

San Joaquin County

2005 Government Operations Greenhouse Gas Emissions Inventory



Narrative Report

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Table of Contents

Executive Summary	6
San Joaquin County Profile	6
The Purpose of Conducting an Inventory	6
Inventory Results	7
Regional and Local Context	10
Climate Change Mitigation Activities in California.....	10
Pacific Gas and Electric Company Supported Inventory Project	11
Climate Change Mitigation Activities in San Joaquin County	12
Introduction	14
General Methodology	14
Local Government Operations Protocol.....	14
Greenhouse Gases and Carbon Dioxide Equivalent	14
Calculating Emissions	15
The Scopes Framework	15
Organizational Boundaries	16
Types of Emissions	17
Significance Thresholds	17
Information Items.....	18
Understanding Totals	19
Inventory Results	20
Emissions Total	20
Buildings and Other Facilities	20
Streetlights, Traffic Signals, and Other Public Lighting	22
Water Delivery Facilities	24
Wastewater Treatment Facilities	25
Airport Facilities	27
Solid Waste Facilities	28
Vehicle Fleet and Mobile Equipment	30
Employee Commute	32
Inventory Methodologies	36
Buildings and Other Facilities	36
Buildings and Other Facilities: Electricity and Natural Gas Related Emission	37
Buildings and Other Facilities: Refrigerant and Fire Suppressant Emissions	37
Buildings and Other Facilities: Backup Power Generators	38
Buildings and Other Facilities: Reporting Inconsistencies and Limitations	39
Streetlights, Traffic Signals, and Other Public Lighting	39
Public Lighting: Electricity Related Emissions	40
Water Transport Facilities	40

Water Transport Facilities: Electricity Related Emissions.....	41
Wastewater Treatment Facilities.....	41
Wastewater Treatment Facilities: Electricity and Natural Gas Related Emissions.....	42
Wastewater Treatment Facilities: Wastewater Treatment Related Emissions.....	42
Wastewater Treatment Facilities: Reporting Inconsistencies and Limitations	44
Airport Facilities.....	44
Airport Facilities: Electricity and Natural Gas Related Emissions	44
Solid Waste Facilities	45
Solid Waste Facilities: Electricity and Natural Gas Related Emissions.....	45
Solid Waste Facilities: Solid Waste Landfill Emissions.....	46
Vehicle Fleet and Mobile Equipment	48
Vehicle Fleet and Mobile Equipment: Fuel and VMT Related Emissions	48
Vehicle Fleet and Mobile Equipment: Refrigerant Related Emissions	49
Vehicle Fleet and Mobile Equipment: Reporting Inconsistencies and Limitations	50
Government-Generated Solid Waste.....	50
Government-Generated Solid Waste: Solid Waste Related Emissions.....	50
Government-Generated Solid Waste: Reporting Inconsistencies and Limitations.....	51
Employee Commute.....	51
Employee Commute: Fuel and VMT Related Emissions	51
Next Steps.....	52
ICLEI’s Five Milestone Process	52
Setting Emissions Reduction Targets.....	53
The Long-Term Goal	53
State of California Targets and Guidance.....	54
Departmental Targets.....	54
Creating an Emissions Reduction Strategy.....	54
Improving Emissions Estimates	56
Project Resources.....	57

List of Tables and Figures

Figure 1: 2005 Government Operations CO ₂ e Emissions by Sector	8
Table 1: 2005 Government Operations CO ₂ e Emissions by Sector	8
Figure 2: 2005 Government Operations CO ₂ e Emissions by Source	9
Table 2: 2005 Government Operations CO ₂ e Emissions by Source	9
Table 3: LGO Protocol Report - Overall Emissions by Scope	10
Table 4: Greenhouse Gases	15
Table 5: Basic Emissions Calculations	15
Table 6: Inventoried Emissions Sources by Scope	16
Table 7: Information Items	18
Figure 3: Buildings and Other Facilities Emissions by Department	21
Table 8: Buildings and Other Facilities Emissions by Department	21
Figure 4: Buildings and Other Facilities Emissions by Source	22
Table 9: Buildings and Other Facilities Emissions by Source	22
Table 10: LGO Protocol Report - Buildings Sector Emissions by Scope and Emission Type	22
Figure 5: Public Lighting Emissions by Subsector	23
Table 11: Public Lighting Emissions by Subsector	23
Table 12: LGO Protocol Report – Public Lighting Emissions by Scope and Emission Type	23
Figure 6: Water Delivery Facilities Emissions by Subsector	24
Table 13: Water Delivery Facilities Emissions by Subsector	24
Table 14: LGO Protocol Report - Water Delivery Facilities Emissions by Scope and Emission Type	25
Figure 7: Wastewater Treatment Facilities Emissions by Subsector	26
Table 15: Wastewater Treatment Facilities Emissions by Subsector	26
Table 16: LGO Protocol Report - Wastewater Treatment Facilities Emissions by Scope and Emission Type	26
Figure 8: Airport Facilities Emissions by Subsector	27
Table 17: Airport Facilities Emissions by Subsector	28
Table 18: LGO Protocol Report – Airport Facilities Emissions by Scope and Emission Type	28
Figure 9: Solid Waste Landfill Emissions by Facility	29
Table 19: Solid Waste Landfill Emissions by Facility	30
Table 20: LGO Protocol Report – Solid Waste Facilities Emissions by Scope and Emission Type	30
Figure 10: Vehicle Fleet Emissions by Source	31
Table 21: Vehicle Fleet Emissions by Source	31
Figure 11: Top 10 Largest Contributors to Emissions from Vehicle Fleet Sector	32
Table 22: LGO Protocol Report - Vehicle Fleet Emissions by Scope and Emission Type	32
Table 23: LGO Protocol Report - Employee Commute Emissions by Scope and Emission Type	33
Table 24: Employee Commute - Travel Mode Data	33
Table 25: Employee Commute - Miles from Work Data	33
Table 26: Employee Commute - Time to Work Data	34
Table 27: Employee Commute – Reasons for Not Carpooling/Vanpooling	34
Table 28: Employee Commute – Reasons for Not Taking Transit	34
Table 29: Employee Commute – Reasons for Not Walking/Biking	35
Figure 12: LGO Protocol Equation 10.1 - Stationary CH ₄ from Incomplete Combustion of Digester Gas (site-specific digester gas data)	43
Figure 13: LGO Protocol Equation 10.3 - Process CH ₄ from Anaerobic and Facultative Wastewater Treatment Lagoons (site-specific data)	43
Figure 14: LGO Protocol Equation 9.1 - Landfills with Comprehensive LFG Collection Systems	47
Figure 15: ICLEI’s Five Milestones for Climate Mitigation	52

