

# City of San Mateo

## 2010 Government Operations Greenhouse Gas Emissions Inventory



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In collaboration with:

Joint Venture Silicon Valley

ICLEI-Local Governments for Sustainability USA

With support from Pacific Gas and Electric Company

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# Credits and Acknowledgements

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## Joint Venture Silicon Valley

The Joint Venture Public Sector Climate Task Force is a forum for cities, counties, and other public agencies in Silicon Valley to work together to develop effective, collaborative solutions for the reduction of greenhouse gas emissions from public agency operations.

Established in 1993, Joint Venture Silicon Valley provides analysis and action on issues affecting our region's economy and quality of life. The organization brings together established and emerging leaders—from business, government, academia, labor and the broader community—to spotlight issues and work toward innovative solutions.

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## Pacific Gas and Electric Company (PG&E)

Pacific Gas and Electric Company provides comprehensive climate planning assistance to local governments, from providing energy usage data and assistance with greenhouse gas inventories, to training and guidance on climate action plans.

This program is funded by California utility customers and administered by PG&E under the auspices of the California Public Utilities Commission.

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ICLEI–Local Governments for Sustainability USA is the leading nonprofit membership association of local governments committed to climate action, clean energy, and sustainability, with more than 500 U.S. members, and 1,100 worldwide. ICLEI USA's mission is to build, serve and drive a movement of local governments to advance deep reductions in greenhouse gas emissions and achieve tangible improvements in local sustainability. ICLEI USA provides tools and resources, technical guidance, trainings, and national standards to help local governments meet their goals, as well as global networks to help them share innovations and learn from one another.

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# Executive Summary

## The Purpose of Conducting an Inventory

Each day, local governments operate buildings, vehicle fleets, street lights, traffic signals, water systems, and wastewater plants; local government employees consume resources commuting to work and generate solid waste which is sent for disposal. All of these activities directly or indirectly cause the release of carbon dioxide and other greenhouse gases into the atmosphere. This report presents the findings and methodology of a local government operations (LGO) greenhouse gas emissions inventory for the City of San Mateo. The inventory measures the greenhouse gas emissions resulting specifically from the City of San Mateo's government operations, arranged by sector to facilitate detailed analysis of emissions sources. The inventory addresses where and what quantity of emissions are generated through various local government activities. Through analysis of a local government's emissions profile, the City of San Mateo can tailor strategies to achieve the most effective greenhouse gas emission reductions.

Strategies by which local governments can significantly reduce emissions from their operations include increasing energy efficiency in facilities and vehicle fleets, utilizing renewable energy sources, reducing waste, and supporting alternative modes of transportation for employees. The benefits of these actions include lower energy bills, improved air quality, and more efficient government operations, in addition to the mitigation of local and global climate change impacts. By striving to save taxpayer money through efficient government operations, the City of San Mateo is working to improve government services in a smart and targeted way that will benefit all of the City's residents.

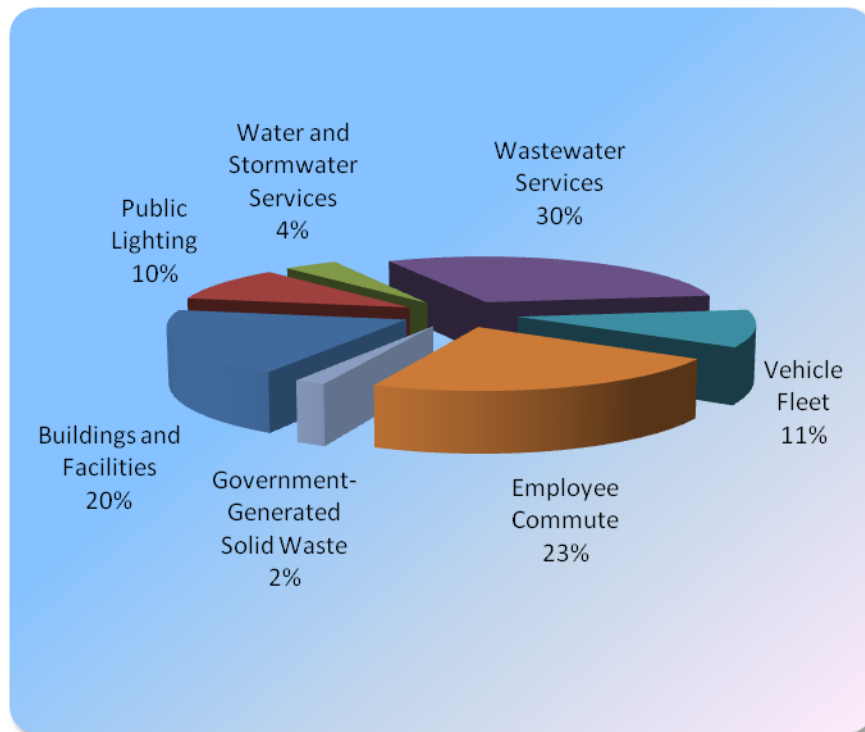
The City of San Mateo recognizes that climate change resulting from the greenhouse gas emissions of human activities is a reality. Global average surface temperatures are rising due to intensification of activities that release carbon dioxide and other greenhouse gases into the atmosphere. Potential impacts of climate change include rising sea levels, more severe and frequent storms, increased flooding, greater rates of coastal erosion, loss of critical habitat and ecosystems, more severe heat waves, increased precipitation, extended drought conditions, larger wildfires, shortages in water supply, formation of ground level ozone, and heightened exposure to vector born diseases.

By conducting this inventory, the City of San Mateo is acting now to limit future impacts that threaten the lives and property of the San Mateo's residents and businesses, make government operations more efficient, and improve the level of service it offers to the residents in the City of San Mateo.

## Inventory Results

The following figures and tables summarize the results of the LGO greenhouse gas emissions inventory for the City of San Mateo, by sector and source.

**Figure 1: 2010 Government Operations CO<sub>2</sub>e Emissions by Sector**

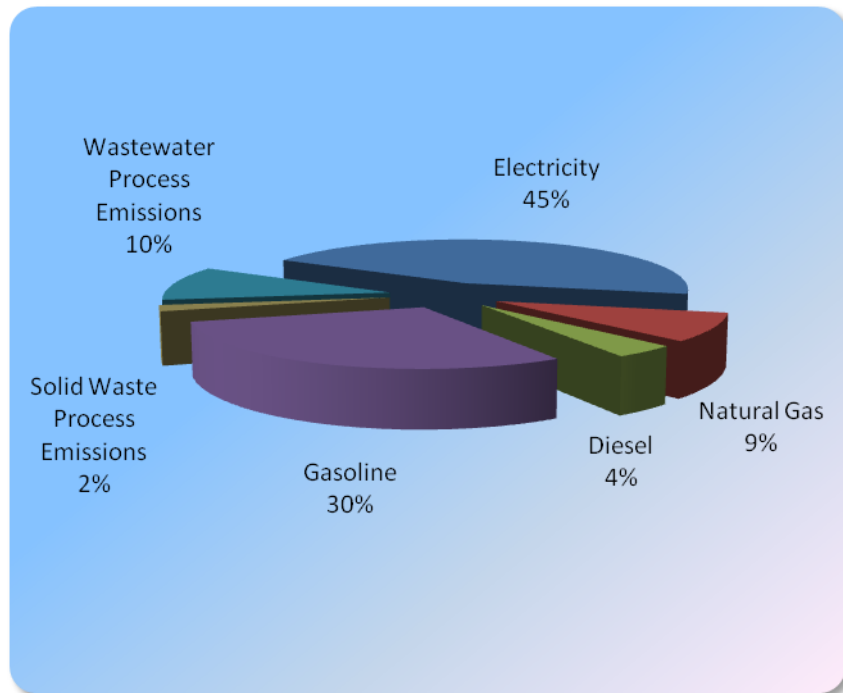


**Table 1: 2010 Government Operations CO<sub>2</sub>e Emissions by Sector**

Sector	metric tons CO <sub>2</sub> e
Buildings and Facilities	1,743.67
Public Lighting	926.49
Water and Stormwater Services	375.54
Wastewater Services	2,722.46
Vehicle Fleet	983.85
Employee Commute	2,013.29
Government-Generated Solid Waste	168.73
<b>Totals</b>	<b>8,934.03</b>



**Figure 2: 2010 Government Operations CO<sub>2</sub>e Emissions by Source**



**Table 2: 2010 Government Operations CO<sub>2</sub>e Emissions by Source**

Source	metric tons CO <sub>2</sub> e
Electricity	4,028.68
Natural Gas	788.62
Diesel	355.61
Gasoline	2,645.59
Solid Waste Process Emissions	168.73
Wastewater Process Emissions	946.80
<b>Totals</b>	<b>8,934.03</b>

**Table 3: LGO Protocol Report - Overall Emissions by Scope**

Total Emissions				
	CO <sub>2</sub> e	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
SCOPE 1	2,723.335	1,767.823	0.096	3.076
SCOPE 2	4,028.684	3,995.196	0.269	0.090
SCOPE 3	2,182.014	1,965.912	8.170	0.144
INFORMATION ITEMS	0.000	0.000	0.000	0.000



For more detail on the concepts of scopes, sources, and sectors, and to review more granular data produced through the inventory study, please refer to the full report on the following pages.

