

TOWN OF SAN ANSELMO

2016 GREENHOUSE GAS INVENTORIES FOR COMMUNITY AND GOVERNMENT OPERATIONS EMISSIONS

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Prepared by the
Marin Climate & Energy Partnership



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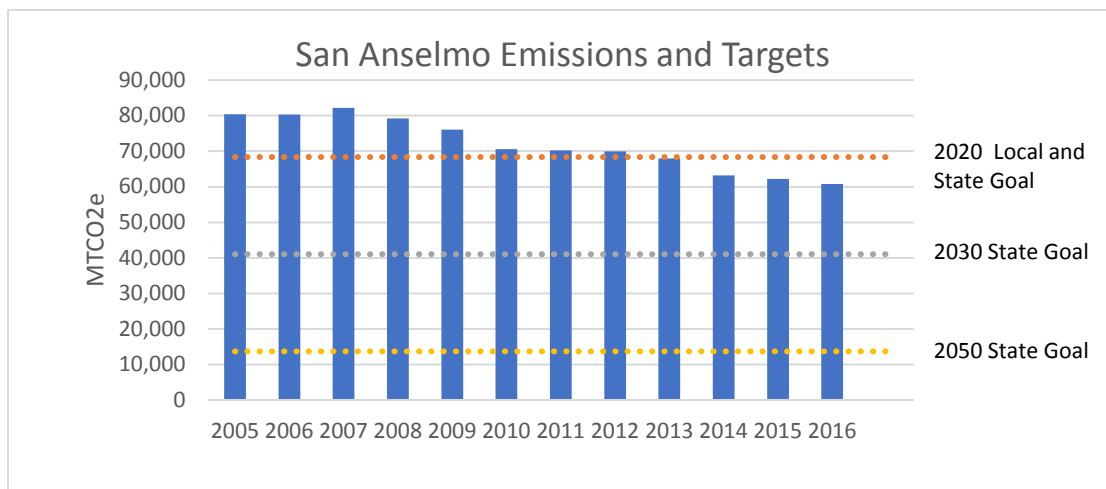
EXECUTIVE SUMMARY

THE TAKEAWAY:

COMMUNITY EMISSIONS DOWN 24%
AND GOVERNMENT OPERATIONS
EMISSIONS DOWN 18% SINCE 2005

San Anselmo publishes annual community greenhouse gas (GHG) emissions estimates through the Marin Climate & Energy Partnership (MCEP). Annual inventories help the Town to more closely monitor its progress in meeting its local goal to reduce community emissions 15% below baseline (2005) emissions by 2020 and to meet the statewide goal to reduce emissions 40% below 1990 levels by 2030. In addition to the community inventories, MCEP periodically prepares inventories for government operations emissions.

This report reviews emissions generated from the community from 2005 through 2016, the most recent year data is available. The inventory shows that the San Anselmo community has reduced emissions 24% since 2005 and met its 2020 goal seven years early. Emissions dropped from about 80,425 metric tons carbon dioxide equivalents (MTCO_{2e}) in 2005 to 60,770 MTCO_{2e} in 2016. The community emissions trend and targets are shown below. San Anselmo needs to reduce emissions another 19,750 MTCO_{2e} to meet the State target for 2030 and another 47,100 MTCO_{2e} to meet the State target for 2050, which is 80% below 1990 levels.



This report also reviews emissions from government operations, a subset of community emissions. Emissions from government operations decreased 18% between 2005 and 2016, or 90 metric tons CO_{2e}. 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. Emissions from government operations are detailed beginning on page 10.

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 Town of San Anselmo 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 Anselmo community and local government operations in 2016. This inventory provides a comparison to baseline 2005 emissions and identifies the sectors where significant reductions in greenhouse gas emissions have occurred. In some instances, previous year emissions were updated with new data and/or recalculated to ensure the same methodology was employed for all inventory years.

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, and the [U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, version 1.1 \(July 2013\)](#) was used for the quantification and reporting of community emissions. 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

Community emissions are categorized according to seven sectors:

- Residential
- Commercial
- Transportation
- Off-Road Vehicles and Equipment
- Waste
- Water
- Wastewater

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; 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. For example, greenhouse gas emissions associated with air travel and the production of goods outside the community’s boundary are not included in the inventory. Additionally, the community inventory does not include refrigerants released into the atmosphere from the use of air conditioning in cars and buildings.

COMMUNITY INVENTORY

COMMUNITY INVENTORY SUMMARY

In 2005, the activities taking place by the San Anselmo community resulted in approximately 80,425 metric tons of CO₂e. In 2016, those activities resulted in approximately 60,769 metric tons of CO₂e, a reduction of 24% from 2005 levels. This means that the Town has met the local and State goal to reduce emissions 15% below the 2005 baseline by 2020 and is on its way to meeting the 2030 target to reduce emissions another 40% by 2030.

The community inventory tracks emissions in seven sectors:

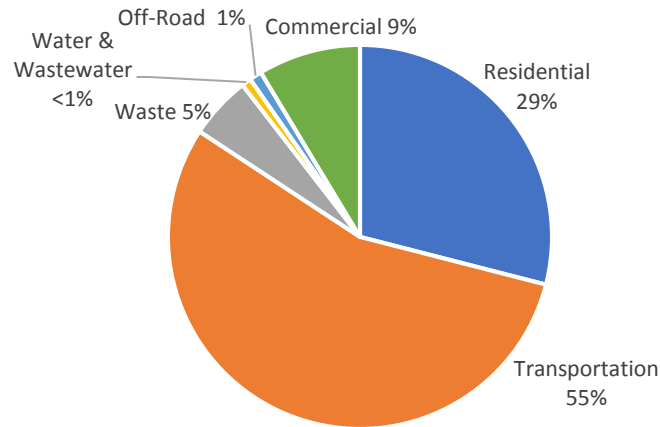
- The **Residential** sector represents emissions generated from the use of electricity, natural gas, and propane in San Anselmo homes.
- The **Commercial** sector represents emissions generated from the use of electricity and natural gas in commercial, industrial and governmental buildings and facilities.
- The **Transportation** sector includes tailpipe emissions from passenger vehicle trips originating and ending in San Anselmo, as well as a share of tailpipe emissions generated by medium and heavy-duty vehicles and buses travelling on Marin County roads. Electricity used to power electric vehicles is embedded in electricity consumption reported in the Residential and Commercial sectors.
- The **Waste** sector represents fugitive methane emissions that are generated over time as organic material decomposes in the landfill. Although most methane is captured or flared off at the landfill, approximately 25% escapes into the atmosphere.
- The **Off-Road** sector represents emissions from the combustion of gasoline and diesel fuel from the operation of off-road vehicles and equipment used for construction and landscape maintenance.
- The **Water** sector represents emissions from energy used to pump, treat and convey potable water from the water source to San Anselmo water users.
- The **Wastewater** sector represents stationary, process and fugitive greenhouse gases that are created during the treatment of wastewater generated by the community, as well as emissions created from electricity used to convey and treat wastewater.