Executive Summary

San Joaquin County Profile

San Joaquin County is centrally located in California's Great Central Valley. The County encompasses nearly 920,000 acres (or about 1,440 square miles), and is interlaced with a complex network of creeks, rivers and canals which define the character and landscape almost as much as the vast acreages devoted to agriculture. In 2005 the County's population of approximately 658,660 was concentrated largely in its seven cities: Stockton, Tracy, Manteca, Lodi, Escalon, Ripon and Lathrop. State Route 99 and Interstate 5, two of the State's major north-south roadways, pass through San Joaquin County, offering excellent access to the County in both directions. Interstates 205 and 580 provide direct connections to the San Francisco Bay Area to the west.

San Joaquin County is located within Climate Zone 12,¹ according to Pacific Gas & Electric. Climate Zone 12 is classified as a Mediterranean climate, by the Köppen Classification System, and is characterized by dry summers and mild winters. Climate Zone 12 recorded 2,841 heating degree days² and 1,328 cooling degree days in 2005.³

The County of San Joaquin provides a wide variety of public services, including community development, public works, environmental health and public safety. In 2005 the County's 32 departments were comprised of 6,752 employees. San Joaquin County's total budget was \$1.14 billion for fiscal year 2005-2006, of which \$311.3 million were dedicated to General Purposes.

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 San Joaquin County. The inventory measures the greenhouse gas emissions resulting specifically from San Joaquin County'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 County of San Joaquin can tailor strategies to achieve the most effective greenhouse gas emission reductions.

¹ Pacific Energy Center's Guide to: California Climate Zones, retrieved from

http://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california_climate_zones_01-16.pdf

² Heating and Cooling Degree Days are a measurement designed to reflect demand for energy needed to heat or cool a facility, and are calculated as the difference between the average daily temperature for a region and a baseline temperature (usually 65° or 80° F). HDD value is the summation of degrees of the average temperature per day below 65° F for the year. CDD is the summation of degrees of the average temperature per day above 80° F for the year.

³ NNDC Climate Data, retrieved from <http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp>

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, San Joaquin County is working to improve government services in a smart and targeted way that will benefit all of the County's residents, workforce, and visitors.

San Joaquin County 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, San Joaquin County is acting now to limit future impacts that threaten the lives and property of San Joaquin County's residents and businesses, make government operations more efficient, and improve the level of service it offers to the residents of San Joaquin County.

Inventory Results

The following figures and tables summarize the results of the LGO greenhouse gas emissions inventory for San Joaquin County. A total of 154,524 metric tons CO₂e were inventoried from government operations in 2005.

As illustrated in Figure 1 and Table 1, the sector producing the most greenhouse gas emissions in San Joaquin County was the Solid Waste Facilities sector at 67.1%, followed by the Buildings and Facilities sector at 14.2%. As shown in Figure 2 and Table 2, Methane from Landfills and combustion of Gasoline were the sources with the greatest percentage of emissions (67.0% and 15.5% respectively).

Table 3 delineates the different types of greenhouse gases (CO₂, CH₄, N₂O, etc.), which are assigned a standard metric of carbon dioxide equivalent (CO₂e), and then combined to describe the County's total emissions by Scope. In 2005, the largest source of emissions was Scope 1 Direct Emissions occurring from stationary and mobile combustion of fuels, leakage of landfill gasses and refrigerants, and emissions from wastewater treatment processes.