## **Regional and Local Context**

### **Climate Change Mitigation Activities in California**

Since 2005, the State of California has responded to growing concerns over the effects of climate change by adopting a comprehensive approach to addressing emissions in the public and private sectors. This approach was officially initiated with the passage of the Global Warming Solutions Act of 2006 (AB 32), which requires the state to reduce its greenhouse gas emissions to 1990 levels by 2020. The AB 32 Scoping Plan was developed to identify strategies for meeting the AB 32 goal, and was adopted by ARB in December 2008. Among many other strategies, it encourages local governments to reduce emissions in their jurisdictions by 15 percent below current levels by 2020. In addition, it identifies the following strategies that will impact local governance:

- Develop a California cap-and-trade program
- Expand energy efficiency programs
- Establish and seek to achieve reduction targets for transportation-related GHG emissions
- Expand the use of green building practices
- Increase waste diversion, composting, and commercial recycling toward zero-waste
- Continue water efficiency programs and use cleaner energy sources to move and treat water
- Reduce methane emissions at landfills
- Preserve forests that sequester carbon dioxide

Other measures taken by the state include mandating stronger vehicle emissions standards (AB 1493, 2002), establishing a low-carbon fuel standard (EO # S-01-07, 2007), mandating a climate adaptation plan for the state (S-EO # 13-08, 2008), establishing a Green Collar Job Council, and establishing a renewable energy portfolio standard for power generation or purchase in the state. The state also has made a number of legislative and regulatory changes that have significant implications for local governments:

- SB 97 (2007) required the Office of Planning and Research to create greenhouse gas planning guidelines for the California Environmental Quality Act (CEQA). In addition, ARB is tasked with creating energy-use and transportation thresholds in CEQA reviews, which may require local governments to account for greenhouse gas emissions when reviewing project applications.
- AB 811 (2007) authorizes all local governments in California to establish special districts that can be used to finance solar or other renewable energy improvements to homes and businesses in their jurisdiction.

- SB 375 (2008) revises the process of regional transportation planning by metropolitan planning organizations (MPOs), which are governed by elected officials from local jurisdictions. The statute calls on ARB to establish regional transportation-related greenhouse gas targets and requires the large MPOs to develop regional “Sustainable Communities Strategies” of land use, housing and transportation policies that will move the region towards its GHG target. The statute stipulates that transportation investments must be consistent with the Sustainable Communities Strategy and provides CEQA streamlining for local development projects that are consistent with the Strategy.

### **Pacific Gas and Electric Company Supported Inventory Project**

With the administrative support of Pacific Gas and Electric Company (PG&E) and funding from California utility customers under the auspices of the California Public Utilities Commission, ICLEI - Local Governments for Sustainability (“ICLEI”) was contracted to work with Joint Venture Silicon Valley to assist in the training and support of an intern in the City of San Mateo and other participating jurisdictions who conducted the inventories. Joint Venture Silicon Valley coordinated this multi-jurisdictional greenhouse gas inventory update. John Sztukowski, GHG Analyst, facilitated the completion of the municipal inventory along with this report. Throughout 2012, ICLEI provided training and technical assistance to participating regional organizations, interns, and local government staff.



# Introduction

## General Methodology

### Local Government Operations Protocol

A national standard called the Local Government Operations Protocol (LGO Protocol) has been developed and adopted by the California Air Resources Board (ARB) in conjunction with ICLEI, the California Climate Action Registry, and The Climate Registry. This standard provides accounting principles, boundaries, quantification methods, and procedures for reporting greenhouse gas emissions from local government operations. The LGO Protocol forms the basis of ICLEI's Clean Air & Climate Protection Software (CACP 2009), which allows local governments to compile data and perform the emissions calculations using standardized methods.

### Greenhouse Gases and Carbon Dioxide Equivalent

In accordance with LGO Protocol recommendations, CACP 2009 calculates and reports all six internationally recognized greenhouse gases regulated under the Kyoto Protocol (Carbon Dioxide, Methane, Nitrous Oxide, Hydrofluorocarbons, Perfluorocarbons, and Sulfur Hexafluoride). Emissions summaries found throughout this report also use CACP 2009's ability to combine emissions from the various greenhouse gases into carbon dioxide equivalent, CO<sub>2</sub>e. Since equal quantities of each greenhouse gas have more or less influence on the greenhouse effect, converting all emissions to a standard metric, CO<sub>2</sub>e, allows apples-to-apples comparisons amongst quantities of all six emissions types. Greenhouse gas emissions are reported in this inventory as metric tons of CO<sub>2</sub>e (MTCO<sub>2</sub>e).

Table 2 exhibits the greenhouse gases and their global warming potential (GWP), a measure of the amount of warming a greenhouse gas may cause compared to the amount of warming caused by carbon dioxide.

**Table 4: Greenhouse Gases**

Gas	Chemical Formula	Activity	Global Warming Potential (CO <sub>2</sub> e)
Carbon Dioxide	CO <sub>2</sub>	Combustion	1
Methane	CH <sub>4</sub>	Combustion, Anaerobic Decomposition of Organic Waste (Landfills, Wastewater), Fuel Handling	21
Nitrous Oxide	N <sub>2</sub> O	Combustion, Wastewater Treatment	310
Hydrofluorocarbons	Various	Leaked Refrigerants, Fire Suppressants	12–11,700
Perfluorocarbons	Various	Aluminum Production, Semiconductor Manufacturing, HVAC Equipment Manufacturing	6,500–9,200
Sulfur Hexafluoride	SF <sub>6</sub>	Transmission and Distribution of Power	23,900

## Calculating Emissions

In general, emissions can be quantified in two ways.

- 1. Measurement-based methodologies** refer to the direct measurement of greenhouse gas emissions from a monitoring system. Emissions measured this way may include those emitted from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility. This method is the most accurate way of inventorying emissions from a given source, but is generally available for only a few sources of emissions.
- 2. Calculation-based methodologies** refer to an estimate of emissions calculated based upon measurable *activity data* and *emission factors*. Table 3 provides examples of common emissions calculations.

**Table 5: Basic Emissions Calculations**

Activity Data	x	Emissions Factor	=	Emissions
Electricity Consumption (kilowatt hours)		CO <sub>2</sub> emitted/kWh		CO <sub>2</sub> emitted
Natural Gas Consumption (therms)		CO <sub>2</sub> emitted/therm		CO <sub>2</sub> emitted
Gasoline/Diesel Consumption (gallons)		CO <sub>2</sub> emitted /gallon		CO <sub>2</sub> emitted
Waste Generated by Government Operations (tons)		CH <sub>4</sub> emitted/ton of waste		CH <sub>4</sub> emitted

## The Scopes Framework

This inventory reports greenhouse gas emissions by sector and additionally by “scope”, in line with the LGO Protocol and WRI/WBCSD GHG Protocol Corporate Standard.

**Scope 1:** Direct emissions from sources within a local government’s operations that it owns and/or controls, with the exception of direct CO<sub>2</sub> emissions from biogenic sources. This includes stationary combustion to produce electricity, steam, heat, and power equipment; mobile combustion of fuels; process emissions from physical or chemical processing; fugitive emissions that result from production, processing, transmission, storage and use of fuels; leaked refrigerants; and other sources.

**Scope 2:** Indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling.

**Scope 3:** All other emissions sources that hold policy relevance to the local government that can be measured and reported. This includes all indirect emissions not covered in Scope 2 that occur as a result of activities within the operations of the local government. Scope 3 emission sources include (but are not limited to) tailpipe emissions from employee commutes, employee business travel, and emissions resulting from the decomposition of government-generated solid waste.



ICLEI and the LGO Protocol provide standard methodologies for calculating emissions from the sources shown in the following table. Other sources of emissions, such as those associated with the production of consumed products do not yet have standard calculation methodologies and are thus excluded from this inventory.

**Table 6: Inventoried Emissions Sources by Scope**

Scope 1	Scope 2	Scope 3
Fuel consumed at facilities	Purchased electricity consumed by facilities	Solid waste generated by government operations
Fuel consumed by vehicle fleet and mobile equipment	Purchased electricity consumed by electric vehicles	Fuel consumed by vehicles during employee commuting
Fuel consumed to generate electricity	Purchased steam	
Leaked refrigerants from facilities and vehicles	Purchased cooling (chilled water)	
Leaked / deployed fire suppressants		
Solid waste in government landfills		
Wastewater decomposition and treatment at a municipal wastewater treatment plant		

### Organizational Boundaries

The organizational boundary for the inventory determines which aspects of operations are included in the emissions inventory, and which are not. Under the LGO Protocol, two control approaches are used for reporting emissions: operational control or financial control. A local government has operational control over an operation if it has full authority to introduce and implement policies that impact the operation. A local government has financial control if the operation is fully consolidated in financial accounts. If a local government has joint control over an operation, the contractual agreement will have to be examined to see who has authority over operating policies and implementation, and thus the responsibility to report emissions under operational control.