Table 2 shows how emissions in each sector have changed since 2005. The greatest reductions have occurred in the Transportation sector (-10,695 MTCO₂e), followed by the Residential sector (-5,946 MTCO₂e) and the Commercial sector (-1,995 MTCO₂e). **Figure 1** shows the relative contribution of emissions from these sectors in 2016. The likely reasons for the largest emissions decreases are described in the remainder of this report.

TABLE 2: EMISSIONS SUMMARY BY SECTOR (MTCO₂E), 2005 THROUGH 2016

Year	Residential	Commercial	Transportation	Waste	Off-Road	Water	Wastewater	Total	% Change from 2005
2005	23,567	7,241	44,272	3,833	613	451	449	80,425	
2006	23,957	7,120	43,903	3,834	611	407	439	80,271	0%
2007	25,575	8,216	43,297	3,492	610	498	510	82,199	2%
2008	25,487	8,043	41,114	3,000	609	477	518	79,247	-1%
2009	24,756	7,872	39,299	2,574	608	471	478	76,057	-5%
2010	23,508	6,649	36,623	2,537	607	271	423	70,618	-12%
2011	23,454	6,588	36,473	2,476	614	194	406	70,205	-13%
2012	22,464	6,544	37,114	2,576	618	205	423	69,944	-13%
2013	21,550	6,398	36,110	2,615	621	240	420	67,954	-16%
2014	17,970	5,931	35,421	2,641	629	197	388	63,178	-21%
2015	18,007	5,839	34,437	2,753	631	164	382	62,213	-23%
2016	17,622	5,246	33,577	3,204	633	116	371	60,769	-24%
Change from 2005	-5,946	-1,995	-10,695	-629	20	-334	-78	-19,657	
% Change from 2005	-25%	-28%	-24%	-16%	3%	-74%	-17%	-24%	

FIGURE 1: EMISSIONS BY SECTOR, 2016

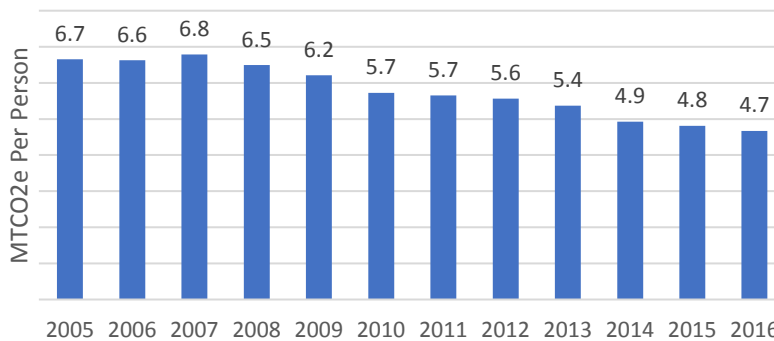


PER CAPITA EMISSIONS

Per capita emissions can be a useful metric for measuring progress in reducing greenhouse gases and for comparing one community's emissions with neighboring cities and against regional and national averages. That said, due to differences in emission inventory methods, it can be difficult to produce directly comparable per capita emissions numbers. Per capita emission rates may be compared among Marin jurisdictions, although some jurisdictions may have higher rates due to the presence of commercial and industrial uses.

Dividing the total community-wide GHG emissions by residents yields a result of 6.7 metric tons CO₂e per capita in 2005. Per capita emissions decreased 30% between 2005 and 2016, falling to 4.7 metric tons per person. Figure 2 shows the trend in per capita emissions over time. It is important to understand that this number is not the same as the carbon footprint of the average individual living in San Anselmo, which would include lifecycle emissions, emissions resulting from air travel, etc.

FIGURE 2: EMISSIONS PER CAPITA



MAJOR SOURCES OF EMISSIONS

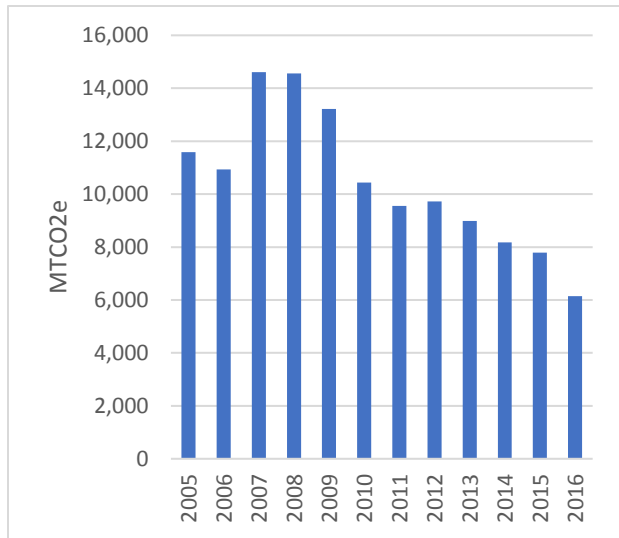
The following sections provide a year-by-year analysis of the changes in GHG emissions from the Town's largest sources: electricity, natural gas, transportation, waste, and water use. Whenever possible, each section discusses the change in emissions from previous years and the likely influence of state and local programs or policies and external factors on reducing emissions.

