

CITY OF SAN RAFAEL

LOCAL GOVERNMENT OPERATIONS GREENHOUSE GAS EMISSIONS INVENTORY FOR 2022

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Prepared by the
Marin Climate & Energy Partnership



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EXECUTIVE SUMMARY

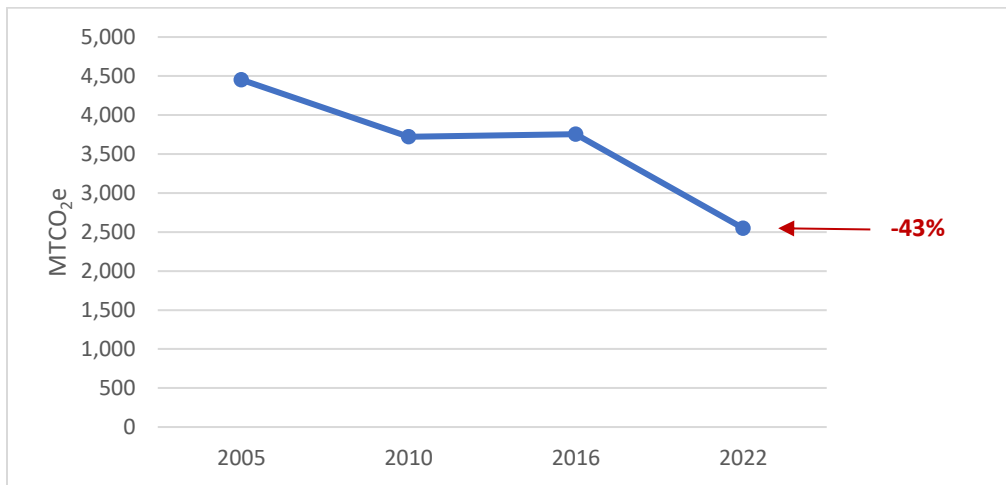
THE TAKEAWAY:

**GOVERNMENT OPERATIONS
EMISSIONS DOWN 43% SINCE 2005**

San Rafael publishes annual community greenhouse gas (GHG) emissions estimates through the Marin Climate & Energy Partnership (MCEP). Annual inventories help the City to more closely monitor its progress in meeting its local goal to reduce community emissions 25% below baseline (2005) emissions by 2020 and to meet the statewide goal to reduce emissions 40% below 1990 emissions by 2030. In addition to the community inventories, MCEP periodically prepares inventories for government operations emissions.

This report reviews emissions from government operations, a subset of community emissions. Emissions from government operations decreased 43% between 2005 and 2022, or about 1,900 metric tons CO₂e. This is equivalent to 33% below the estimated 1990 level. While government emissions are less than 1% of overall community emissions, the local government plays a large role in setting an example for the rest of the community.

TABLE 1: TREND IN LOCAL GOVERNMENT OPERATIONS EMISSIONS, 2005-2022



Recognizing the need for a collaborative approach to greenhouse gas reductions, City and county leaders launched the Marin Climate and Energy Partnership (MCEP) in 2007. The City of San Rafael is a member of MCEP and works with representatives from the County of Marin and the other Marin cities and towns to address and streamline the implementation of a variety of greenhouse gas reduction measures. Funding for this inventory was provided by the Marin County Energy Watch Partnership, which administers public goods charges collected by PG&E. Community inventories are available on the MCEP website at marinclimate.org and are used to update the [Marin Sustainability Tracker](#).

INTRODUCTION

PURPOSE OF INVENTORY

The objective of this greenhouse gas emissions inventory is to identify the sources and quantify the amounts of greenhouse gas emissions generated by the activities of the San Rafael local government operations in 2022. This inventory provides a comparison to baseline 2005 emissions and identifies the sectors where significant reductions in greenhouse gas emissions have occurred.

GENERAL METHODOLOGY

This inventory uses national standards for the accounting and reporting of greenhouse gas emissions. The [Local Government Operations Protocol, version 1.1 \(May 2010\)](#) was used for the quantification and reporting of greenhouse gas emissions from local government operations. Quantification methodologies, emission factors, and activity and source data are detailed in the appendices.