LGO Protocol strongly encourages local governments to utilize operational control as the organization boundary for a government operations emissions inventory. Operational control is believed to most accurately represent the emissions sources that local governments can most directly influence, and this boundary is consistent with other environmental and air quality reporting program requirements. For this reason, this inventory was conducted according to the operational control framework.

### Types of Emissions

As described in the LGO Protocol, emissions from each of the greenhouse gases can come in a number of forms:

**Stationary or mobile combustion:** These are emissions resulting from on-site combustion of fuels (natural gas, diesel, gasoline, etc.) to generate heat, electricity, or to power vehicles and mobile equipment.

**Purchased electricity:** These are emissions produced by the generation of power from utilities outside of the jurisdiction.

**Fugitive emissions:** Emissions that result from the unintentional release of greenhouse gases into the atmosphere (e.g., leaked refrigerants, methane from waste decomposition, etc.).

**Process emissions:** Emissions from physical or chemical processing of a material (e.g., wastewater treatment).

### **Information Items**

Information items are emissions sources that are not included as Scope 1, 2, or 3 emissions in the inventory, but are reported here separately in order to provide a more complete picture of emissions from the City of San Mateo's government operations.

A common emission that is categorized as an information item is carbon dioxide emitted in the combustion of biogenic fuels. Local governments will often burn fuels that are of biogenic origin (wood, landfill gas, organic solid waste, biofuels, etc.) to generate power. Common sources of biogenic emissions are the combustion of landfill gas from landfills or biogas from wastewater treatment plants, as well as the incineration of organic municipal solid waste at incinerators.

Carbon dioxide emissions from the combustion of biogenic fuels are not included in Scope 1 based on established international principles. Methane and nitrous oxide emissions from biogenic fuels are considered Scope 1 stationary combustion emissions and are included in the stationary combustion sections for the appropriate facilities. These principles indicate that biogenic fuels (e.g., wood, biodiesel), if left to decompose in the natural environment, would release CO<sub>2</sub> into the atmosphere, where it would then enter back into the natural carbon cycle. Therefore, when wood or another biogenic fuel is combusted, the resulting CO<sub>2</sub> emissions are akin to natural emissions and should therefore not be considered as human activity-generated emissions. The CH<sub>4</sub> and N<sub>2</sub>O emissions, however, would not have occurred naturally and are therefore included as Scope 1 emissions.

Information items quantified for this inventory include:

- Scope 3 CO<sub>2</sub> emissions from biodiesel consumption to power employee commute vehicles

The emissions categorized as information items in this inventory are presented below in Table 7.



**Table 7: Information Items**

INFORMATION ITEMS	
	CO <sub>2</sub> e
Employee Commute Biodiesel	0.0005
Total Information Items	0.0005

## Understanding Totals

It is important to realize that the totals and sub-totals listed in the tables and discussed in this report are intended to represent all-inclusive, complete totals for the City of San Mateo’s operations. However, these totals are only a summation of inventoried emissions using available estimation methods. Each inventoried sector may have additional emissions sources associated with them that were unaccounted for, such as Scope 3 sources that could not be estimated.

Also, local governments provide different services to their citizens, and the scale of the services (and thus the emissions) is highly dependent upon the size and purview of the local government. For these reasons, comparisons between local government totals should not be made without keen analysis of the basis for figures and the services provided.

It is important to understand that in the case where a local government operates a municipal utility that generates electricity for government facilities, the associated emissions should be considered Scope 1 emissions within the Power Generation Facilities sector, and not Scope 2 emissions within each of the other facilities sectors, when calculating a total. This is advised by the LGO Protocol and done to avoid reporting the same emissions twice, also known as double counting.



# Inventory Results

## Emissions Total

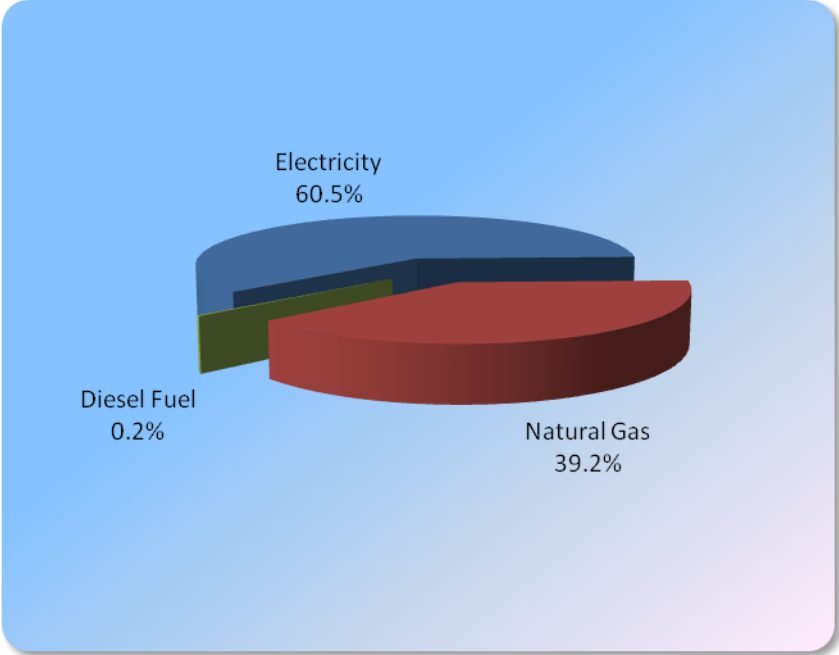
In 2010, the City of San Mateo's greenhouse gas emissions from government operations totaled 8,934 metric tons of CO<sub>2</sub>e. This number represents a roll-up of emissions. While the roll-up is a valuable figure, information on the breakdown of emissions from local government operations by scopes, sources, and sectors allows the comparative analysis and insight needed for effective decision-making on target setting, developing GHG reduction measures, or monitoring. The LGO Protocol and ICLEI identify reporting by scopes, sources, and sectors as the strongly preferred form of reporting a greenhouse gas inventory. For more details on the breakdown of the City of San Mateo's emissions by scopes, sources, and sectors, refer to subsequent sections within Inventory Results in this report.

## Buildings and Other Facilities

The buildings and facilities sector represents the City of San Mateo's third largest GHG emitting sector of the entire municipal inventory at 20%. This can be seen by revisiting Figure 1 and Table 1 in the Executive Summary section. Facility operations contribute to greenhouse gas emissions in two major ways. First, facilities consume vast amounts of electricity. Second, facilities consume large quantities of fuels such as natural gas. Electricity was the leading contributor of GHGs in this sector, accounting for 1,056 metric tons of CO<sub>2</sub>e, as denoted in Table 9 below. Natural Gas was also a major contributor, representing 684 metric tons of CO<sub>2</sub>e for buildings and facilities. This energy data was provided by PG&E. Note the PG&E 2010 GHG coefficient for delivered electricity was 445, the lowest since PG&E started public reporting it in 2003. This number reflects a wet year in 2010, in which PG&E was able to take advantage of cleaner electricity in the form of hydropower, as well as an expanded use of cleaner fossil-fueled electricity in the form of two new state-of-the-art natural gas facilities that began service in 2010.

The City of San Mateo operates several facilities. In 2010, buildings and other facilities in the City of San Mateo produced a total of 1,744 metric tons of CO<sub>2</sub>e. For the purposes of this inventory, facilities were divided into ten primary categories (and minor facilities). All of these facilities are depicted in Figure 3, displaying their overall contribution to GHGs for this sector. In 2010, Recreation and Swim Centers consumed the most energy and thus emitted the most CO<sub>2</sub>e in this sector. They represented 22% of emissions of all facilities, compiling 386 metric tons of CO<sub>2</sub>e in 2010. In fact, the top five energy consuming facilities accounted for 75% of all GHGs in this sector, as summarized in Table 10. Note, diesel fuel used in stationary generators also contributed to CO<sub>2</sub>e emissions for buildings and facilities; however this represented less than 1% of total emissions for this sector.