ELECTRICITY USE

Electricity use in homes and businesses in San Anselmo decreased 12% between 2005 and 2016. The Residential sector, which uses 65% of all electricity in San Anselmo, reduced electricity use 12% since 2005. Electricity use also decreased 12% in the Commercial sector over the same period. Electricity reductions have also occurred due to improved energy efficiency, conservation, and solar installation. Distributed solar generation from local roofs, carports and ground-mounted systems provided about 4% of the electricity used in Marin County in 2016.

Electricity-related greenhouse gas emissions in the Residential and Commercial sectors decreased 47% since 2005, as shown in Figure 3. This is primarily due to the lower carbon intensity of electricity. PG&E has been steadily increasing the amount of renewable energy in its electricity mix, which was 40% less carbon intensive in 2016 than it was in 2005. MCE Clean Energy (MCE), which began providing electricity to San Anselmo customers in 2010, has historically provided electricity that is less carbon intensive than PG&E electricity. In 2016, MCE Light Green electricity was 3% less carbon intensive than PG&E. MCE carries about 73% of the electricity load in San Anselmo. In 2016, about 4.6% of MCE electricity purchased by San Anselmo customers was 100% renewable Deep Green electricity.

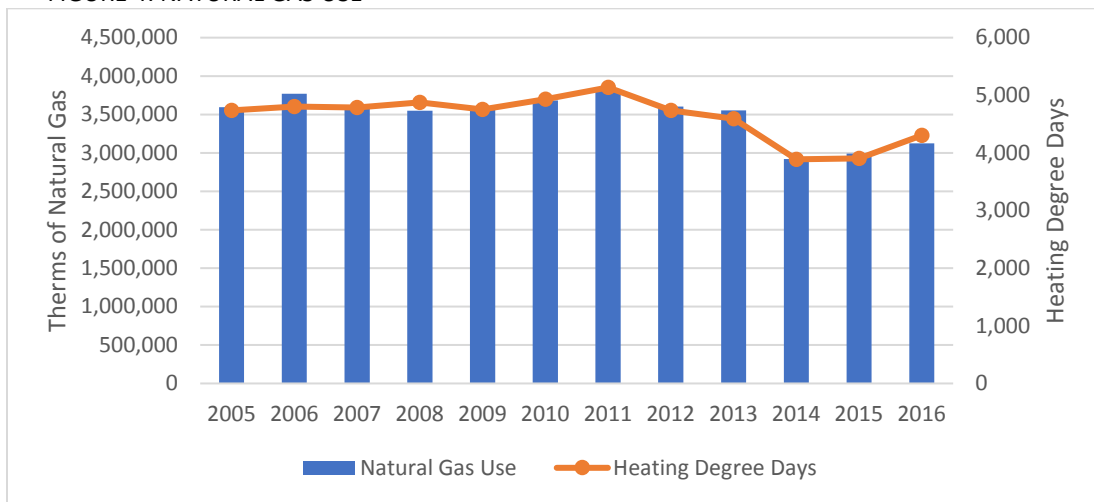
FIGURE 3: ELECTRICITY EMISSIONS



NATURAL GAS USE

Natural gas is used in residential, commercial and industrial buildings to provide space and water heating and power appliances. Use of natural gas is highly variable depending on the weather conditions in a given year. This variability has led natural gas use consumption in San Anselmo to fluctuate from year to year, from a high of 3.8 million therms in 2011 to a low of 2.9 million therms in 2014. Emissions from natural gas consumption increased 4% between 2015 and 2016, most likely due to colder temperatures. The chart below compares natural gas usage in San Anselmo to regional heating degree days, a measure of how much energy is required to warm the interior of a building relative to the outside temperature. Warmer days result in fewer heating degree days. As shown below, natural gas consumption is highly correlated to heating degree days. Overall, natural gas use has declined 13% since 2005.

FIGURE 4: NATURAL GAS USE



Reduction in energy use may also be attributed to energy efficiency programs and rebates, local green building ordinances, and State building codes. California’s goal is to require all new residential buildings to be net zero electricity use by 2020 and all new residential and commercial buildings to be zero net energy by 2030.

TRANSPORTATION

Transportation activities accounted for approximately 55% of San Anselmo’s emissions in 2016. Vehicle miles traveled have decreased approximately 16% since 2005. Transportation emissions have decreased 24%; the additional decline is due to more fuel-efficient and alternatively fueled cars. Marin County continues to be a leader in zero emission vehicles (ZEVs) – second only to Santa Clara County – with an estimated 4,000 ZEVs in Marin in 2016, or about 2% of registered vehicles. ZEVs include battery electric cars, plug-in hybrid electric cars, hydrogen fuel cell cars, and zero-emission motorcycles.

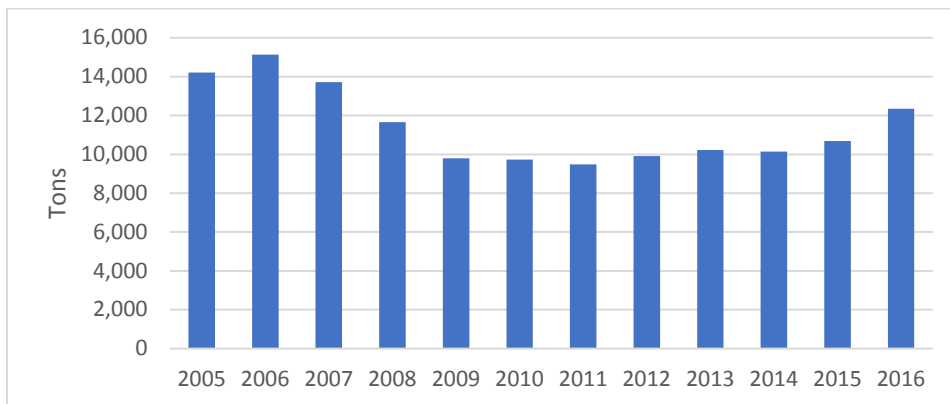
While it is difficult to pinpoint exactly how each land use and transportation policy affects emissions, the Town has undertaken many efforts to reduce transportation emissions. The Town encourages workforce housing and has made it easier for residents to use carbon-free modes of transportation, such as bicycling and walking, through improvements to the transportation network.

