and Legislative-Adjusted BAU Forecasts (Annual MTCO₂e)

Source	2019	2030	2035	2040	2045
Gasoline	954	772	620	467	315
CNG	173	140	112	85	57
Total	1,127	912	732	552	372

Notes: Totals may not sum exactly due to independent rounding. BAU = business-as-usual; CNG = compressed natural gas; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Ascent Environmental 2023.

2.2.5 Solid Waste

Between 2019 and 2045, municipal operations solid waste emissions would increase by approximately 11 percent from 159 to 193 MTCO₂e, accounting for municipal employment change. No additional legislative reductions could be applied to this sector, so legislative-adjusted BAU emissions are equivalent to BAU emissions. Table 29 shows the 2019 inventory and legislative-adjusted BAU forecasted emissions from the municipal operations solid waste sector for 2030, 2035, 2040, and 2045.

Table 29. Solid Waste GHG Emissions Inventory and Legislative-Adjusted BAU Forecasts (Annual MTCO₂e)

Source	2019	2030	2035	2040	2045
Solid Waste	159	174	180	187	193

Notes: BAU = business-as-usual; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Ascent Environmental 2023.

2.2.6 Water Supply

Between 2019 and 2045, emissions from water supplied for municipal operations would be reduced to zero due to 100 percent RPS by 2045. For the water supply from local sources within the city, the electricity usage associated with extracting, conveying, treating, and distributing water is captured in the buildings and facilities energy sector because these activities take place within the city. Therefore, the electricity usage and emissions associated with extracting, conveying, treating, and distributing water from outside the city boundary was applied to the municipal water sector. Table 30 summarizes the legislative reductions used to forecast water supply emissions.

Table 30. Water Supply Forecast Legislative Reductions

Source	Applied Legislative Reductions
Water Consumption	RPS achieved to date and scheduled targets (i.e., 33 percent renewable by 2020, 60 percent renewable by 2030, 100 percent renewable by 2045) applied to SCE's, and State electricity emissions factors.

Notes: RPS = Renewables Portfolio Standard; SCE = Southern California Edison.

Source: Ascent Environmental 2022.

Table 31 shows the 2019 inventory and legislative-adjusted BAU forecasted emissions from municipal operations water supply for 2030, 2035, 2040, and 2045.

Table 31. Water Supply GHG Emissions Inventory and Legislative-Adjusted BAU Forecasts (Annual MTCO₂e)

Activity	2019	2030	2035	2040	2045
Water Supply Emissions	4	2	2	1	0

Notes: BAU = business-as-usual; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Ascent Environmental 2023.

2.2.7 Wastewater Treatment

Between 2019 and 2045, wastewater treatment emissions from municipal operations would increase by approximately 20 percent from 1,144 to 1,386 MTCO_{2e}, accounting for legislative reductions and municipal employment change. This reflects both an increase in wastewater generation and lower electricity emissions factors related to the 2030 and 2045 RPS targets for SCE, pursuant to SB 100, due to treatment processes located outside of the OCPA service area. Although electricity intensity factors are reduced through 2045, increases in process and fugitive emissions resulting from wastewater collection and treatment would offset decreased electricity emissions. Table 32 summarizes the legislative reductions used to forecast emissions from municipal operations wastewater treatment.

Table 32. Wastewater Treatment Forecast Legislative Reductions

Source	Applied Legislative Reductions
Wastewater Treatment	RPS achieved to date and scheduled targets (i.e., 33 percent renewable by 2020, 60 percent renewable by 2030, 100 percent renewable by 2045) applied to SCE's electricity emissions factors.

Notes: RPS = Renewables Portfolio Standard; SCE = Southern California Edison.

Source: Ascent Environmental 2022.

Table 33 shows the 2019 inventory and legislative-adjusted BAU forecasted emissions from wastewater treatment for 2030, 2035, 2040, and 2045.

Table 33. Wastewater Treatment GHG Emissions Inventory and Legislative-Adjusted BAU Forecasts (Annual MTCO_{2e})

Activity	2019	2030	2035	2040	2045
Wastewater Treatment	1,144	1,246	1,386	1,340	1,386

Notes: BAU = business-as-usual; GHG = greenhouse gas; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: Ascent Environmental 2023.

2.3 DISCUSSION

The community and municipal legislative-adjusted BAU emissions would decrease by approximately 38 percent and 64 percent between 2019 and 2045, respectively. This is a result of reductions that would be achieved from several legislative actions including:

- ▶ a greater renewable mix in SCE's and State electricity supply (60 percent by 2030 and 100 percent by 2045);
- ▶ carbon-free electricity supplied by OCPA;
- ▶ improved building energy efficiency through compliance with Title 24 standards;
- ▶ reductions in on-road vehicle emissions factors from State vehicle standards as forecasted in EMFAC2021 and ACC II standards; and
- ▶ reductions in off-road vehicle and equipment emissions factors forecasted in OFFROAD2021.

Going forward, new legislative actions that would affect emissions may be adopted by State and federal agencies; however, because information regarding these regulatory changes is currently unavailable or not final, emissions reductions from future potential legislative actions are not quantified in this memorandum. Where new State regulations or programs are imminent and reasonably foreseeable, they can be incorporated as complementary actions to locally based GHG reduction measures.

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