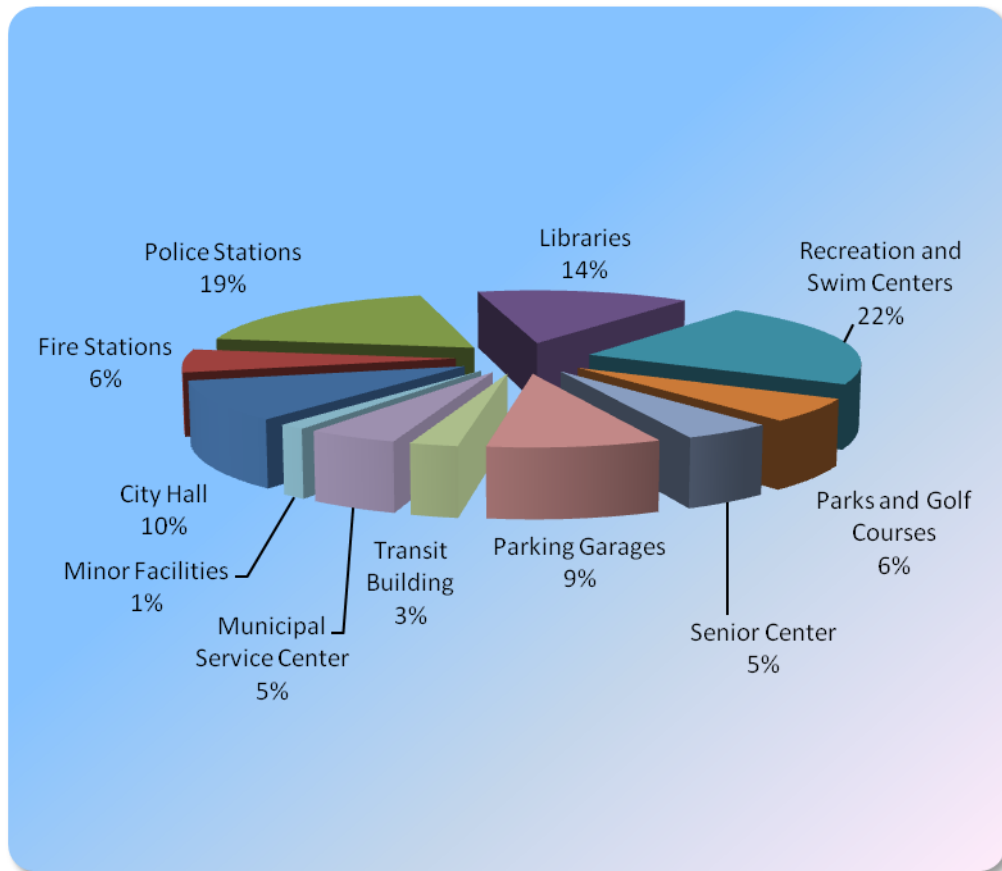
**Figure 3: Buildings and Other Facilities Emissions by Department**



**Table 8: Buildings and Other Facilities Emissions by Department**

Source	metric tons CO2e	Cost (\$)
Electricity	1,055.55	\$829,256
Natural Gas	684.06	\$119,064
Diesel Fuel	4.06	\$1,248
<b>Totals</b>	<b>1,743.67</b>	<b>\$ 949,568</b>

**Figure 4: Buildings and Other Facilities Emissions by Source**



**Table 9: Buildings and Other Facilities Emissions by Source**

Facility	metric tons CO <sub>2</sub> e	Cost (\$)
City Hall	180.42	\$94,106
Fire Stations	103.83	\$46,514
Police Stations	325.74	\$165,081
Libraries	250.99	\$168,181
Recreation and Swim Centers	386.01	\$151,134
Parks and Golf Courses	104.83	\$81,095
Senior Center	82.55	\$40,335
Parking Garages	158.04	\$108,600
Transit Building	43.92	\$34,050
Municipal Service Center	83.21	\$38,394
Minor Facilities	24.14	\$22,078
<b>Totals</b>	<b>1,743.67</b>	<b>\$949,568</b>



**Table 10: Top 5 Largest Contributors to Emissions from Buildings Sector**

Facility	% of Total Buildings/Facilities Emissions from Electricity	% of Total Buildings/Facilities Emissions from Natural Gas	% of Total Buildings/Facilities Emissions from Other Sources	CO <sub>2</sub> e Emissions from Electricity	CO <sub>2</sub> e Emissions from Natural Gas	CO <sub>2</sub> e Emissions from Other Sources	Total CO <sub>2</sub> e Emissions
Rec/Swim Centers	12%	38%	0%	127.48	258.52	0.00	386.01
Police Stations	18%	19%	8%	195.01	130.42	0.31	325.74
Libraries	19%	7%	11%	200.35	50.17	0.46	250.99
City Hall	10%	11%	8%	103.88	76.23	0.32	180.42
Parking Garages	15%	0%	0%	158.04	0.00	0.00	158.04
<b>Totals</b>	<b>74%</b>	<b>75%</b>	<b>27%</b>	<b>784.76</b>	<b>515.34</b>	<b>1.09</b>	

**Table 11: LGO Protocol Report - Buildings Sector Emissions by Scope and Emission Type**

Scope	Emission Type	Greenhouse Gas Emissions (metric tons)			
		CO <sub>2</sub> e	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
<b>SCOPE 1</b>	Stationary Combustion	688.121	686.346	0.065	0.001
	<b>Total Direct Emissions</b>	<b>688.121</b>	<b>686.346</b>	<b>0.065</b>	<b>0.001</b>
	<b>SCOPE 2</b>	CO <sub>2</sub> e	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
	Purchased Electricity	1055.548	1046.774	0.071	0.024
	<b>Total Indirect Emissions</b>	<b>1055.548</b>	<b>1046.774</b>	<b>0.071</b>	<b>0.024</b>

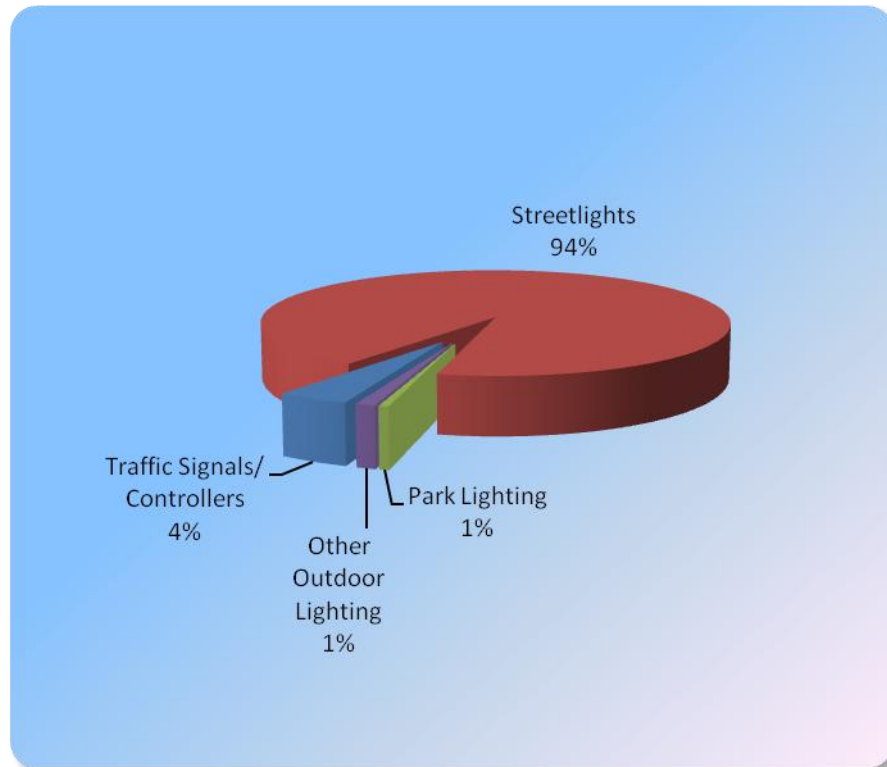
## Streetlights, Traffic Signals, and Other Public Lighting

Like most local governments, the City of San Mateo operates a range of public lighting including traffic signs/controllers, streetlights, park lighting, and other outdoor lighting. All of the emissions associated with the operation of this infrastructure are due to electricity consumption. Data relating to electricity consumption for public lighting was obtained from PG&E.

In 2010, public lighting in the City of San Mateo consumed 4,551,892 kilowatt hours of electricity, producing approximately 926 metric tons of CO<sub>2</sub>e. Table 12 illustrates 2010 emissions based on the type of public lighting, electricity consumed, and the costs associated with the activities that generated these emissions. The City of San Mateo

spent approximately \$583,426 in 2010 on the electricity used to power public lighting. The majority of the emissions, electricity consumption, and cost can be attributed to streetlights, accounting for 94% of all public lighting and producing approximately 870 metric tons of CO<sub>2</sub>e.