WASTE DISPOSAL

Waste generated by the community hit a low in 2011 but has since increased as shown in the chart below (based on countywide disposal data). Landfilled waste increased 16% between 2015 and 2016 but is still 13% below the 2005 baseline.

The decrease in emissions from waste disposal is most likely a result of community and County goals to move toward Zero Waste. Ongoing waste diversion programs include a residential food waste composting program and mandatory food waste recycling subscription for larger commercial producers.

FIGURE 5: DISPOSED WASTE

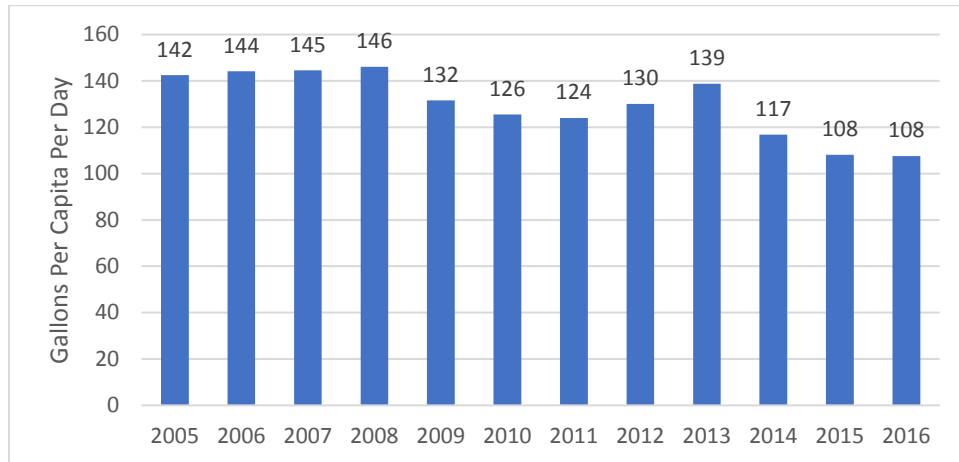


Source: CalRecycle

WATER USE

Per capita water use declined 24% since 2005. Emissions, which are based on an estimate of energy used to pump, treat, and convey water from the water source to the Town limits, dropped 74% between 2005 and 2016. The additional reduction is due to the lower carbon intensity of electricity. The Sonoma County Water Agency, which supplies approximately 25% of the Marin Municipal Water District's (MMWD) water, uses renewable and carbon-free sources for its electricity needs. MMWD began purchasing MCE Deep Green electricity in mid-2017.

FIGURE 6: PER CAPITA WATER USE



Source: Marin Municipal Water District

MMWD provides rebates and programs to reduce water use. Rebates are available to replace fixtures with high-efficiency toilets and clothes washers, and to purchase pool covers, hot water recirculating systems, organic mulch, laundry-to-landscape system components, and rain barrels. MMWD provides free home and landscape water-use evaluations. The California Department for Water Resources offers a turf replacement rebate of up to \$2,000 for single-family homes.

GOVERNMENT OPERATIONS INVENTORY

GOVERNMENT PROFILE

The Town of San Anselmo is a general law city and operates under the council-city manager form of government. The local government operates administrative, planning, building, and public works departments, as well as a community center and library. In 2016, there were 76 total employees, including full-time and part-time workers. The General Fund expenditures budget was \$15,851,170 in fiscal year 2015-2016.

GOVERNMENT OPERATIONS INVENTORY SUMMARY

In 2005, San Anselmo's government operations produced approximately 490 metric tons CO₂e. In 2016, those activities resulted in approximately 400 metric tons CO₂e, a reduction of 90 metric tons, or 18%. The local government's share of community emissions is 0.7%. The following summaries break down these totals by sector and sources.

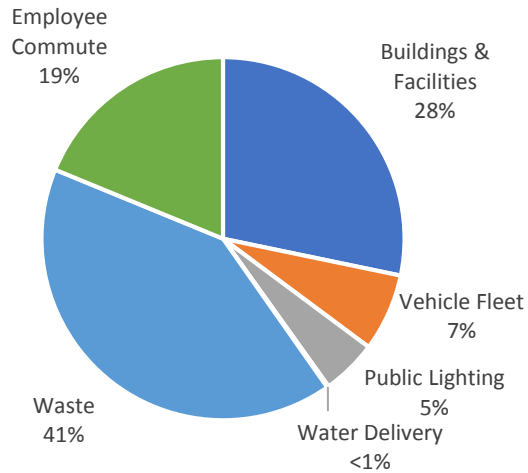
SUMMARY BY SECTOR

As shown in Table 3, emissions from government operations were reduced in all sectors except the waste sector. The greatest reduction occurred in the public lighting sector, where emissions dropped 57 metric tons CO₂e, or 74%. Other significant reductions occurred in the buildings and facilities sector (56 metric tons) and employee commute sector (34 metric tons). Figure 7 shows that the waste sector was the largest emitter of greenhouse gas emissions in 2016 (41% of total emissions), followed by the buildings and facilities sector (28%) and the employee commute sector (19%).