Figure 1: 2005 Government Operations CO₂e Emissions by Sector

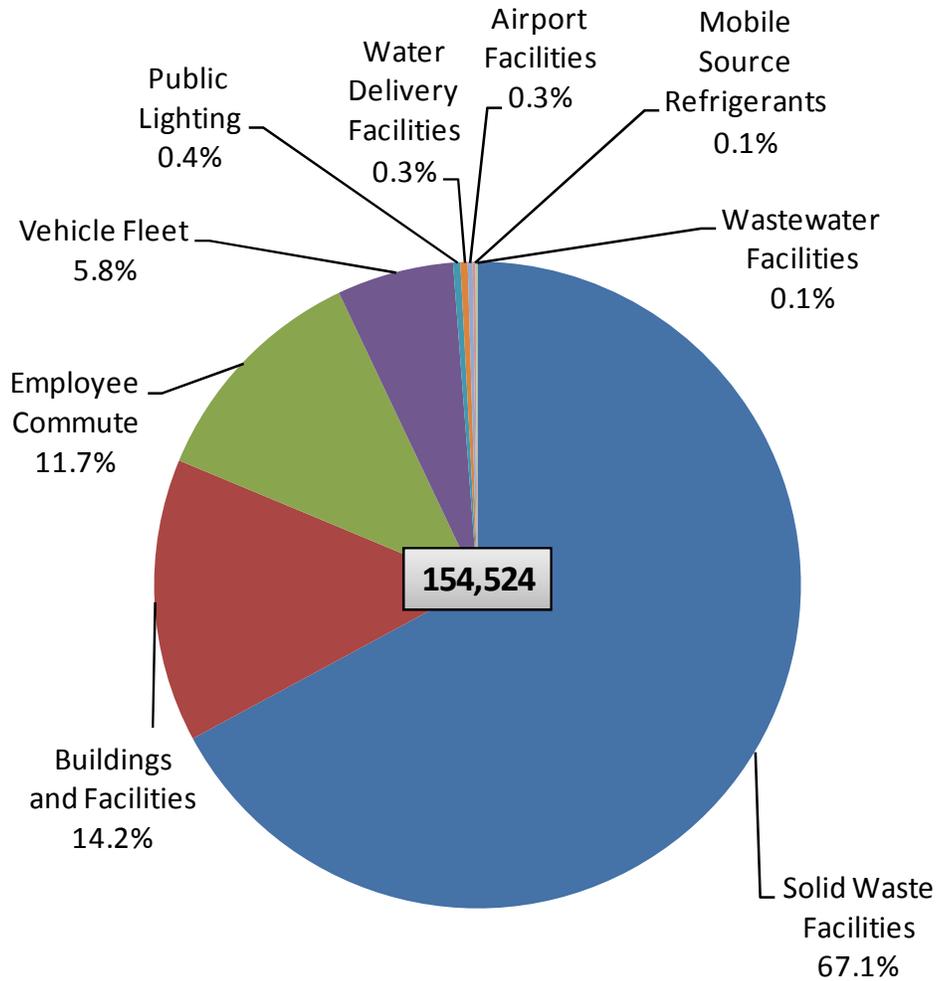


Table 1: 2005 Government Operations CO₂e Emissions by Sector

Sector	metric tons CO ₂ e	% of Sector Emissions	Cost (\$)
Solid Waste Facilities	103,722	67.1%	105,736
Buildings and Facilities	21,902	14.2%	6,334,811
Employee Commute	18,011	11.7%	-
Vehicle Fleet	9,020	5.8%	2,138,441
Public Lighting	573	0.4%	612,470
Water Delivery Facilities	537	0.3%	335,132
Airport Facilities	394	0.3%	168,769
Mobile Source Refrigerants	230	0.1%	-
Wastewater Facilities	136	0.1%	52,453
Totals	154,524	100%	\$ 9,747,812

Figure 2: 2005 Government Operations CO₂e Emissions by Source

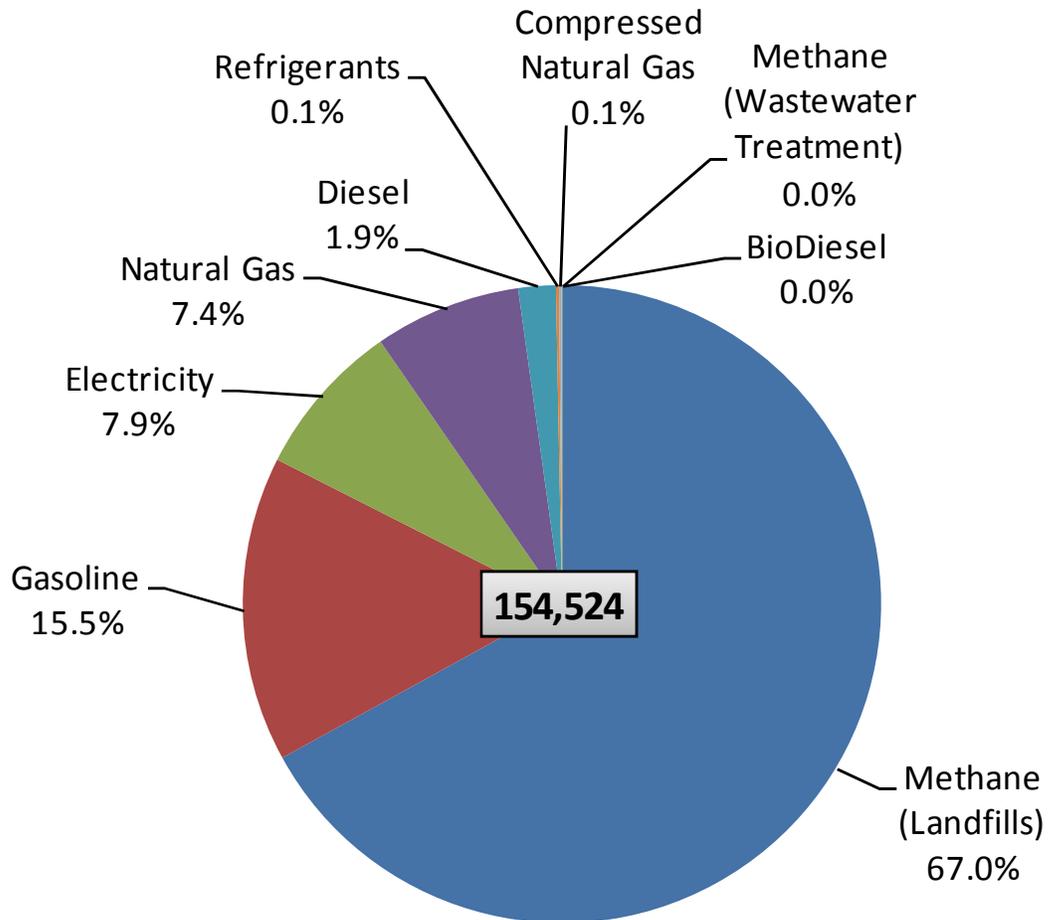


Table 2: 2005 Government Operations CO₂e Emissions by Source

Source	metric tons CO ₂ e	% of Sector Emissions	Quantity	Units	Cost (\$)
Methane (Landfills)	103,522	67.0%	4,930	Metric Tons	-
Gasoline	23,913	15.5%	2,647,331	US Gallons	1,537,211
Electricity	12,212	7.9%	54,587,003	kWh	6,839,575
Natural Gas	11,486	7.4%	2,160,776	Therms	769,796
Diesel	2,935	1.9%	287,284	US Gallons	568,487
Refrigerants	230.0	0.1%	0	kg	-
Compressed Natural Gas	183	0.1%	24,900	Gallons Gasoline Equivalent	32,743
Methane (Wastewater Treatment)	43	0.0%	2	Metric Tons	-
BioDiesel	0.0	0.0%	3,595	US Gallons	-
Totals	154,524	100%			\$ 9,747,812