Local government operations emissions are categorized according to the following sectors:

- Buildings and Other Facilities
- Public Lighting
- Water Delivery Facilities
- Vehicle Fleet
- Solid Waste
- Employee Commute

CALCULATING EMISSIONS

Emissions are quantified by multiplying the measurable activity data – e.g., kilowatt hours of electricity, therms of natural gas, and gallons of diesel or gasoline – by emissions factors specific to the energy source. Most emissions factors are the same from year to year. Emission factors for electricity, however, change from year to year due to the specific sources that are used to produce electricity. For example, electricity that is produced from coal generates more greenhouse gases than electricity that is generated from natural gas and therefore has a higher emissions factor. Electricity that is produced solely from renewable energy sources such as solar and wind has an emissions factor of zero.

This inventory calculates individual greenhouse gases – e.g., carbon dioxide, methane and nitrous oxide – and converts each greenhouse gas emission to a standard metric, known as “carbon dioxide equivalents” or CO₂e, to provide an apple-to-apples comparison among the various emissions. Table 1 shows the greenhouse gases identified in this inventory and their global warming potential (GWP), a measure of the amount of warming each gas causes when compared to a similar amount of carbon dioxide. Methane, for example, is 28 times as potent as carbon dioxide over 100 years; therefore, one metric ton of methane is equivalent to 28 metric tons of carbon dioxide. Greenhouse gas emissions are reported in this inventory as metric tons of carbon dioxide equivalents, or MTCO₂e.

TABLE 1: GREENHOUSE GASES

Gas	Chemical Formula	Emission Source	Global Warming Potential
Carbon Dioxide	CO ₂	Combustion of natural gas, gasoline, diesel, and other fuels	1
Methane	CH ₄	Combustion, anaerobic decomposition of organic waste in landfills and wastewater	28
Nitrous Oxide	N ₂ O	Combustion, wastewater treatment	265
Hydroflourocarbons	Various	Leaked refrigerants, fire suppressants	4 to 12,400

Source: IPCC Fifth Assessment Report (2014)

TYPES OF EMISSIONS

Emissions from each of the greenhouse gases can come in a number of forms:

- **Stationary or mobile combustion** resulting from the on-site combustion of fuels (natural gas, diesel, gasoline, etc.) to generate heat or electricity, or to power vehicles and equipment.
- **Purchased electricity** resulting from the generation of power from utilities outside the jurisdictional boundary.
- **Fugitive emissions** resulting from the unintentional release of greenhouse gases into the atmosphere, such as leaked refrigerants and methane from waste decomposition.
- **Process emissions** from physical or chemical processing of a material, such as wastewater treatment.

UNDERSTANDING TOTALS

The totals listed in the tables and discussed in the report are a summation of emissions using available estimation methods. Each inventoried sector may have additional emissions sources associated with them that were unaccounted for due to a lack of data or robust quantification methods.

GOVERNMENT OPERATIONS INVENTORY

GOVERNMENT PROFILE

The City of San Rafael is a general law city and operates under the council-city manager form of government. The local government operates administrative, planning, building, public works, community services, fire and police departments. In 2022, there were 496 total employees.

GOVERNMENT OPERATIONS INVENTORY SUMMARY

In 2005, San Rafael's government operations produced approximately 4,453 metric tons CO₂e. In 2022, those activities resulted in approximately 2,550 metric tons CO₂e, a reduction of 1,903 metric tons, or 43%, and the local government's share of community emissions was 0.8%. The following summaries break down these totals by sector and sources.