TABLE 3: SUMMARY BY SECTOR, 2005 AND 2016

Sector	2005 Metric Tons CO ₂ e	2016 Metric Tons CO ₂ e	Change Metric Tons CO ₂ e	% Change
Buildings & Facilities	169	113	-56	-33%
Vehicle Fleet	46	28	-18	-40%
Public Lighting	77	20	-57	-74%
Water Delivery	3	1	-2	-80%
Waste	86	164	77	90%
Employee Commute	109	75	-34	-31%
Total	490	400	-90	-18%

FIGURE 7: EMISSIONS BY SECTOR, 2016



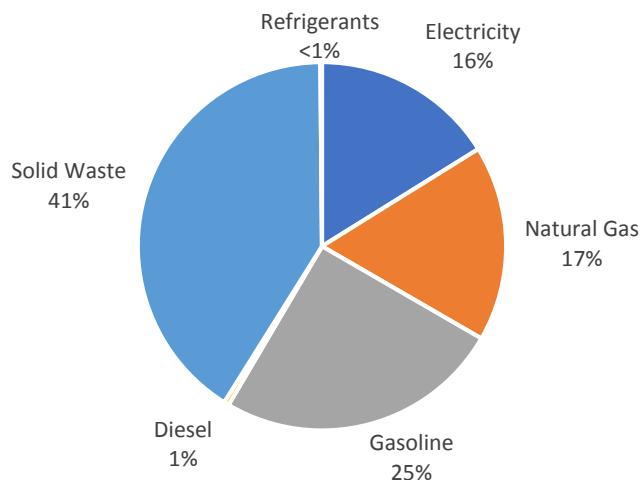
SUMMARY BY SOURCE

Table 4 shows a summary of the Town’s greenhouse gas emissions by source. The greatest decreases occurred in emissions from electricity (103 metric tons) and gasoline (53 metric tons). Solid waste and gasoline were the largest sources of greenhouse gas emissions in San Anselmo’s governmental operations in 2016 (see Figure 8), contributing 66% of all emissions.

TABLE 4: SUMMARY BY SOURCE, 2005 AND 2016

Source	2005 Metric Tons CO _{2e}	2016 Metric Tons CO _{2e}	Change Metric Tons CO _{2e}	% Change
Electricity	168	65	-103	-62%
Natural Gas	81	69	-12	-15%
Gasoline	153	101	-53	-34%
Diesel	1	2	0	28%
Solid Waste	86	164	77	90%
Refrigerants	0	1	0	44%
Total	490	400	-90	-18%

FIGURE 8: EMISSIONS BY SOURCE, 2016



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 2016, San Anselmo operated four major facilities – the Town Hall, the library, the public works corporation yard, and the Isabel Cook Community Center. As shown in Table 5, emissions from the buildings sector decreased 33% between 2005 and 2016. Electricity consumption decreased 14%, and emissions decreased 50% due to the lower carbon intensity of electricity in 2016. Natural gas consumption and emissions decreased 15%.

TABLE 5: BUILDINGS AND OTHER FACILITIES EMISSIONS, 2005 AND 2015

Source	2005 Energy Consumption	2016 GHG Emissions (MTCO ₂ e)	2016 Energy Consumption	2016 GHG Emissions (MTCO ₂ e)	% Change in Energy Consumption	% Change in GHG Emissions (MTCO ₂ e)
Electricity	395,601 kWh	88	339,884 kWh	44	-14%	-50%
Natural Gas	15,194 therms	81	12,951 therms	69	-15%	-15%
Refrigerants	--	0.01	--	0.01	n/a	0%
Total	--	169	--	113	--	-33%

Table 6 shows electricity and natural gas usage by facility. Electricity consumption decreased in most Town buildings.

TABLE 6: ENERGY USAGE AT SAN ANSELMO BUILDINGS AND FACILITIES

Building/ Facility	Energy Source	2005 Energy Consumption	2016 Energy Consumption	% Change in Energy Consumption
Town Hall	Electricity	208,960 kWh	162,485 kWh	-22%
	Natural Gas	3,116 therms	2,243 therms	-28%
Library	Electricity	34,120 kWh	36,189 kWh	6%
	Natural Gas	693 therms	865 therms	25%
Corporation Yard	Electricity	6,880 kWh	11,830 kWh	72%
	Natural Gas	376 therms	291 therms	-23%
Isabel Cook Community Center	Electricity	113,640 kWh	76,631 kWh	-33%
	Natural Gas	10,696 therms	8,347 therms	-22%
Parks and Minor Facilities	Electricity	32,001 kWh	26,570 kWh	-17%
	Natural Gas	313 therms	1,205 therms	285%
Electric Vehicle Charging	Electricity	–	26,176 kWh	n/a

PUBLIC LIGHTING

San Anselmo operates approximately 650 street and outdoor lights, as well as traffic and pedestrian signals. Emissions associated with the operation of this public lighting are from electricity consumption. The Town has converted 96% of its streetlights and most of its traffic signals to LED fixtures, reducing electricity consumption by 56% as shown in Table 8. Emissions from the public lighting sector decreased 74% between 2005 and 2016.

TABLE 7: PUBLIC LIGHTING, 2005 AND 2016

Source	2005 Electricity Consumption	2005 GHG Emissions (MTCO ₂ e)	2016 Electricity Consumption	2016 GHG Emissions (MTCO ₂ e)	% Change in Electricity Consumption	% Change in GHG Emissions (MTCO ₂ e)
Streetlights	287,348 kWh	64	121,266 kWh	16	-58%	-75%
Traffic Signals	56,870 kWh	13	30,615 kWh	4	-46%	-69%
Outdoor Lighting	180 kWh	0.04	181 kWh	0.02	1%	-41%
Total	344,398 kWh	77	152,062 kWh	20	-56%	-74%

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 Town were pumps. electricity used to operate these pumps declined 65% and emissions dropped 80%.

TABLE 8: WATER DELIVERY EMISSIONS, 2005 AND 2016

Source	2005 Electricity Consumption	2005 GHG Emissions (MTCO ₂ e)	2016 Electricity Consumption	2016 GHG Emissions (MTCO ₂ e)	% Change in Electricity Consumption	% Change in GHG Emissions (MTCO ₂ e)
Water Delivery	12,728 kWh	3	4,462 kWh	1	-65%	-80%

VEHICLE FLEET

The vehicles and mobile equipment used in San Anselmo’s daily operations include public works trucks and equipment. 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. Police vehicles, which were operated by the San Anselmo Police Department in 2005, are excluded from this inventory in order to provide an apples-to-apples comparison.

Table 9 shows that gasoline consumption decreased 43% since 2005 while diesel consumption increased 28%. The net effect was to decrease total fuel consumption 42% and emissions 40%.