Table 3: LGO Protocol Report - Overall Emissions by Scope

Total Emissions ⁴						
	CO ₂ e	CO ₂	CH ₄	N ₂ O	HFC 134A	HCFC 12
SCOPE 1	124,301	20,353	4,933	0.4	0.2	-
SCOPE 2	11,851	11,754	0.7	0.3	-	-
SCOPE 3	18,372	17,802	1.4	1.7	-	-
INFORMATION ITEMS	16,435	16,435	-	-	-	0.1

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 to 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 related greenhouse gas (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

⁴ Total emissions are reported as metric tons of each respective greenhouse gas emission type. Values less than 1 have been expanded to include one decimal point. In instances where an emission type is either not present or omitted, the category is marked “-” to signify zero emissions. Omissions and other limitations are outlined in the Significance Thresholds section, and discussed further in the Inventory Methodologies section.

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 jurisdictions.
- SB 375 (2008) revises the process of regional transportation planning by metropolitan planning organizations (MPOs), which are governed by local elected officials. . The statute calls on ARB to establish regional transportation-related GHG 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 it provides CEQA streamlining for local development projects that are consistent with the Strategy.
- AB 341 (2011) requires local governments to develop a source reduction and recycling element of an integrated waste management plan containing specified components, including a source reduction component, a recycling component, and a composting component. The statute aims for not less than 75% of solid waste generated to be reduced, recycled, or composted by the year 2020.

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 the Great Valley Center throughout 2012 to assist in the quantification of greenhouse gas emissions in San Joaquin County and the following other participating communities: the Counties of Stanislaus and Merced and the cities of Atwater, Dos Palos, Gustine, Lodi, Los Banos, Manteca and Tracy. This marks the second round of inventory projects in the San Joaquin Valley. Since 2010, PG&E, ICLEI and the Great Valley Center have completed municipal inventories for the following cities: Ceres, Hughson, Livingston, Modesto, Newman, Oakdale, Patterson, Riverbank, Turlock and Waterford. By the end of 2012, nearly all jurisdictions in the three-county region of the northern San Joaquin Valley will have completed municipal greenhouse gas emissions inventories.

ICLEI is a nonprofit association of local governments that provides information, delivers training resources, organizes conferences, facilitates networking and city-to-city exchanges, carries out research and pilot projects, and offers technical services and consultancy related to climate planning. Throughout 2012, ICLEI provided training and technical assistance to participating regional organizations, interns, and local government staff and facilitated the completion of this report.

Climate Change Mitigation Activities in San Joaquin County

San Joaquin County has already begun the process of emissions mitigation within County operations, which is also intended to result in higher energy efficiency and, therefore, savings.

San Joaquin County's "Green" Purchasing Policy, adopted in February 2008, sets forth practices that promote environmental sustainability. Program objectives include the reduction of waste by increasing product efficiency and effectiveness; procuring products and services that minimize environmental impacts at work and within the community; and purchasing products (where practicable) which include recycled content, conserve resources, and reduce greenhouse gas emissions/carbon footprint. The County adopted this policy in order to serve as a leader, model, and active participant with local businesses, residents, and other civic and public agencies interested in the same cause.

The San Joaquin County Environmentally Preferable "Green" Purchasing Committee (County Green Committee) was established in April of 2009. All Departments were invited to participate, and invitations were also sent to some outside agencies. The Committee assists County personnel with resources, information and technical assistance. The Green Committee advocates for sound practices, reviews policies, and lends support in sustainable endeavors.

The County Green Committee compiles an annual report of accomplishments. Among these are the following highlights.

Notable Accomplishments:

- The County has been purchasing alternative fuel vehicles since the 1990's. As of 2009, the County had a fleet of 200 alternative fueled and hybrid vehicles: 143 hybrid gas/electric, 49 CNG, and 8 Bi-fuel CNG/gas.
- Since 2006 the County has utilized sheep herds to assist with vegetation management at landfills. These sites are difficult and fairly expensive to maintain using manpower and traditional fueled equipment. The sheep are a more efficient way to control the weeds than crews of human workers, present less risk of injury to the human staff, reduce the need for fueled equipment, and eliminate the need for chemical maintenance. The County's use of sheep has generated interest from other jurisdictions and the community.
- County agencies recycle paper, cardboard, newspaper, aluminum cans, and plastic and glass bottles from all offices. Materials are collected by staff and outside entities, and sold (where possible) as feedstock for the manufacture of various recycled products. In 2009 the County recycled approximately 1.2 million pounds of paper material.
- The Robert J. Cabral Building at the San Joaquin County Agricultural Center utilizes solar panels to provide some of their energy needs, as does the County Administration Building. These projects provided energy savings of \$33,644 in 2010.

- By 2010, 30.36% of total office supply spending was for recycled products
- By 2010, nearly 99.9% of office supply orders were being placed online, reducing paper waste, time, errors, and carbon emissions
- The County has expanded utilization of electronic document conversion and data storage, reducing paper usage, physical storage space required, cabinets needed, and improving access to documents
- The County estimates an annual savings of \$120,000 by using electronic diagnostic images stored electronically as opposed to purchasing, storing and disposing of radiologic film – and existing film is being recycled.

Introduction

General Methodology

Local Government Operations Protocol

A national standard⁵ 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. Through this Protocol, the partners have sought to enable local governments to measure and report GHG emissions associated with government operations in a harmonized fashion. 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, CO₂e. Since equal quantities of each greenhouse gas have more or less influence on the greenhouse effect, converting all emissions to a standard metric, CO₂e, allows apples-to-apples comparisons amongst quantities of all six emissions types. Greenhouse gas emissions are reported in this inventory as metric tons of CO₂e (MTCO₂e).