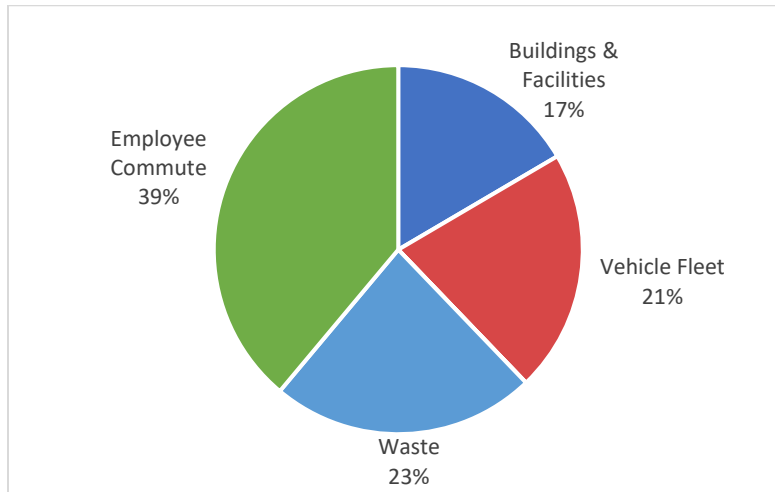
SUMMARY BY SECTOR

As shown in Table 2, emissions from government operations were reduced in all sectors. The greatest reduction occurred in the public lighting sector, where emissions dropped 545 metric tons CO₂e, or 100% due to the conversion of most lighting to LED and the City's purchase of 100% renewable electricity. Other significant reductions occurred in the vehicle fleet sector (390 metric tons) and the buildings and facilities sector (387 metric tons). Figure 2 shows that the employee commute sector was the largest emitter of greenhouse gas emissions in 2022 (39% of total emissions), followed by the vehicle fleet sector (21%) and the buildings and facilities sector (17%).

TABLE 2: SUMMARY BY SECTOR, 2005 AND 2022

Sector	2005 Metric Tons CO ₂ e	2022 Metric Tons CO ₂ e	Change Metric Tons CO ₂ e	% Change
Buildings & Facilities	809	422	-387	-48%
Vehicle Fleet	933	543	-390	-42%
Public Lighting	545	0	-545	-100%
Water Delivery	118	0	-118	-100%
Waste	711	593	-117	-17%
Employee Commute	1,337	992	-345	-26%
Total	4,453	2,550	-1,903	-43%

FIGURE 2: EMISSIONS BY SECTOR, 2022



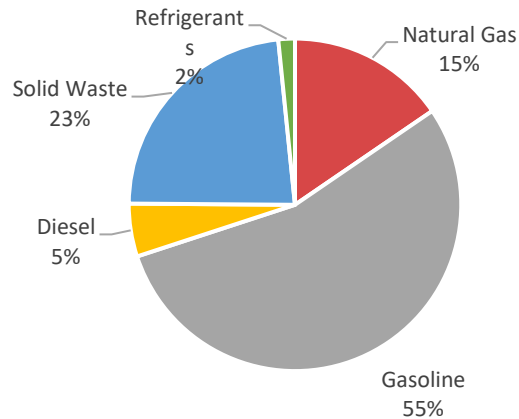
SUMMARY BY SOURCE

Table 3 shows a summary of the City’s greenhouse gas emissions by source. The greatest decreases occurred in emissions from electricity (1,161 metric tons) and gasoline (596 metric tons), which includes gasoline used in both the municipal fleet and City employees’ commute. Emissions from the combustion of natural gas increased 32%. Despite the decrease in gasoline emissions, gasoline was the largest source of greenhouse gas emissions in San Rafael’s governmental operations in 2022 (see Figure 3), contributing more than one-half of all emissions.

TABLE 3: SUMMARY BY SOURCE, 2005 AND 2022

Source	2005 Metric Tons CO _{2e}	2022 Metric Tons CO _{2e}	Change Metric Tons CO _{2e}	% Change
Electricity	1,161	0	-1,161	-100%
Natural Gas	298	394	96	32%
Gasoline	1,986	1,390	-596	-30%
Diesel	271	131	-139	-52%
Solid Waste	711	593	-117	-17%
Refrigerants	26	41	15	56%
Total	4,453	2,550	-1,903	-43%

FIGURE 3: EMISSIONS BY SOURCE, 2022



GOVERNMENT OPERATIONS INVENTORY DETAIL BY SECTOR

This section explores government operations and emissions by taking a detailed look at each primary sector.

BUILDINGS AND OTHER FACILITIES

Facilities operations contribute to greenhouse gas emissions in two major ways. First, facilities consume electricity and fuels such as natural gas. This consumption is associated with the majority of greenhouse gas emissions from facilities. In addition, air conditioning and refrigeration equipment in buildings can emit hydrofluorocarbons (HFCs) and other greenhouse gases when these systems leak refrigerants. Refrigerants are very potent greenhouse gases and have Global Warming Potential (GWP) of up to many thousand times that of CO₂. For example, HFC-134a, a very common refrigerant, has a GWP of 1300, or 1300 times that of CO₂. Therefore, even small amounts of leaked refrigerants can have a significant effect on greenhouse gas emissions.