TABLE 9: VEHICLE FLEET EMISSIONS, 2005 AND 2016

Source	2005 Fuel Consumption	2005 GHG Emissions (MTCO ₂ e)	2016 Fuel Consumption	2016 GHG Emissions (MTCO ₂ e)	% Change in Fuel Consumption	% Change in GHG Emissions (MTCO ₂ e)
Gasoline	4,944 gallons	117	2,797 gallons	129	-43%	-43%
Diesel	136 gallons	127	174 gallons	61	28%	28%
Refrigerants	--	0.4	--	0.6	--	45%
Total	5,080 gallons	46	2,970 gallons	28	-42%	-40%

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 86% between 2005 and 2016 and emissions increased 90%.

TABLE 10: WASTE EMISSIONS, 2005 AND 2016

Source	2005 Landfilled Waste (tons)	2005 GHG Emissions (MTCO _{2e})	2016 Landfilled Waste (tons)	2016 GHG Emissions (MTCO _{2e})	% Change in Landfilled Waste	% Change in GHG Emissions (MTCO _{2e})
Town Hall	17.9	5	58.5	17	227%	233%
Fire Station	4.0	1	26.0	7	550%	562%
Corp Yard	105.7	30	117.0	33	11%	13%
City Cans	105.5	30	181.6	52	72%	75%
Community Center	17.9	5	58.5	17	227%	233%
Robson House	21.9	6	21.6	6	-1%	1%
Parks	36.4	10	112.9	32	210%	216%
Total	309.3	86	576.2	164	86%	90%

EMPLOYEE COMMUTE

Emissions in the employee commute sector are due to the combustion of fuels used by Town employees commuting to and from work in San Anselmo. Emissions decreased 31% due to a decrease in the vehicle miles traveled per employee and an improvement in the fuel efficiency of vehicles San Anselmo employees drive to work. However, it is difficult to draw definitive conclusions from the data, as emissions are determined from employee commute surveys. Thirty-one percent of Town employees, including all part-time employees, responded to the survey in 2015. Estimates for total employee commutes were extrapolated from this data. Police Department employees were excluded from the 2005 data.

TABLE 11: EMPLOYEE COMMUTE EMISSIONS, 2005 AND 2016

	2005	2016	% Change
Number of Employees	31	74	139%
Vehicle Miles Traveled (VMT)	229,039	203,479	-11%
VMT Per Employee	7,388	2,750	-63%
Emissions per Employee (MTCO_{2e})	3.5	1.0	-72%
GHG Emissions (MTCO_{2e})	109	75	-31%

APPENDIX A: COMMUNITY INVENTORY

Community GHG Emissions Summary Table

Jurisdiction: Town of San Anselmo
 Population: 13,017 (CA Department of Finance)
 Number of Households: 5,332 (CA Department of Finance)

Inventory Year: 2016
 Date Prepared: November 26, 2018
 Reporting Framework: Communitywide Activities

ID	Emissions Type	Source or Activity	Included, Required Activities	Included, Optional Activities	Excluded (IE, NA, NO or NE)	Notes	Emissions (MTCO ₂ e)
1.0	Built Environment						
1.1	Use of fuel in residential and commercial stationary combustion equipment	Both	•				16,728
1.2	Industrial stationary sources	Source			NE		
1.3	Power generation in the community	Source			NO		
1.4	Use of electricity in the community	Activity	•			Includes transmission and distribution losses	6,140
1.5	District heating/cooling facilities in the community	Source			NE		
1.6	Use of district heating/cooling facilities in the community	Activity			NE		
1.7	Industrial process emissions in the community	Source			NO		
1.8	Refrigerant leakage in the community	Source			NE		
2.0	Transportation and Other Mobile Sources						
2.1	On-road passenger vehicles operating within the community boundary	Source			IE	Obtained data for preferred activity-based method instead	
2.2	On-road passenger vehicles associated with community land uses	Activity	•				27,191
2.3	On-road freight and service vehicles operating within the community boundary	Source			IE	Obtained data for preferred activity-based method instead	
2.4	On-road freight and service vehicles associated with community land uses	Activity	•				4,353
2.5	On-road transit vehicles associated with community land uses	Activity		•		Unable to obtain source data, therefore obtained activity-based data instead	2,033

2.6	Transit rail vehicles operating with the community boundary	Source			NO		
2.7	Use of transit rail travel by the community	Activity			NE		
2.8	Inter-city passenger rail vehicles operating within the community boundary	Source			NO		
2.9	Freight rail vehicles operating within the community boundary	Source			NO		
2.10	Marine vessels operating within the community boundary	Source			NE		
2.11	Use of ferries by the community	Activity			NE		
2.12	Off-road surface vehicles and other mobile equipment operating within the community boundary	Source		•			633
2.13	Use of air travel by the community	Activity			NE		
3.0	Solid Waste						
3.1	Operation of solid waste disposal facilities in the community	Source			NO		
3.2	Generation and disposal of solid waste by the community	Activity	•				3,204
4.0	Water and Wastewater						
4.1	Operation of water delivery facilities in the community	Source			IE	Energy use is included in 1.1 and 1.4.	
4.2	Use of energy associated with use of potable water by the community	Activity	•				116
4.3	Use of energy associated with generation of wastewater by the community	Activity	•				89
4.4	Process emissions from operation of wastewater treatment facilities located in the community	Source			NO		
4.5	Process emissions associated with generation of wastewater by the community	Activity	•				282
4.6	Use of septic systems in the community	Source			NE		
5.0	Agriculture						
5.1	Domesticated animal production	Source			NE		
5.2	Manure decomposition and treatment	Source			NE		
6.0	Upstream Impacts of Communitywide Activities						
6.1	Upstream impacts of fuels used in stationary applications by the community	Activity			NE		
6.2	Upstream and transmission and distribution (T&D) impacts of purchased electricity used by the community	Activity			IE	Transmission and distribution losses included in 1.4.	
6.3	Upstream impacts of fuels used by water and wastewater facilities for water used and wastewater generated within the community boundary	Activity			IE	Included in 4.2 and 4.3.	
6.4	Upstream impacts of select materials (concrete, food, paper, carpets, etc.) used by the whole community.	Activity			NE		

Legend

IE – Included Elsewhere: Emissions for this activity are estimated and presented in another category of the inventory. The category where these emissions are included should be noted in the explanation.