Table 4 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.

⁵ The LGO Protocol was officially adopted by The Climate Registry in 2009. The Climate Registry is a collaboration among North American states, provinces, territories and Native Sovereign Nations.

Table 4: Greenhouse Gases

Gas	Chemical Formula	Activity	Global Warming Potential (CO ₂ e)
Carbon Dioxide	CO ₂	Combustion	1
Methane	CH ₄	Combustion, Anaerobic Decomposition of Organic Waste (Landfills, Wastewater), Fuel Handling	21
Nitrous Oxide	N ₂ 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 ₆	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 5 provides examples of common emissions calculations.

Table 5: Basic Emissions Calculations

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

The Scopes Framework

This inventory reports greenhouse gas emissions by sector and additionally by “scope”, in line with the LGO Protocol and World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD) Greenhouse Gas Emissions 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 CO₂ emissions from biogenic sources. This includes stationary combustion to produce electricity,

steam, and heat, or to 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 organizational 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 San Joaquin County.

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).

Significance Thresholds

Within any local government's own operations there will be emission sources that fall within Scope 1 and Scope 2 that are minimal in magnitude and difficult to accurately measure. Within the context of local government operations, emissions from leaked refrigerants and backup generators may be common sources of these types of emissions. For these less significant emissions sources, LGO Protocol specifies that up to 5 percent of total emissions can be reported using methodologies that deviate from the recommended methodologies in LGO Protocol. In the context of registering emissions with an independent registry (such as the California Climate Action Registry), emissions that fall under the significance threshold are called *de minimis*.

In this report, some emissions were calculated using methods that deviate from the methods recommended in the LGO Protocol. However, the LGO Protocol identifies several alternative methods that still meet emission calculation standards. For the following areas, alternative methods were used to estimate emissions for the inventory year:

- Scope 1 fugitive emissions from the leakage of refrigerants from vehicles and mobile equipment
- Scope 2 CO₂, CH₄ and N₂O emissions from electricity purchased from Lodi Electric Utility

In addition, emissions data from the following sources could not be obtained for this report and therefore emissions from these sources are not included in this inventory:

- Scope 1 fugitive emissions from the leakage of refrigerants from stationary heating, air conditioning, and refrigeration units
- Scope 3 CH₄ waste-related emissions from the decomposition of organic solid waste from government-generated solid waste
- Scope 3 CO₂, CH₄ and N₂O emissions from combustion of fuels by employees for business-related travel

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 San Joaquin County’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 CO₂ 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 CO₂ emissions are akin to natural emissions and should not be considered as human activity-generated emissions. The CH₄ and N₂O emissions, however, would not have occurred naturally and are included as Scope 1 emissions. The emissions categorized as information items in this inventory are presented below in Table 7.

Table 7: Information Items

INFORMATION ITEMS	
	CO ₂ e
Biogenic CO ₂ : Foothill Landfill Process Emissions	11,029
Biogenic CO ₂ : North County Landfill Process Emissions	5,242
Mobile Source Refrigerants (R-12)	131
Biogenic CO ₂ from Biofuel	35
Total Information Items	16,436

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 San Joaquin County'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 2005, San Joaquin County's greenhouse gas emissions from government operations totaled 154,777 metric tons of CO₂e. 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, and 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 San Joaquin County's emissions by scopes, sources, and sectors, refer to subsequent sections within Inventory Results in this report. Please also refer to the Inventory Methodologies section for an overview of the approaches employed to calculate these results, including information about inconsistencies and limitations.

Buildings and Other Facilities

Facility operations contribute to greenhouse gas emissions in two major ways. Facilities consume electricity and fuels⁶ such as natural gas. This consumption is associated with the majority of greenhouse gas emissions from facilities. Electricity and natural gas consumption data were obtained from PG&E and Lodi Electric Utility. In addition, fire suppression, air conditioning, and refrigeration equipment in buildings can emit Hydrofluorocarbons (HFCs) and other greenhouse gases when these systems leak refrigerants or fire suppressants.⁷ Refrigerants and fire suppressants are very potent greenhouse gases and have Global Warming Potential (GWP) of up to many thousand times that of CO₂. For example HFC-134a, a very common refrigerant, has a GWP of 1300, or 1300 times that of CO₂; therefore, even small amounts of leaked refrigerants can have a significant effect on greenhouse gas emissions.

San Joaquin County operates many facilities, ranging from general County offices to hospitals and libraries. For the purpose of reporting emissions, these facilities were grouped by department when possible. Any facilities that were unknown or previously uncategorized in 2005 were included in the facility section of the inventory and were named "Unknown/Uncategorized Offices." Data relating to electricity and natural gas consumption were obtained from PG&E.

The Buildings and Facilities sector produced the second-largest amount of emissions by sector. Overall, these facilities produced 21,902 metric tons of CO₂e (14.2% of total emissions). As illustrated in Figure 3 and Table 8, the facility group producing the most greenhouse gas emissions in San Joaquin County was Hospital facilities at 42.6%. The second

⁶ Backup generator fuel consumption could not be distinguished from fuels used by other outdoor and mobile equipment, which are included in the Vehicle Fleet sector.

⁷ Facility refrigerants could not be obtained for the inventory year (refer to *Significance Thresholds* above). Fire suppressants are maintained by a third party and are reported to have released no emissions during the inventory year.

largest contributor was Sheriff and Fire facilities at 21.8%. As illustrated in Figure 4 and Table 9, the source producing the most greenhouse gas emissions in the Buildings and Facilities sector was natural gas at 51.6%, followed by electricity at 48.4%. Table 10 reports emissions by scope and emission type, as recommended by the LGO Protocol. In the Buildings and Facilities sector, Scope 1 Direct Emissions accounted for a majority of the CO₂e emissions.