In 2022, San Rafael operated several major facilities, including City Hall, the public safety center, the library, fire stations, public works buildings, childcare facilities, and community centers. As shown in Table 4, emissions from the buildings sector decreased 48% between 2005 and 2022. Electricity consumption decreased 6%, and natural gas consumption increased 41%. Emissions from refrigerants increased due to the City’s installation of new HVAC units in the Public Safety Center and fire stations. Total emissions from buildings and facilities decreased, however, primarily because the City purchased MCE Deep Green electricity for all facilities in 2022.

TABLE 4: BUILDINGS AND OTHER FACILITIES EMISSIONS, 2005 AND 2022

Source	2005 Energy Consumption	2005 GHG Emissions (MTCO ₂ e)	2022 Energy Consumption	2022 GHG Emissions (MTCO ₂ e)	% Change in Energy Consumption	% Change in GHG Emissions (MTCO ₂ e)
Electricity	2,231,608 kWh	498	2,095,090 kWh	0	-6%	-100%
Natural Gas	56,042 therms	298	79,110 therms	389	41%	41%
Refrigerants	--	13	--	28	--	112%
Total	--	809	--	422	--	-48%

Table 5 shows electricity and natural gas usage by facility.

TABLE 5: ENERGY USAGE AT SAN RAFAEL BUILDINGS AND FACILITIES, 2005 AND 2022

Building/ Facility	Energy Source	2005 Energy Consumption	2022 Energy Consumption	% Change in Energy Consumption
City Hall	Electricity	637,920 kWh	30,965 kWh	-95%
	Natural Gas	5,651 therms	17,099 therms	203%
Community Centers	Electricity	329,020 kWh	366,767 kWh	11%
	Natural Gas	27,758 therms	43,946 therms	58%
Childcare Facilities	Electricity	111,985 kWh	76,759 kWh	-31%
	Natural Gas	4,304 therms	2,847 therms	-34%
Public Works	Electricity	324,010 kWh	98,152 kWh	-70%
	Natural Gas	5,541 therms	3,577 therms	-35%
Fire Department	Electricity	248,214 kWh	1,060,651 kWh	327%
	Natural Gas	9,431 therms	6,286 therms	-33%
Library	Electricity	117,350 kWh	159,540 kWh	36%
	Natural Gas	0 therms	5,016 therms	-
Parking Garages & Lots	Electricity	211,118 kWh	177,894 kWh	-16%
Other Facilities	Electricity	251,991 kWh	101,397 kWh	-60%
	Natural Gas	3,357 therms	339 therms	-90%

PUBLIC LIGHTING

San Rafael operates streetlights, traffic signals, and other outdoor lighting. Emissions associated with the operation of this public lighting are from electricity consumption. Electricity consumption in the public lighting sector decreased 44% between 2005 and 2022 due to conversion of inefficient lighting to LED fixtures and bulbs. Emissions decreased 100%; the additional reduction is due to the City’s purchase of MCE Deep Green electricity in 2022.

TABLE 6: PUBLIC LIGHTING EMISSIONS, 2005 AND 2022

Source	2005 Electricity Consumption	2005 GHG Emissions (MTCO _{2e})	2022 Electricity Consumption	2022 GHG Emissions (MTCO _{2e})	% Change in Electricity Consumption	% Change in GHG Emissions (MTCO _{2e})
Streetlights	2,066,450 kWh	461	1,054,493 kWh	0	-49%	-100%
Traffic Signals	249,861 kWh	56	238,530 kWh	0	-5%	-100%
Outdoor Lighting	126,245 kWh	28	63,397 kWh	0	-50%	-100%
Total	2,442,556 kWh	545	1,356,420 kWh	0	-44%	-100%

WATER DELIVERY

This sector includes any facilities used for the management and distribution of water. Typical systems included in this sector are potable water delivery pumps, sprinkler and irrigation controls, and stormwater management. The systems identified for this report and used by the City were water delivery pumps and sprinkler and irrigation systems. The source of San Rafael’s water delivery emissions is from electricity consumption. Overall, electricity usage declined 42% and emissions dropped 100%.

TABLE 7: WATER DELIVERY EMISSIONS, 2005 AND 2022

Source	2005 Electricity Consumption	2005 GHG Emissions (MTCO _{2e})	2022 Electricity Consumption	2022 GHG Emissions (MTCO _{2e})	% Change in Electricity Consumption	% Change in GHG Emissions (MTCO _{2e})
Irrigation	7,410 kWh	2	5,369 kWh	0	-28%	-100%
Water Pumps	520,185 kWh	116	301,444 kWh	0	-42%	-100%
Total	527,595 kWh	118	306,813 kWh	0	-42%	-100%

VEHICLE FLEET

The vehicles and mobile equipment used in San Rafael’s daily operations include public works trucks and equipment, police cars and motorcycles, fire trucks, and vehicles for use by administration and other department staff. These vehicles and equipment burn gasoline and diesel, which result in greenhouse gas emissions. In addition, vehicles with air conditioning use refrigerants that leak from the vehicle. This sector also includes fuel consumption and emissions from the operation of off-road and stationary equipment.