NE – Not Estimated: Emissions occur but have not been estimate or reported (e.g., data unavailable, effort required not justifiable).

NA – Not Applicable: The activity occurs but does not cause emissions; explanation should be provided.

NO – Not Occurring: The source or activity does not occur or exist within the community.

Community Emissions Data Sources and Calculation Methodologies

Sector/ID	Emissions Source	Source and/or Activity Data	Emission Factor and Methodology
1.0 Built Environment			
1.1 Stationary Combustion	Stationary Combustion (CO ₂ , CH ₄ & N ₂ O)	Known fuel use (meter readings by PG&E) and estimated fuel use (American Community Survey 5-Year Estimates, and U.S. Energy Information Administration Household Site Fuel Consumption data).	Default CO ₂ , CH ₄ & N ₂ O emission factors by fuel type (U.S. Community Protocol v. 1.1 Tables B.1 and B.3). U.S. Community Protocol v. 1.1, Appendix C, Method BE.1.1 and BE.1.2.
1.4 Electricity Use	Electricity Use (CO ₂ , CH ₄ & N ₂ O)	Known electricity use (meter readings by PG&E and MCE) and estimated direct access electricity consumption.	Verified utility-specific emission factors (PG&E and MCE) and eGrid subregion default emission factors. U.S. Community Protocol v. 1.1, Appendix C, Method BE.2.1.
	Electric Power Transmission and Distribution Losses (CO ₂ , CH ₄ & N ₂ O)	Estimated electricity grid loss for Western region from eGrid.	U.S. Community Protocol v. 1.1, Appendix C, Method BE.4.1.
2.0 Transportation and Other Mobile Sources			
2.2 On-Road Passenger Vehicle Operation	On-Road Mobile Combustion (CO ₂)	Estimated passenger vehicle miles traveled associated with origin and destination land uses (Metropolitan Transportation Commission, http://capvmt.us-west-2.elasticbeanstalk.com/data).	CO ₂ for on-road passenger vehicles quantified in the EMFAC2017 model. Passenger vehicle emissions calculated according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.1.A.
	On-Road Mobile Combustion (CH ₄ & N ₂ O)	Estimated vehicle miles traveled associated with origin and destination land uses (Metropolitan Transportation Commission, http://capvmt.us-west-2.elasticbeanstalk.com/data).	CH ₄ and N ₂ O for on-road passenger vehicles quantified in the EMFAC2017 model and adjusted for IPCC AR5 100-year values. Passenger vehicle emissions calculated according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.1.A.
2.4 On-Road Freight and Service Truck Freight Operation	On-Road Mobile Combustion (CO ₂)	Estimated commercial vehicle miles traveled within the boundary (Metropolitan Transportation Commission utilizing the 2017 Regional Transportation Plan).	CO ₂ for on-road commercial vehicles quantified in the EMFAC2017 model. Emissions allocated utilizing LEHD data according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.2.A.
	On-Road Mobile Combustion (CH ₄ & N ₂ O)	Estimated commercial vehicle miles traveled within the boundary (Metropolitan Transportation Commission utilizing Plan Bay Area 2040 and the 2017 Regional Transportation Plan).	CH ₄ and N ₂ O for on-road commercial vehicles quantified in the EMFAC2017 model and adjusted for IPCC AR5 100-year values. Emissions allocated utilizing LEHD data according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.2.A.
2.5 On-Road Transit Operation	On-Road Mobile Combustion (CO ₂)	Estimated commercial vehicle miles traveled within the boundary (Metropolitan Transportation Commission utilizing Plan Bay Area 2040 and the 2017 Regional Transportation Plan).	CO ₂ for on-road commercial vehicles quantified in the EMFAC2017 model. Emissions allocated according to jurisdiction's share of countywide population. Recommended U.S. Community Protocol v. 1.1, Appendix D, Method TR.4.A could not be used due to lack of data.
	On-Road Mobile Combustion	Estimated commercial vehicle miles traveled within the boundary (Metropolitan Transportation Commission utilizing	CH ₄ and N ₂ O for on-road passenger vehicles quantified in the EMFAC2017 model and adjusted for IPCC AR5 100-year values.

	(CH ₄ & N ₂ O)	Plan Bay Area 2040 and the 2017 Regional Transportation Plan).	Emissions allocated according to jurisdiction's share of countywide population. Recommended U.S. Community Protocol v. 1.1 Method TR.4.B, Appendix D, could not be used due to lack of data.
2.12 Off-Road Vehicles and Equipment	Off-Road Mobile Combustion (CO ₂)	Estimated fuel use from OFFROAD 2007 for Lawn and Garden and from OFFROAD2017 for Construction equipment. All categories are allocated by share of countywide households.	CO ₂ emissions calculated according U.S. Community Protocol v. 1.1, Appendix D, Method TR.8. Emission factors provided in Table TR.1.6.
	Off-Road Mobile Combustion (CH ₄ & N ₂ O)	Estimated fuel use from OFFROAD 2007 for Lawn and Garden and from OFFROAD2017 for Construction equipment. All categories are allocated by share of countywide households.	CH ₄ and N ₂ O emissions calculated according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.8. Emission factors provided in the Local Government Operations Protocol Table G.11 and G.14.
3.0 Solid Waste			
3.2 Solid Waste Generation and Disposal	Fugitive Emissions from Landfilled Waste (CH ₄)	Estimated landfilled tons based on reporting to CalRecycle by Marin County Solid and Hazardous Waste JPA and allocated to jurisdiction based on share of countywide population. Waste characterization based on the Statewide Waste Characterization Study (2008 and 2014) and Alternative Daily Cover by Jurisdiction of Origin and Material Type as reported to CalRecycle.	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.
4.0 Water and Wastewater			
4.2 Water Supply & Conveyance, Treatment and Distribution	Electricity Use (CO ₂)	Water consumption (district-wide gpcd) provided by Marin Municipal Water District (MMWD). Assumed 75% of water from MMWD resources and 25% from Sonoma County Water Agency (SCWA). Electricity consumption data provided by MMWD.	Verified utility-specific emission factors (PG&E, MCE and SCWA). Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.14.
	Electricity Use (CH ₄ & N ₂ O)	Water consumption (district-wide gpcd) provided by Marin Municipal Water District (MMWD). Assumed 75% of water from MMWD resources and 25% from Sonoma County Water Agency (SCWA). Electricity consumption data provided by MMWD.	eGrid subregion default emission factors. Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.14.
4.5 Treatment of Wastewater	Stationary Emissions from Combustion of Digester Gas (CH ₄)	Known amount of digester gas produced per day and known percent of methane in digester gas provided by Central Marin Sanitation Agency.	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.1.a.
	Stationary Emissions from Combustion of	Known amount of digester gas produced per day and known percent of methane in digester gas provided by Central Marin	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.2.a.