**Figure 5: Public Lighting Emissions by Subsector**



**Table 12: Public Lighting Emissions by Subsector**

Subsector (Light Type)	metric tons CO <sub>2</sub> e	% of Sector Emissions	Electricity Use (kWh)	Cost (\$)
Traffic Signals/ Controllers	40.18	4%	197,387	\$35,675
Streetlights	869.83	94%	4,273,522	\$533,414
Park Lighting	5.58	1%	27,410	\$4,837
Other Outdoor Lighting	10.90	1%	53,573	\$9,500
<b>Totals</b>	<b>926.49</b>	<b>100%</b>	<b>4,551,892</b>	<b>\$583,426</b>



**Table 13: LGO Protocol Report – Public Lighting Emissions by Scope and Emission Type**

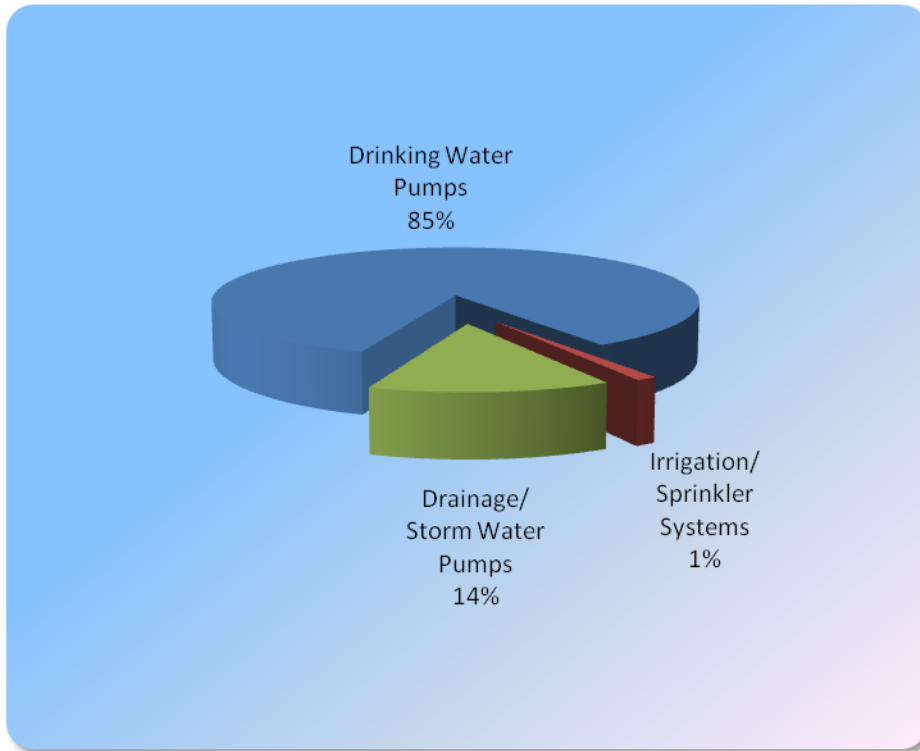
Scope	Emission Type	Greenhouse Gas Emissions (metric tons)			
		CO <sub>2</sub> e	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
<b>SCOPE 2</b>					
	Purchased Electricity	926.494	918.793	0.062	0.021
	<b>Total Indirect Emissions</b>	926.494	918.793	0.062	0.021

## Water Delivery Facilities

This sector includes emissions from equipment used for the distribution or transport of water, including drinking water, sprinkler systems and irrigation. The City of San Mateo operates a range of water transport equipment, including water delivery pumps, sprinkler/irrigation control, and drainage and storm water pumps. Electricity consumption is the primary source of greenhouse gas emissions from the operation of the City of San Mateo’s water transport infrastructure. Electricity and natural gas data for water delivery facilities was provided by PG&E.

In 2010, the City of San Mateo’s Water Delivery Services emitted approximately 376 metric tons of CO<sub>2</sub>e. This is the second lowest GHG emitting sector for the City of San Mateo’s 2010 inventory, representing 4% of total emissions. Water delivery pumps were by far the leading contributor to GHG emissions in this sector, emitting nearly 320 metric tons of CO<sub>2</sub>e, which is 85% of the water delivery services. This is primarily in the form of electricity use; however, natural gas was also used in water delivery pumps.

**Figure 6: Water Delivery Facilities Emissions by Subsector**



**Table 14: Water Delivery Facilities Emissions by Subsector**

Subsector (Equipment Type)	metric tons CO2e	% of Sector Emissions	Electricity Use (kWh)	Electricity Cost (\$)	Natural Gas Use (Therms)	Natural Gas Cost (\$)
Drinking Water Pumps	319.99	85%	1,530,704	\$224,491	1,585	\$1,644
Irrigation/ Sprinkler Systems	4.56	1%	22,383	\$5,256	0	\$0
Drainage/ Storm Water Pumps	51.00	14%	250,569	\$43,548	0	\$0
<b>Totals</b>	<b>375.54</b>	<b>100%</b>	<b>1,803,656</b>	<b>\$273,295</b>	<b>1,585</b>	<b>\$1,644</b>

**Table 15: LGO Protocol Report - Water Delivery Facilities Emissions by Scope and Emission Type**

Scope	Emission Type	Greenhouse Gas Emissions (metric tons)			
		CO <sub>2</sub> e	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
<b>SCOPE 1</b>					
	Stationary Combustion	8.425	8.404	0.001	0.000
	<b>Total Direct Emissions</b>	<b>8.425</b>	<b>8.404</b>	<b>0.001</b>	<b>0.000</b>
<b>SCOPE 2</b>					
	Purchased Electricity	367.117	364.065	0.025	0.008
	<b>Total Indirect Emissions</b>	<b>367.117</b>	<b>364.065</b>	<b>0.025</b>	<b>0.008</b>

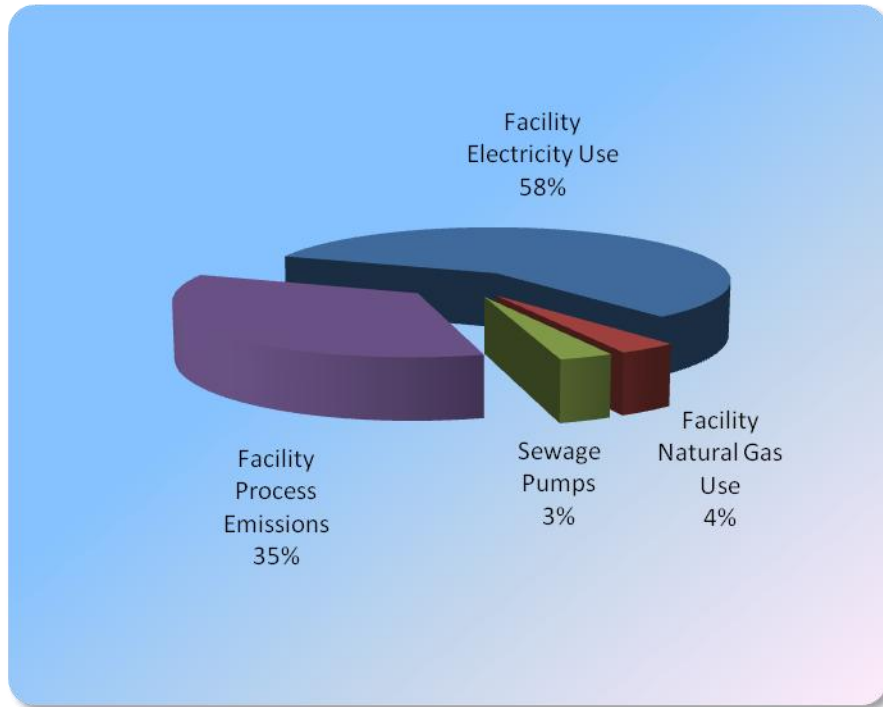
## Wastewater Treatment Facilities

Wastewater coming from homes and businesses is rich in organic matter and has a high concentration of carbon and nitrogen (along with other organic elements). As wastewater is collected, treated, and discharged, chemical processes in aerobic and anaerobic conditions lead to the creation and emission of two greenhouse gases: methane and nitrous oxide. Local governments that operate wastewater treatment facilities, including treatment plants, septic systems, collection lagoons, and other facilities, must therefore account for the emission of these gases.

The City of San Mateo's wastewater treatment facility emitted 2,722 metric tons of CO<sub>2</sub>e in 2010, the highest emitting sector of this inventory. This is primarily due to the facility's electricity use (58%) and process emissions of nitrous oxide (35%) produced by the central treatment plant. The nitrous oxide process emissions are based on the amount of nitrogen that is discharged by the central treatment facility. It is also calculated based on the population served, 92,482, which reflects the total amount of residents in the City of San Mateo when this data was gathered. Data relating to electricity and natural gas consumption was obtained from PG&E for the year 2010. Data relating to the wastewater treatment plant's process emissions were gathered in the year 2008 for the year 2005. This was used for this inventory report as it reflects the most recent data available. Note the City of San Mateo does have an anaerobic digester, which can produce a high percentage of methane in the digester gas; however, in 2005 the anaerobic digester was used to treat a by-product of the Low Pressure Oxidization solids handling system only. Therefore, there was no methane gas to be collected.

Carbon dioxide emissions from flared methane are not counted towards total emissions as they are considered to be equivalent to the gases produced from natural decomposition processes. Any biogenic CO<sub>2</sub> from flared methane in the City of San Mateo is therefore not considered for the purposes of this report.