Figure 3: Buildings and Other Facilities Emissions by Department

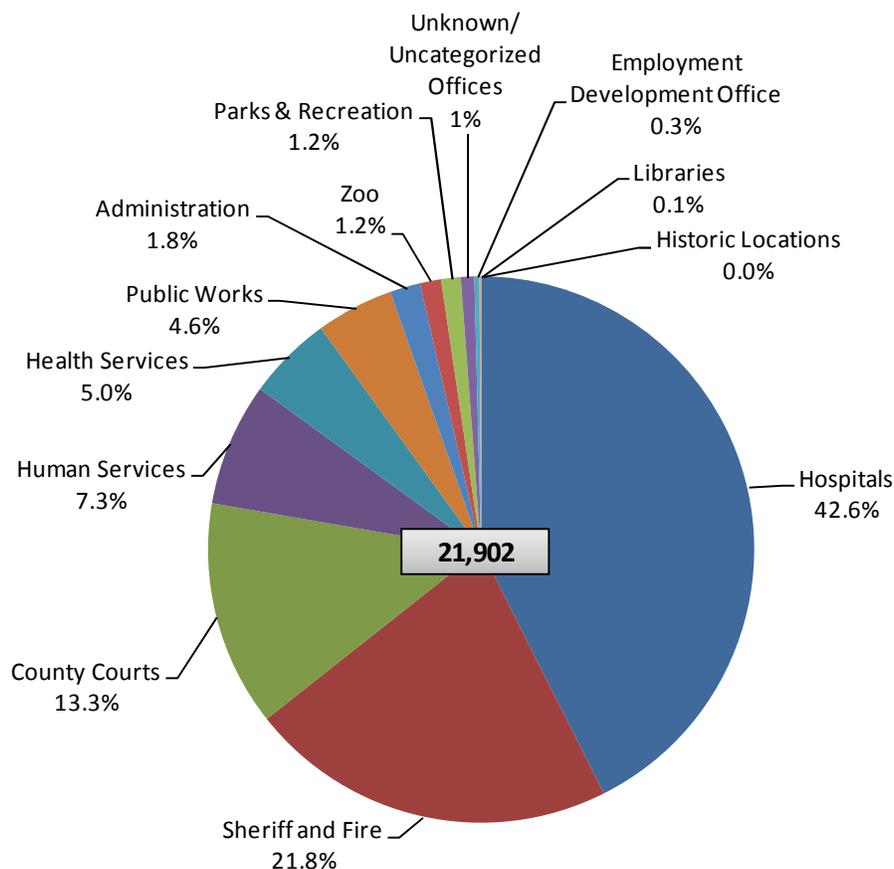


Table 8: Buildings and Other Facilities Emissions by Department

Department	metric tons CO ₂ e	% of Sector Emissions	Cost (\$)
Hospitals	9,322	42.6%	1,548,766
Sheriff and Fire	4,774	21.8%	1,201,478
County Courts	2,924	13.3%	1,243,323
Human Services	1,596	7.3%	855,015
Health Services	1,101	5.0%	509,291
Public Works	1,005	4.6%	400,324
Administration	393	1.8%	182,208
Zoo	272	1.2%	105,270
Parks & Recreation	255	1.2%	148,087
Unknown/Uncategorized Offices	174	0.8%	92,819
Employment Development Office	66	0.3%	35,768
Libraries	20	0.1%	12,048
Historic Locations	1	0.0%	414
Totals	21,902	100%	\$ 6,334,811

Figure 4: Buildings and Other Facilities Emissions by Source

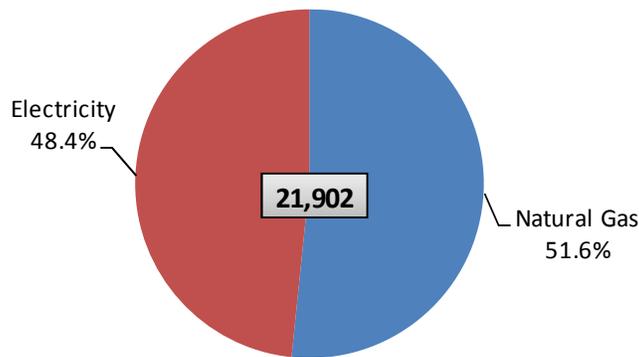


Table 9: Buildings and Other Facilities Emissions by Source

Source	metric tons CO ₂ e	% of Sector Emissions	Quantity	Quantity Units	Cost (\$)
Natural Gas	11,310	51.6%	2,127,718	Therms	735,936
Electricity	10,592	48.4%	47,347,282	kWh	5,598,875
Totals	21,902				\$ 6,334,811

Table 10: LGO Protocol Report - Buildings Sector Emissions by Scope and Emission Type

BUILDINGS & OTHER FACILITIES					
Scope	Emission Type	Greenhouse Gas Emissions (metric tons)			
		CO ₂ e	CO ₂	CH ₄	N ₂ O
SCOPE 1					
	Stationary Combustion	11,310	11,281	1.1	0.0
SCOPE 2					
	Purchased Electricity	10,592	10,505	0.6	0.2

Streetlights, Traffic Signals, and Other Public Lighting

Like most local governments, San Joaquin County operates a range of public lighting including streetlights, traffic signals/controllers, and other outdoor lighting. The majority of 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.

While many of the streetlights located within San Joaquin County are owned and operated by the County, some are owned and operated directly by PG&E. Since San Joaquin County does not have operational control over these lights, the emissions resulting from their operation are classified as Scope 3.

The Public Lighting sector produced the fifth-largest amount of emissions of all sectors overall. Overall, these facilities produced 573 metric tons of CO₂e (less than 1% of total emissions). As illustrated in Figure 5 and Table 11, the subsector producing the most greenhouse gas emissions in the Public Lighting sector was Utility-Owned Streetlights at 63.1%, followed by Traffic Signals/Controllers at 21.2%. County-Owned Streetlights produced 12.5% of sector emissions. Table 12 reports emissions by scope and emission type, as recommended by the LGO Protocol. In the Public Lighting sector, Scope 3 emissions accounted for a majority of the CO₂e emissions. This sector of the inventory does not include those park lights which could not be disaggregated from multipurpose park light and sprinkler control records.