	Digester Gas (N ₂ O)	Sanitation Agency.	
	Process Emissions from Wastewater Treatment Plant without Nitrification or Denitrification	Estimated population served by wastewater treatment plant provided by Central Marin Sanitation Agency.	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.8.
	Fugitive Emissions from Effluent Discharge (N ₂ O)	Estimated population served by wastewater treatment plant provided by Central Marin Sanitation Agency. Assumed significant industrial or commercial input.	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.12(alt).

APPENDIX B: GOVERNMENT OPERATIONS INVENTORY

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	15,194 therms	80.56	0.00	0.01	0.00	80.81
	Fugitive Emissions	Refrigerants	0.00	0.00	0.00	0.00	0.01
	TOTAL		80.56	0.00	0.01	0.00	80.82
Scope 2	Purchased Electricity	395,601 kWh	87.78	0.00	0.01	0.00	88.32
	TOTAL		87.78	0.00	0.01	0.00	88.32

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2016

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	12,951 therms	68.67	0.00	0.01	0.00	68.88
	Fugitive Emissions	Refrigerants	0.00	0.00	0.00	0.00	0.01
	TOTAL		68.67	0.00	0.00	0.00	68.89
Scope 2	Purchased Electricity	339,884 kWh	43.94	0.00	0.01	0.00	44.24
	TOTAL		43.94	0.00	0.01	0.00	44.24

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).

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	344,398 kWh	79.41	0.00	0.01	0.00	76.89

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2016

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	152,062 kWh	19.66	0.00	0.00	0.00	19.79

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.

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	12,728 kWh	2.82	0.00	0.01	0.00	2.84

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2016

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	4,462 kWh	0.58	0.00	0.00	0.00	0.58

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.

VEHICLE FLEET SECTOR NOTES

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2005

Scope	Emission Type	Fuel Consumption	Greenhouse Gas Emissions (metric tons)				
			CO ₂	N ₂ O	CH ₄	HFCs	CO ₂ e
Scope 1	Mobile Combustion	4,944 gallons gasoline	43.41	0.00	0.00	0.00	44.21
	Mobile Combustion	136 gallons diesel	1.39	0.00	0.00	0.00	1.39
	Fugitive Emissions	Refrigerants	0.00	0.00	0.00	0.00	0.39
	TOTAL			44.80	0.00	0.00	0.00

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2016

Scope	Emission Type	Fuel Consumption	Greenhouse Gas Emissions (metric tons)				
			CO ₂	N ₂ O	CH ₄	HFCs	CO ₂ e
Scope 1	Mobile Combustion	2,797 gallons gasoline	24.55	0.00	0.00	0.00	25.35
	Mobile Combustion	174 gallons diesel	1.77	0.00	0.00	0.00	1.77
	Fugitive Emissions	--	0.00	0.00	0.00	0.00	0.57
	TOTAL	20,579 gallons	26.33	0.00	0.00	0.00	27.69

On and off-road vehicle fleet and equipment fuel data and VMT data were provided by Town of San Anselmo. Police vehicles were excluded from the 2005 inventory in order to provide a comparable analysis. LGO Protocol methods were followed in collection and analysis of vehicle fuel consumption and cost and vehicle miles traveled (VMT). VMT data for 2010 was used as a proxy for 2016. Utilized default CO₂ emission factors for transport fuel from the Local Government Operations Protocol, v. 1.1, May 2010, Table G.11. Utilized default N₂O and CH₄ emission factors for highway vehicles by model year from the Local Government Operations Protocol, v. 1.1, May 2010, Table G.12.

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.

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	309.3 tons	0.00	0.00	3.09	0.00	86.42

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2016

Scope	Emission Type	Weight	Greenhouse Gas Emissions (metric tons)				
			CO ₂	N ₂ O	CH ₄	HFCs	CO ₂ e
Scope 3	Landfilled Waste	576.2 tons	0.00	0.00	5.85	0.00	163.90

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 2014). 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	Fuel Consumption (gallons)	Greenhouse Gas Emissions (metric tons)				
				CO ₂	N ₂ O	CH ₄	HFCs	CO ₂ e
Scope 3	Mobile Combustion	31	12,308 gasoline	108.06	0.00	0.00	0.00	109.13

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2016

Scope	Emission Type	Number of Employees	Fuel Consumption (gallons)	Greenhouse Gas Emissions (metric tons)				
				CO ₂	N ₂ O	CH ₄	HFCs	CO ₂ e
Scope 3	Mobile Combustion	76	8,434 gasoline	74.05	0.00	0.00	0.00	75.23

In 2015, the Town 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 employees. 24 employees responded to the survey, a response rate of 32%. Estimates for total employee commutes were extrapolated from this data. Default CO₂ emission factors for transport fuel from the Local Government Operations Protocol, v. 1.1, May 2010, Table G.11 were used. 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 adjusted to reflect IPCC AR5 values for N₂O and CH₄. Police department employees were excluded from the 2005 inventory in order to provide a comparable analysis.

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 Anselmo's government operations. Information items for this inventory include refrigerators using R-12 refrigerant and air conditioning units using R-22. 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	R-12	0.02
Air Conditioners	R-22	0.37
TOTAL		0.39