Table 8 shows that gasoline consumption decreased 26% since 2005 and diesel consumption decreased 54%, for a total decrease in fuel consumption of 33%. Emissions fell 42%; the additional decline is due to the City using renewable diesel in all vehicles in 2022.

TABLE 8: VEHICLE FLEET EMISSIONS, 2005 AND 2022

Source	2005 Fuel Consumption	2005 GHG Emissions (MTCO _{2e})	2022 Fuel Consumption	2022 GHG Emissions (MTCO _{2e})	% Change in Fuel Consumption	% Change in GHG Emissions (MTCO _{2e})
Gasoline	72,682 gallons	649	53,856 gallons	476	-26%	-27%
Diesel	26,489 gallons	271	12,206 gallons	53	-54%	-80%
Refrigerants	--	13	--	13	--	0%
Total	99,171 gallons	933	66,062 gallons	542	-33%	-42%

WASTE

Waste generated by government buildings and operations include organic material such as paper, food scraps, plant debris, textiles, and construction waste. This organic material generates methane as it decays in the anaerobic environment of a landfill. An estimated 75% of this methane is routinely captured via landfill gas collection systems; however, a portion escapes into the atmosphere. Emissions from waste are an estimate of methane generation that will result from the decomposition of organic waste sent to the landfill in the inventoried year, even though those emissions will occur over the 100+ year timeframe that the waste will decompose.

Waste generated by governmental operations increased 19% between 2005 and 2022 and emissions decreased 17% due to the lower organic content of waste sent to the landfill.

TABLE 9: WASTE EMISSIONS, 2005 AND 2022

Source	2005 Landfilled Waste	2005 GHG Emissions (MTCO _{2e})	2022 Landfilled Waste	2022 GHG Emissions (MTCO _{2e})	% Change in Landfilled Waste	% Change in GHG Emissions (MTCO _{2e})
Street Cans	1,438 tons	402	1,713 tons	336	19%	-16%
Parks	548 tons	153	160 tons	31	-71%	-79%
Community Centers	239 tons	67	339 tons	67	42%	0%
Other Facilities	135 tons	38	270 tons	82	210%	118%
Waste Hauled by the City	184 tons	51	391 tons	77	112%	49%
Total	2,544 tons	711	3,022 tons	593	19%	-17%

EMPLOYEE COMMUTE

Emissions in the employee commute sector are due to the combustion of fuels used by City employees commuting to and from work in San Rafael. Emissions dropped 26% due to an improvement in the fuel-efficiency of the vehicles San Rafael employees are driving to work. However, it is difficult to draw definitive conclusions from the data, as emissions are determined from employee commute surveys. Twenty-one percent of City employees responded to the survey in 2023. Estimates for total employee commutes were extrapolated from this data.

TABLE 10: EMPLOYEE COMMUTE EMISSIONS, 2005 AND 2022

	2005	2022	% Change
Number of Employees	425	496	17%
Vehicle Miles Traveled	2,572,471	2,867,029	11%
Emissions per Employee	3.1	2.0	-%
GHG Emissions (MTCO_{2e})	1,337	992	-26%

APPENDIX

BUILDINGS AND OTHER FACILITIES SECTOR NOTES

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2005

Scope	Emission Type	Energy Consumption	Greenhouse Gas Emissions (metric tons)				
			CO ₂	N ₂ O	CH ₄	HFCs	CO ₂ e
Scope 1	Stationary Combustion	56,042 therms	297.13	0.00	0.03	0.00	298.07
	Fugitive Emissions	Refrigerants	0.00	0.00	0.00	0.00	13.15
	TOTAL		297.13	0.00	0.03	0.00	311.22
Scope 2	Purchased Electricity	2,231,608 kWh	495.15	0.01	0.03	0.00	498.23
	TOTAL		495.15	0.01	0.03	0.00	498.23