Figure 5: Public Lighting Emissions by Subsector

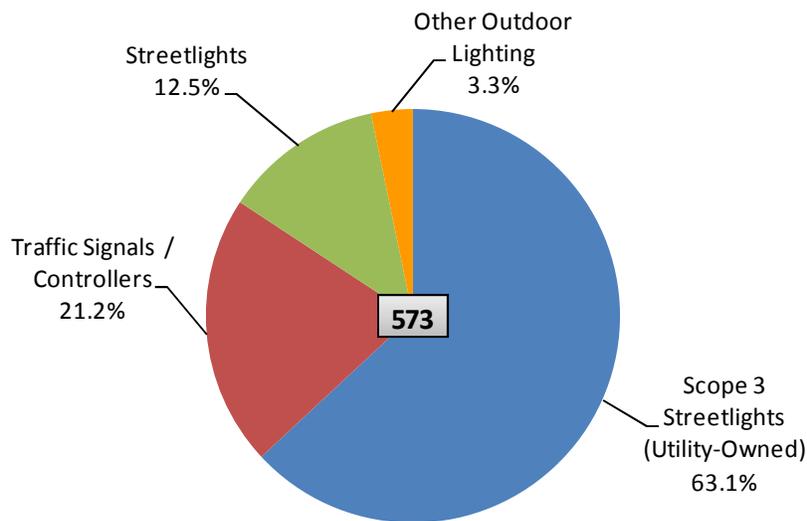


Table 11: Public Lighting Emissions by Subsector

Subsector (Light Type)	metric tons CO ₂ e	% of Sector Emissions	Electricity Use (kWh)	Cost (\$)
Scope 3 Streetlights (Utility-Owned)	361	63.1%	1,614,333	490,137
Traffic Signals / Controllers	121	21.2%	542,141	75,767
Streetlights	71	12.5%	319,229	36,195
Other Outdoor Lighting	19	3.3%	83,466	10,371
Totals	573	100%	2,559,169	\$ 612,470

Table 12: LGO Protocol Report – Public Lighting Emissions by Scope and Emission Type

STREETLIGHTS, TRAFFIC SIGNALS, AND OTHER PUBLIC LIGHTING					
Scope	Emission Type	Greenhouse Gas Emissions (metric tons)			
SCOPE 2	Purchased Electricity	CO ₂ e	CO ₂	CH ₄	N ₂ O
		211	210	0.0	0.0
SCOPE 3	Utility-Owned Streetlights	CO ₂ e	361		

Water Delivery Facilities

This sector includes emissions from equipment used for the distribution or transport of water, including drinking water, stormwater, sprinkler systems and irrigation. San Joaquin County operates a range of water transport equipment, including water delivery pumps, wells, and irrigation/sprinkler systems. Some facilities and equipment use natural gas, but electricity usage is the primary source of greenhouse gas emissions from the operation of San Joaquin County’s water transport equipment. All data relating to electricity and natural gas consumption were obtained from PG&E.

The Water Transport sector produced the sixth-largest amount of emissions overall, with 537 metric tons of CO₂e (less than 1% of total emissions). As illustrated in Figure 6 and Table 13, the subsector producing the most greenhouse gas emissions in the Water Transport sector was Water Delivery Pumps at 83.9%, followed by Stormwater Management at 14.9%. Table 14 reports emissions by scope and emission type, as recommended by the LGO Protocol. In the Water Transport sector, Scope 2 Indirect Emissions accounted for nearly all of the CO₂e emissions.

Figure 6: Water Delivery Facilities Emissions by Subsector

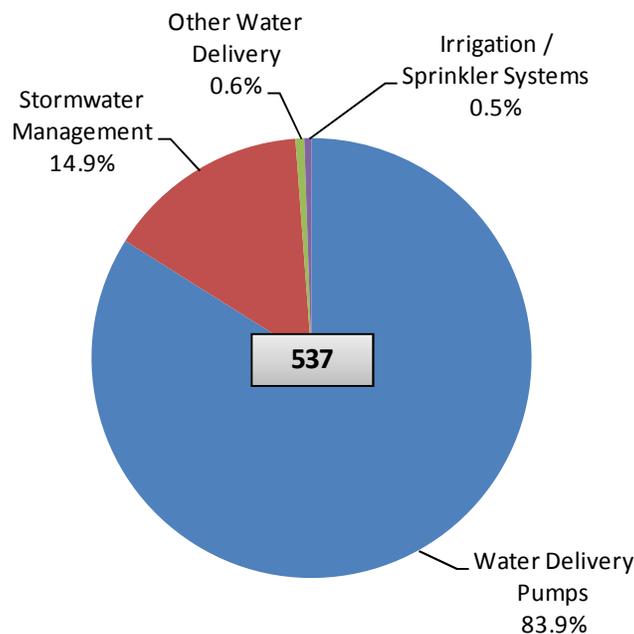


Table 13: Water Delivery Facilities Emissions by Subsector

Subsector (Equipment Type)	metric tons CO ₂ e	% of Sector Emissions	Electricity Use (kWh)	Electricity Cost (\$)	Natural Gas Use (therms)	Natural Gas Cost (\$)
Water Delivery Pumps	451	83.9%	2,013,630	277,798	15	130
Stormwater Management	80	14.9%	357,542	51,437	-	-
Other Water Delivery	3.4	0.6%	15,169	3,102	-	-
Irrigation / Sprinkler Systems	2.9	0.5%	12,817	2,665	-	-
Totals	537	100%	2,399,158	\$ 335,002	15	\$ 130

Table 14: LGO Protocol Report - Water Delivery Facilities Emissions by Scope and Emission Type

WATER TRANSPORT FACILITIES					
Scope	Emission Type	Greenhouse Gas Emissions (metric tons)			
SCOPE 1		CO ₂ e	CO ₂	CH ₄	N ₂ O
	Stationary Combustion	0.1	0.1	0.0	0.0
SCOPE 2		CO ₂ e	CO ₂	CH ₄	N ₂ O
	Purchased Electricity	537	532	0.0	0.0

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.