**Figure 7: Wastewater Treatment Facilities Emissions by Subsector**



**Table 16: Wastewater Treatment Facilities Emissions by Subsector**

Subsector	metric tons CO <sub>2</sub> e
Facility Electricity Use	1592.51
Facility Natural Gas Use	96.13
Sewage Pumps	87.02
Facility Process Emissions	946.80
<b>Totals</b>	<b>2722.46</b>

**Table 17: LGO Protocol Report - Wastewater Treatment Facilities Emissions by Scope and Emission Type**

Scope	Emission Type	Greenhouse Gas Emissions (metric tons)			
		CO <sub>2</sub> e	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
<b>SCOPE 1</b>					
	Stationary Combustion	96.133	95.887	0.009	0.000
	Process Emissions	946.802	0.000	0.000	3.054
	<b>Total Direct Emissions</b>	<b>1042.935</b>	<b>95.887</b>	<b>0.009</b>	<b>3.054</b>
<b>SCOPE 2</b>					
	Purchased Electricity	1679.525	1665.564	0.112	0.037
	<b>Total Indirect Emissions</b>	<b>1679.525</b>	<b>1665.564</b>	<b>0.112</b>	<b>0.037</b>
<b>INDICATORS</b>					
	Average Nitrogen Discharge	962		kg N/day	
	Population Served	92,482			

## Vehicle Fleet and Mobile Equipment

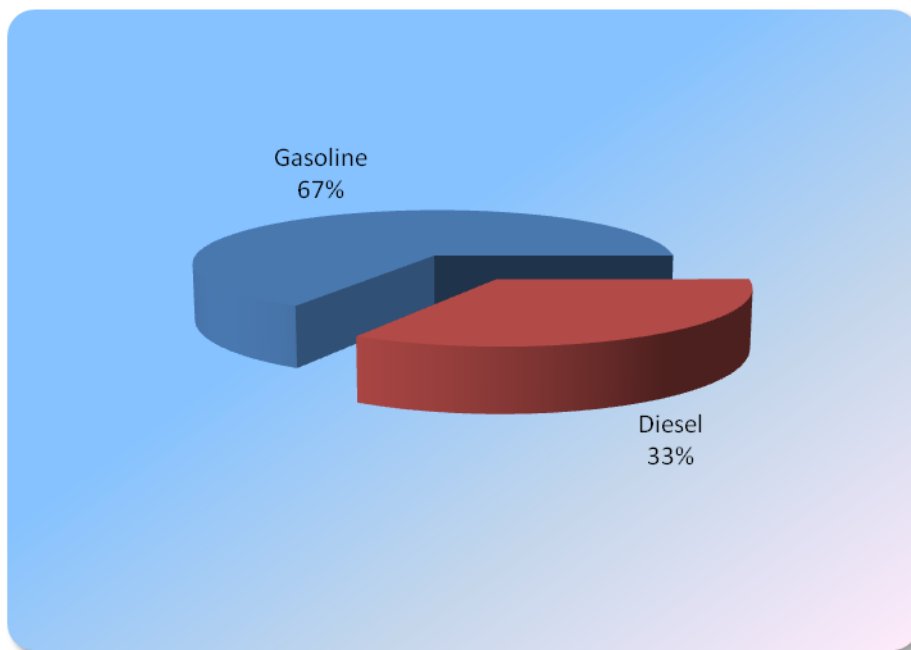
The vehicles and mobile equipment used in the City of San Mateo’s daily operations, including maintenance trucks used for parks and recreation to police cruisers and fire trucks, burn gasoline, diesel, and other fuels, which results in greenhouse gas emissions. The combustion of these fuels not only emits carbon dioxide directly, but also a small amount of more potent GHGs such as methane and nitrous oxide. See Table 20 for the breakdown of these different GHG emissions. Vehicle fleet data was provided by Serena Mau, Assistant to Facilities Manager, and aggregated by Nancy Clifton, GHG intern for the City of San Mateo.

In 2010, the City of San Mateo operated a vehicle fleet with 232 vehicles and 34 pieces of mobile equipment. Many different types of vehicles were accounted for, including passenger cars for administrative purposes, light and heavy trucks used for community development, community services, and public works, emergency vehicles from patrol cars and police motorcycles to fire trucks, and a variety of equipment for construction and maintenance. The City of San Mateo’s vehicle fleet is the fourth highest the GHG emitting sector of their municipal inventory, representing 11% of total emissions. In 2010, The City of San Mateo’s Police Department was the primary contributor to GHGs in this sector, accounting for 36% of emissions at approximately 358 metric tons of CO<sub>2</sub>e. The vehicle fleet in sum emitted 984 metric tons of CO<sub>2</sub>e in 2010, with two-thirds of those emissions coming from gasoline consumption. For additional information, refer to the figures and tables below.

Note that vehicles with air conditioning or refrigeration equipment use refrigerants that can leak from the vehicle. Refrigerants are very potent greenhouse gases and have Global Warming Potential (GWP) of up to many thousand

times that of CO<sub>2</sub>. For example, HFC-134a, a very common refrigerant in mobile air-conditioning units, has a GWP of 1300, or 1300 times that of CO<sub>2</sub>. Therefore, even small amounts of leaked refrigerants can have a significant effect on greenhouse gas emissions. Unfortunately, refrigerants from these mobile sources were not available for the City of San Mateo's 2010 municipal inventory. However, it is strongly encouraged that this data is tracked and quantified for future inventories.

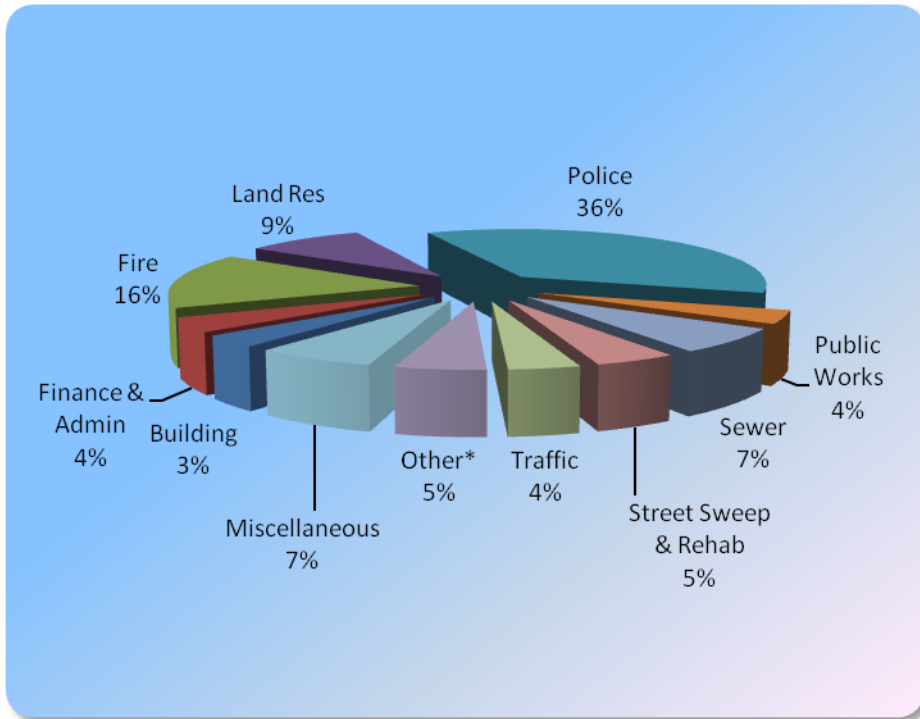
**Figure 8: Vehicle Fleet Emissions by Source**



**Table 18: Vehicle Fleet Emissions by Source**

Source	metric tons CO <sub>2</sub> e	Consumption Quantity	Consumption Units
Gasoline	655.32	1,167,008	US gallons
Diesel	328.53	244,190	US gallons
<b>Totals</b>	<b>983.85</b>	<b>1,411,198</b>	

**Figure 9: Vehicle Fleet Emissions by Department**



**Table 19: Vehicle Fleet Emissions by Department**

Department	metric tons CO <sub>2</sub> e
Building	34.17
Finance & Admin	41.06
Fire	154.68
Land Res	87.15
Police	357.65
Public Works	37.46
Sewer	69.88
Street Sweep & Rehab	45.19
Traffic	39.55
Other*	50.14
Miscellaneous	66.93
<b>Totals</b>	<b>983.85</b>

\*Other includes Code Enforcement, Parking, Parks & Rec, Pool, Source Control, and WQCP departments.