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2022

Scope	Emission Type	Energy Consumption	Greenhouse Gas Emissions (metric tons)				
			CO ₂	N ₂ O	CH ₄	HFCs	CO ₂ e
Scope 1	Stationary Combustion	79,110 therms	388.04	0.00	0.04	0.00	394.08
	Fugitive Emissions	Refrigerants	0.00	0.00	0.00	0.00	27.90
	TOTAL		388.04	0.00	0.04	0.00	421.98
Scope 2	Purchased Electricity	2,095,090 kWh	331.52	0.00	0.04	0.00	0.00
	TOTAL		331.52	0.00	0.04	0.00	0.00

Energy usage was provided by Pacific Gas & Electric Company (PG&E) based on PG&E service accounts. LGO Protocol recommended methods were followed in collection and analysis of this activity data. For electricity, verified utility-specific (PG&E and MCE) CO₂ emissions factor and eGrid subregion default N₂O and CH₄ emission factors for WECC California were used. For natural gas, default CO₂, CH₄ & N₂O emission factors by fuel type were used (U.S. Community Protocol, v. 1.1, May 2010, Tables B.1 and B.3).

Refrigerant type and capacity for air conditioning units were provided by San Rafael public works staff. 2010 refrigerant data was used as a proxy for 2005. LGO Protocol alternate methods were followed in collection and analysis of refrigerant activity data.

PUBLIC LIGHTING SECTOR NOTES

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2005

Scope	Emission Type	Energy Consumption	Greenhouse Gas Emissions (metric tons)				
			CO ₂	N ₂ O	CH ₄	HFCs	CO ₂ e
Scope 2	Purchased Electricity	2,442,556 kWh	541.95	0.01	0.04	0.00	545.33

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2022

Scope	Emission Type	Energy Consumption	Greenhouse Gas Emissions (metric tons)				
			CO ₂	N ₂ O	CH ₄	HFCs	CO ₂ e
Scope 2	Purchased Electricity	1,356,420 kWh	0.00	0.00	0.03	0.00	0.00

Energy usage was provided by Pacific Gas & Electric Company (PG&E) based on energy usage of PG&E service accounts. LGO Protocol recommended methods were followed in collection and analysis of this activity data. Verified utility-specific (PG&E and MCE) CO₂ emissions factor and eGrid subregion default N₂O and CH₄ emission factors for WECC California were used to calculate emissions.

WATER DELIVERY SECTOR NOTES

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2005

Scope	Emission Type	Energy Consumption	Greenhouse Gas Emissions (metric tons)				
			CO ₂	N ₂ O	CH ₄	HFCs	CO ₂ e
Scope 2	Purchased Electricity	527,595 kWh	117.06	0.00	0.01	0.00	117.79

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2022

Scope	Emission Type	Energy Consumption	Greenhouse Gas Emissions (metric tons)				
			CO ₂	N ₂ O	CH ₄	HFCs	CO ₂ e
Scope 2	Purchased Electricity	306,813 kWh	0.00	0.00	0.01	0.00	0.00

Energy usage was provided by Pacific Gas & Electric Company (PG&E) based on energy usage of PG&E service accounts. LGO Protocol recommended methods were followed in collection and analysis of this activity data. Verified utility-specific (PG&E and MCE) CO₂ emissions factor and eGrid subregion default N₂O and CH₄ emission factors for WECC California were used to calculate emissions.

VEHICLE FLEET SECTOR NOTES

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2005

Scope	Emission Type	Energy Consumption	Greenhouse Gas Emissions (metric tons)				
			CO ₂	N ₂ O	CH ₄	HFCs	CO ₂ e
Scope 1	Combustion	72,682 gallons gasoline	638.15	0.04	0.03	0.00	648.84
	Combustion	26,489 gallons diesel	270.45	0.00	0.00	0.00	270.68
	Fugitive Emissions	Refrigerants	0.00	0.00	0.00	0.01	13.15
	TOTAL		908.60	0.04	0.03	0.01	932.67

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2022

Scope	Emission Type	Energy Consumption	Greenhouse Gas Emissions (metric tons)				
			CO ₂	N ₂ O	CH ₄	HFCs	CO ₂ e
Scope 1	Combustion	53,856 gallons gasoline	472.86	0.01	0.02	0.00	476.30
	Combustion	12,206 gallons diesel	52.88	0.00	0.00	0.00	53.05
	Fugitive Emissions	Refrigerants	0.00	0.00	0.00	0.01	13.15
	TOTAL		525.73	0.01	0.02	0.01	542.50

On and off-road vehicle fleet and equipment fuel data were provided by City of San Rafael. VMT data for 2010 was used as a proxy for 2022. LGO Protocol methods were followed in collection and analysis of vehicle fuel consumption and vehicle miles traveled (VMT). Default CO₂ emission factors for transport fuel from the Local Government Operations Protocol, v. 1.1, May 2010, Table G.11 were used for gasoline and diesel. Renewable diesel emission factor provided by NEXGEN. Default N₂O and CH₄ emission factors for highway vehicles by model year from the from the Local Government Operations Protocol, v. 1.1, May 2010, Table G.12. 2005 emissions were used and were adjusted to reflect IPCC AR5 values for N₂O and CH₄.

Refrigerant capacities for vehicles were estimated using sources provided by ICLEI. LGO Protocol alternate methods were followed in collection and analysis of refrigerant activity data. 2010 activity data and emissions were used as a proxy for 2005 and 2022 data.

WASTE SECTOR NOTES

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2005

Scope	Emission Type	Weight	Greenhouse Gas Emissions (metric tons)				
			CO ₂	N ₂ O	CH ₄	HFCs	CO ₂ e
Scope 3	Landfilled Waste	2,543.6 tons	0.00	0.00	25.38	0.00	710.68

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2022

Scope	Emission Type	Weight	Greenhouse Gas Emissions (metric tons)				
			CO ₂	N ₂ O	CH ₄	HFCs	CO ₂ e
Scope 3	Landfilled Waste	3,022.2 tons	0.00	0.00	21.19	0.00	593.41

Solid waste collection data for quantity of containers, container size, pick-ups per week was provided by Marin Sanitary Service. Containers were assumed to be 100% filled at 250 lbs. per cubic yard. 2005 data was revised to reflect a higher weight per cubic yard estimate as recommended by Marin Sanitary Service. All trash bins were assumed to have a 0% diversion rate.

Waste characterization estimated based on the Statewide Waste Characterization Study (2008 and 2021). Emission factors calculated utilizing U.S. Community Protocol for Accounting and Report of Greenhouse Gas Emissions, Version 1.1, July 2013, Appendix E, Method SW.4. 2005 emissions were adjusted to reflect IPCC AR5 values for CH₄.

EMPLOYEE COMMUTE SECTOR NOTES

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2005

Scope	Emission Type	Number of Employees	Vehicle Miles Traveled	Greenhouse Gas Emissions (metric tons)				
				CO ₂	N ₂ O	CH ₄	HFCs	CO ₂ e
Scope 3	Mobile Combustion	220	2,572,471	1,306.95	0.11	0.08	0.00	1,337.23

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2022

Scope	Emission Type	Number of Employees	Vehicle Miles Traveled	Greenhouse Gas Emissions (metric tons)				
				CO ₂	N ₂ O	CH ₄	HFCs	CO ₂ e
Scope 3	Mobile Combustion	496	2,867,029	986.48	0.02	0.05	0.00	913.86

In 2024, the City distributed commute surveys to its employees regarding travel mode, vehicle type and model year, fuel type, fuel efficiency, and miles traveled to work. Information provided by respondents was used to estimate gallons of fuel consumed and, if necessary, to determine fuel efficiency at www.fueleconomy.gov. Weekly data were converted into annual VMT data assuming 10% reduction for vacation days, sick days and holidays for full-time and part-time employees. 103 employees responded to the survey, a response rate of 21%. Estimates for total employee commutes were extrapolated from this data. Utilized default CO₂ emission factors for transport fuel from the Local Government Operations Protocol, v. 1.1, May 2010, Table G.11. 2005 emissions were adjusted to reflect IPCC AR5 values for N₂O and CH₄.

INFORMATION ITEMS

Information items are emissions sources that are not included in the inventory but are reported here to provide a more complete picture of emissions from San Rafael’s government operations. Information items for this inventory include one parks department vehicle, refrigerators, freezers, and air conditioning units using R-12 and R-22 refrigerants. These refrigerants are not included in the inventory because they are ozone-depleting substances and are being phased out by 2020 under the terms of the Montreal Protocol.

INFORMATION ITEMS

Source	Refrigerant	Metric Tons CO ₂ e
Refrigerators and Air Conditioning	R-12, R-22	13.83
Total		13.83