**Table 20: LGO Protocol Report - Vehicle Fleet Emissions by Scope and Emission Type**

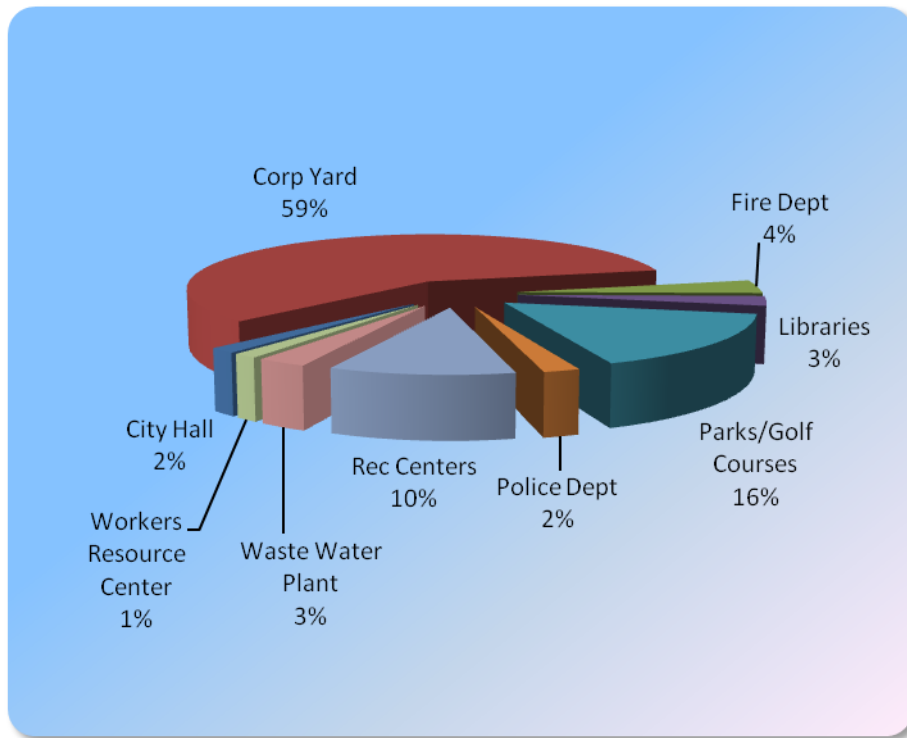
Scope	Emission Type	Greenhouse Gas Emissions (metric tons)			
		CO <sub>2</sub> e	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
<b>SCOPE 1</b>	Mobile Combustion	983.854	977.187	0.022	0.020
	<b>Total Direct Emissions</b>	<b>983.854</b>	<b>977.187</b>	<b>0.022</b>	<b>0.020</b>
<b>INDICATORS</b>	Number of Vehicles	232			
	Vehicle Miles Traveled	1,470,151			
	Number of Pieces of Equipment	34			
	Equipment Fuel Usage (gallons)	3,281			

### Government-Generated Solid Waste

Many local government operations generate solid waste, much of which is eventually sent to a landfill. Typical sources of waste in local government operations include paper and food waste from offices and facilities, construction waste from public works, and plant debris from parks departments. Organic materials in government-generated solid waste (including paper, food scraps, plant debris, textiles, wood waste, etc.) generate methane as they decay in the anaerobic environment of a landfill. Emissions from the waste sector are an estimate of methane generation that will result from the anaerobic decomposition of all organic waste sent to landfill in the base year. It is important to note that although these emissions are attributed to the inventory year in which the waste is generated, the emissions themselves will occur over the 100+ year timeframe that the waste will decompose.

In 2010, 665 tons of government-generated solid waste was estimated to be landfilled, accounting for approximately 169 metric tons of CO<sub>2</sub>e, in the form of methane from decomposing matter. This is the lowest sector of emissions for the City of San Mateo’s 2010 inventory. Of the nine waste pick-up sites, the Corporation Yard contributed the greatest amount of waste in this sector, representing 59% of all emissions associated with municipal waste. This waste data was provided by Misty McKinney, Waste Zero Specialist at Recology, the hauler for the City of San Mateo’s municipal waste.

**Figure 10: Government Waste Emissions by Subsector**



**Table 21: Government Waste Emissions by Subsector**

Department	metric tons CO <sub>2</sub> e
City Hall	2.71
Corp Yard	99.19
Fire Dept	6.39
Libraries	4.69
Parks/Golf Courses	27.19
Police Dept	3.53
Recreation Centers	17.85
Waste Water Plant	4.82
Workers Resource Center	2.36
<b>Totals</b>	<b>168.73</b>

**Table 22: LGO Protocol Report - Government Waste Emissions by Scope and Emission Type**

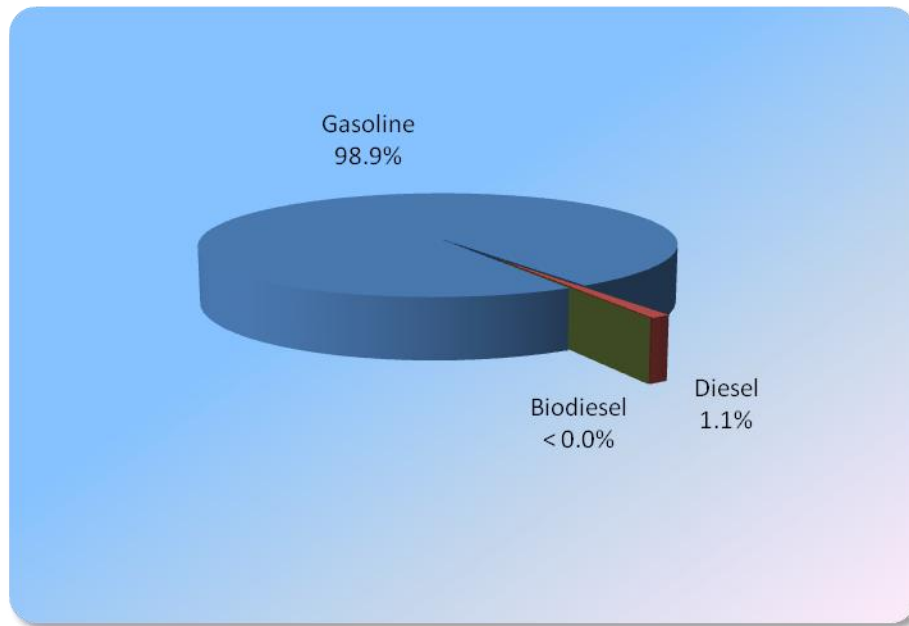
Scope	Emission Type	Greenhouse Gas Emissions (metric tons)	
		CO <sub>2</sub> e	CH <sub>4</sub>
<b>SCOPE 3</b>	Waste All Facilities	168.727	8.035
<b>INDICATORS</b>	Tons of solid waste	665.3	

## Employee Commute

Emissions in the Employee Commute sector are due to combustion of fuels in vehicles used by government employees for commuting to work at the City of San Mateo. An employee commute survey was distributed and used to collect the data needed to calculate emissions and also capture other information that will help the City of San Mateo set effective policy addressing emissions reduction for this sector. The survey was completed by 292 employees (including merit and hourly) and was extrapolated to account for the 910 employees that worked for the City of San Mateo in 2010. The City of San Mateo employee commutes accounted for approximately 2,013 metric tons of CO<sub>2</sub>e. This represents the second highest CO<sub>2</sub>e emitting sector for the City of San Mateo’s 2010 municipal inventory. The survey data was conducted by the City of San Mateo in 2006, the most recent employee commute survey, and was aggregated for the purposes of the 2010 inventory by Nancy Clifton, intern for the City of San Mateo.

In addition to the employee commute data that was used to calculate the GHG emissions, supplementary employee information was quantified to gain a greater insight into the background of this sector. For example, the majority of the City of San Mateo employees drive to work alone, representing 87% of the City of San Mateo’s workforce. Also, many San Mateo employees live within 5 miles of work, representing 40% of the workforce, by far the leading category of employee distance to work. This data and more is captured in the figures and tables below.

**Figure 11: Employee Commute Emissions by Fuel Type**



**Table 23: Employee Commute Emissions by Fuel Type**

Fuel	metric tons CO <sub>2</sub> e	Consumption Quantity	Consumption Units
Gasoline	1,990.27	221,288	gallons
Diesel	23.02	2,253	gallons
Biodiesel	0.00	82	gallons
<b>Totals</b>	<b>2,013.29</b>	<b>223,623</b>	

**Table 24: LGO Protocol Report - Employee Commute Emissions by Scope and Emission Type**

Scope	Emission Type	Greenhouse Gas Emissions (metric tons)			
		CO <sub>2</sub> e	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
<b>SCOPE 3</b>	Mobile Combustion	2,013.287	1,965.912	0.136	0.144
<b>INDICATORS</b>	Vehicle Miles Traveled*	4,915,435			
	Number of Employees	910			

\*estimated for all employees

292 employees completed the commute survey for a response rate of 32.1%

**Table 25: Employee Commute - Travel Mode Data**

Mode of Travel	Percentage
Drive Alone	87.2%
Carpool	5.2%
Motorcycle	0.9%
Public Transit	0.5%
Bike	1.8%
Walk	2.4%
Telecommute	1.9%

**Table 26: Employee Commute - Miles from Work Data**

Miles	Percentage
0-5	40.1%
6-10	15.4%
11-15	11.0%
15-20	8.6%
21-25	10.6%
26-30	3.8%
31-35	3.1%
36-40	1.0%
41-45	1.0%
46-50	0.3%
51-75	3.4%
76-100	0.3%
Over 100	1.4%







# Next Steps

## Setting Emissions Reduction Targets

This inventory provides an emissions baseline that can be used to provide insight as to what sectors the City of San Mateo should focus on to reduce emissions for their municipal operations. The greenhouse gas emissions reduction target is a goal to reduce emissions to a certain percentage below base year levels by a chosen planning horizon year. An example target might be a 30 percent reduction in emissions below 2005 levels by 2020. A target provides an objective toward which to strive and against which to measure progress. It allows a local government to quantify its commitment to fighting global warming—demonstrating that the jurisdiction is serious about its commitment and systematic in its approach.

In selecting a target, it is important to strike a balance between scientific necessity, ambition, and what is realistically achievable. The City of San Mateo should give itself enough time to implement chosen emissions reduction measures— noting that the farther out the target year is, the more the City of San Mateo should pledge to reduce. Regardless of the chosen long-term emissions reduction target (e.g., 15-year, 40-year), the City of San Mateo should establish linear interim targets for every two- to three-year period. Near-term targets facilitate additional support and accountability, and linear goals help to ensure continued momentum around local climate protection efforts. To monitor the effectiveness of its programs, the City of San Mateo should plan to re-inventory its emissions on a regular basis; many jurisdictions are electing to perform annual inventories. Industry standards recommend conducting an emissions inventory every three to five years.

## The Long-Term Goal

Near-term climate work should be guided by the long-term goal of reducing its emissions by 80 percent to 95 percent from the 2005 baseline level by the year 2050. By referencing a long-term goal that is in accordance with current scientific understanding, the City of San Mateo can demonstrate that it intends to do its part towards addressing greenhouse gas emissions from its internal operations.

It is important to keep in mind that it will be next to impossible for local governments to reduce emissions by 80 to 95 percent without the assistance of state and federal policy changes that create new incentives and new sources of funding for emissions reduction projects and programs. However, in the next 15 years, there is much that local governments can do to reduce emissions independently. It is also important that the City of San Mateo works to reduce its emissions sooner, rather than later: the sooner a stable level of greenhouse gases in the atmosphere is achieved, the less likely it is that some of the most dire climate change scenarios will be realized. Additionally, cost saving projects can be undertaken now – why wait to increase the quality of local government service and operations, while reducing taxpayer costs?



## **State of California Targets and Guidance**

An integral component of the State of California’s climate protection approach has been the creation of three core emissions reduction targets at the community level. While these targets are specific to the community-scale, they can be used to inform emissions targets for government operations as well. On June 1, 2005, California Governor Schwarzenegger signed Executive Order S-3-05 establishing climate change emission reductions targets for the State of California. The California targets are an example of near-, mid- and long-term targets:

- Reduce emissions to 2000 levels by 2010
- Reduce emissions to 1990 levels by 2020
- Reduce emissions to 80 percent below 1990 levels by 2050

The AB 32 Scoping Plan also provides further guidance on establishing targets for local governments; specifically the Plan suggests creating an emissions reduction goal of 15 percent below “current” levels by 2020. This target has informed many local government’s emission reduction targets for municipal operations—most local governments in California with adopted targets have targets of 15 to 25 percent reductions under 2005 levels by 2020.

## **Departmental Targets**

If possible, the City of San Mateo should consider department-specific targets for each of the departments that generate emissions within its operations. This allows the City of San Mateo staff to do a more in-depth analysis of what is achievable in each sector in the near, mid and long-term, and also provides encourages department leaders to consider their department’s impact on the climate and institute a climate-conscious culture within their operations.

## **Creating an Emissions Reduction Strategy**

This inventory identifies the major sources of emissions from the City of San Mateo’s operations and, therefore, where policymakers will need to target emissions reductions activities if they are to make significant progress toward adopted targets. For example, since the employee commutes were a major source of emissions from the City of San Mateo’s operations, it is possible that the City of San Mateo could meet near-term targets by implementing a few major actions within the employee commute sector. Medium-term targets could be met by focusing emissions reduction actions on the wastewater treatment sector, and the long term (2050) target will not be achievable without major reductions in all of these sectors.

Please note that, whenever possible, reduction strategies should include cost-saving projects that both reduce costs (such as energy bills) while reducing greenhouse gas emissions. These “low hanging fruit” are important because they frequently represent win-win situations in which there is no downside to implementation. Selecting these projects in the

order of largest to smallest benefit ensures that solid, predictable returns can be realized locally. These projects lower recurring expenditures, save taxpayer dollars, create local jobs, and benefit the community environmentally.

Given the results of the inventory, it is recommended that the City of San Mateo focus on the following tasks in order to significantly reduce emissions from its government operations:

- Switch traffic signals from incandescent bulbs to Light Emitting Diodes (LEDs)
- Change procurement policy to specify high fuel efficiency for each vehicle class in the City of San Mateo's vehicle fleet
- Offer bio-fuels in conjunction or as a replacement for fuel used by the vehicle fleet
- Conduct comprehensive analysis of Building and Facilities existing kilowatt usage and assess opportunities for sustainable reductions, for example:
  - reduction or elimination of phantom loads
  - analysis of existing electric equipment and appliances efficiencies, including lighting
  - consider higher efficiency replacements
- Consider feasibility study to apply sustainable energy technologies, for example photovoltaic and solar thermal to further reduce CO<sub>2</sub>e emissions annually
- Offer employees more opportunities for flex schedules and telecommuting to reduce employee commute emissions
- Consider options for water conservation techniques
- Increase office recycling, e.g. paper, cardboard, cans, toner cartridges

Using these strategies as a basis for a more detailed overall emissions reductions strategy, or climate action plan, the City of San Mateo should be able to reduce its impact on global warming. In the process, it may also be able to improve the quality of its services, reduce costs, stimulate local economic development, and inspire local residents and businesses to redouble their own efforts to combat climate change.

## Improving Emissions Estimates

One of the benefits of a local government operations emissions inventory is that local government staff can identify areas in their current data collection systems where data collection can be improved. For example, a local government may not directly track fuel consumption by each vehicle and instead will rely upon estimates based upon VMT or

purchased fuel to calculate emissions. This affects the accuracy of the emissions estimate and may have other implications for government operations as a whole.

During the inventory process, the City of San Mateo staff identified the following gaps in data that, if resolved, would allow the City of San Mateo to meet the recommended methods outlined in LGO Protocol in future inventories.

- Direct tracking of refrigerants recharged into HVAC and refrigeration equipment
- Direct tracking of fire suppressants recharged into fire suppression equipment
- Refrigerants recharged into vehicles in the vehicle fleet
- An updated employee commute survey
- An updated assessment of data relating to process emissions for the wastewater treatment plant.

The City of San Mateo staff should review the areas of missing data and establish data collection systems for this data as part of normal operations. In this way, when staff are ready to re-inventory for a future year, they will have the proper data to make a more accurate emissions estimate.

# Project Resources

ICLEI created various tools for the City of San Mateo to use to assist with greenhouse gas emissions inventories. These tools are designed to work in conjunction with LGO Protocol, which is the primary reference document for conducting an emissions inventory. The following tools should be saved as resources and supplemental information to this report:

- The “Master Data Workbook”, an Excel-based tool that contains most or all of the raw data (including emails), data sources, emissions, notes on inclusions and exclusions, and reporting tools
- The “Data Gathering Instructions”, an instructions guide on the types of emissions and data collection methodology for each inventory sector.
- The “Quality Control Checklist for Master Data Workbook”, a checklist which provides a list of items to review in the Master Data Workbook to ensure information was entered correctly.
- The “CACP 2009 Data Entry Instructions”, an instructions guide on how to enter data collected in the Master Data Workbook into the Clean Air and Climate Protection Software (CACP 2009), ICLEI’s greenhouse gas emissions calculator.
- The CACP 2009 “Backup” files, a group of files which contain the calculations of emissions based on inputs from the Master Data Workbook into CACP 2009. The CACP 2009 software is required to open the Backup files.
- The “Checklist for Reviewing the Government Analysis Inputs/Outputs, Details Export” a checklist which provides a list of items to review in this CACP 2009 export file to ensure information was entered correctly.
- CACP 2009 “Government Analysis Inputs/Outputs, Summary with Notes Export”, an Excel-based export file which contains a summary report of all calculated emissions, with explanatory notes included.
- CACP 2009 “Government Analysis Inputs/Outputs, Details Export”, an Excel-based export file which contains a detailed report of all calculated emissions.
- The “Completing the Inventory Report”, an instructions guide from ICLEI on how to report greenhouse gas emissions according to the LGO Protocol.
- The “Charts and Tables Data Conditioning Sheet”, an Excel-based tool created by ICLEI and completed by the author to aid in creating the charts and tables within the Master Data Workbook.
- A presentation with slides completed by the author to summarize findings from the greenhouse gas inventory