Electricity consumption and the on-site combustion of natural gas are also significant sources of greenhouse gas emissions from the operation of wastewater treatment facilities, as well as sewers and lift stations. Data relating to electricity and natural gas consumption were obtained from PG&E.

San Joaquin County operated four wastewater treatment systems in 2005, as well as various sewage pumps. Of the three systems in place, two utilize anaerobic digestion. These systems are located in County Service Area #44 (Fair Oaks), Zones E and G, which is located to the south of Tracy, California. The third system is located in County Service Area #15 (Waterloo), which is northeast of Stockton, California. This system utilizes an anaerobic facultative lagoon. The fourth system was located in County Service Area #31 (Flag City), until it was closed in 2007. Unfortunately activity data could not be obtained for many of these systems. Thus, emissions reported in this sector of the inventory are slightly underestimated.

The Wastewater Treatment sector produced the lowest amount of emissions in this inventory. Overall, these facilities produced 136 metric tons of CO₂e (less than 1% of total emissions). As illustrated in Figure 7 and Table 15, the subsector producing the most greenhouse gas emissions in the Wastewater Treatment sector was Flag City Wastewater Treatment Plant at 44.3%, followed by the Waterloo Facultative Lagoon at 31.3% and the Raymus Village Sewer & Well at 21.0%. Table 16 reports emissions by scope and emission type, as recommended by the LGO Protocol. In the Wastewater Treatment sector, Scope 2 Indirect Emissions accounted for a majority of the CO₂e emissions.

Figure 7: Wastewater Treatment Facilities Emissions by Subsector

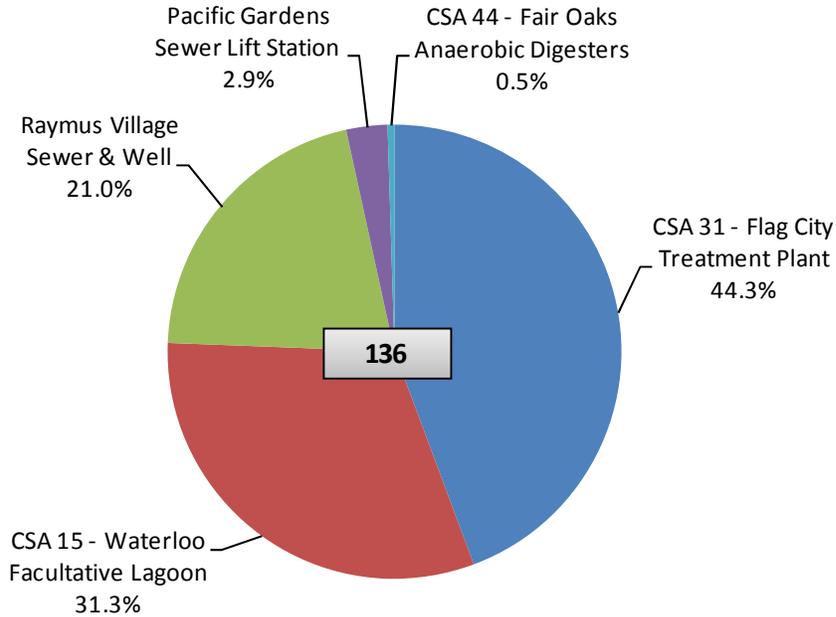


Table 15: Wastewater Treatment Facilities Emissions by Subsector

Subsector	metric tons CO ₂ e	% of Sector Emissions	Electricity Use (kWh)	Electricity Cost (\$)	Natural Gas Use (therms)	Natural Gas Cost (\$)
CSA 31 - Flag City Treatment Plant	60	44.3%	268,600	35,599	-	-
CSA 15 - Waterloo Facultative Lagoon	42	31.3%	-	-	-	-
Raymus Village Sewer & Well	28	21.0%	126,440	14,084	24	135
Pacific Gardens Sewer Lift Station	4	2.9%	17,845	2,635	-	-
CSA 44 - Fair Oaks Anaerobic Digesters	0.7	0.5%	-	-	-	-
Totals	136	100%	412,885	\$ 52,318	24	\$ 135

Table 16: LGO Protocol Report - Wastewater Treatment Facilities Emissions by Scope and Emission Type

WASTEWATER TREATMENT FACILITIES					
Scope	Emission Type	Greenhouse Gas Emissions (metric tons)			
		CO ₂ e	CO ₂	CH ₄	N ₂ O
SCOPE 1					
	Stationary Combustion	0.1	0.1	0.0	0.0
	Process Emissions	43	-	2	-
	Total Direct Emissions	43	0	2	0
SCOPE 2					
	Purchased Electricity	92	92	0.0	0.0

Airport Facilities

Electricity and natural gas consumption are sources of greenhouse gas emissions from the operation of San Joaquin County's Airport Facilities. Data relating to electricity and natural gas fuel consumption were obtained from PG&E.

The Airport Facilities sector produced the seventh-largest amount of emissions in this inventory. Overall, these facilities produced 394 metric tons of CO₂e (less than 1% of total emissions). As illustrated in Figure 8 and Table 17 below, the subsector producing the most greenhouse gas emissions in the Airport Facilities sector was the Airport Terminal Building at 54.3%, followed by the Airport Restaurant at 21.5%. Table 18 reports emissions by scope and emission type, as recommended by the LGO Protocol. In the Airport Facilities sector, Scope 2 Indirect Emissions accounted for a majority of the CO₂e emissions.

Figure 8: Airport Facilities Emissions by Subsector

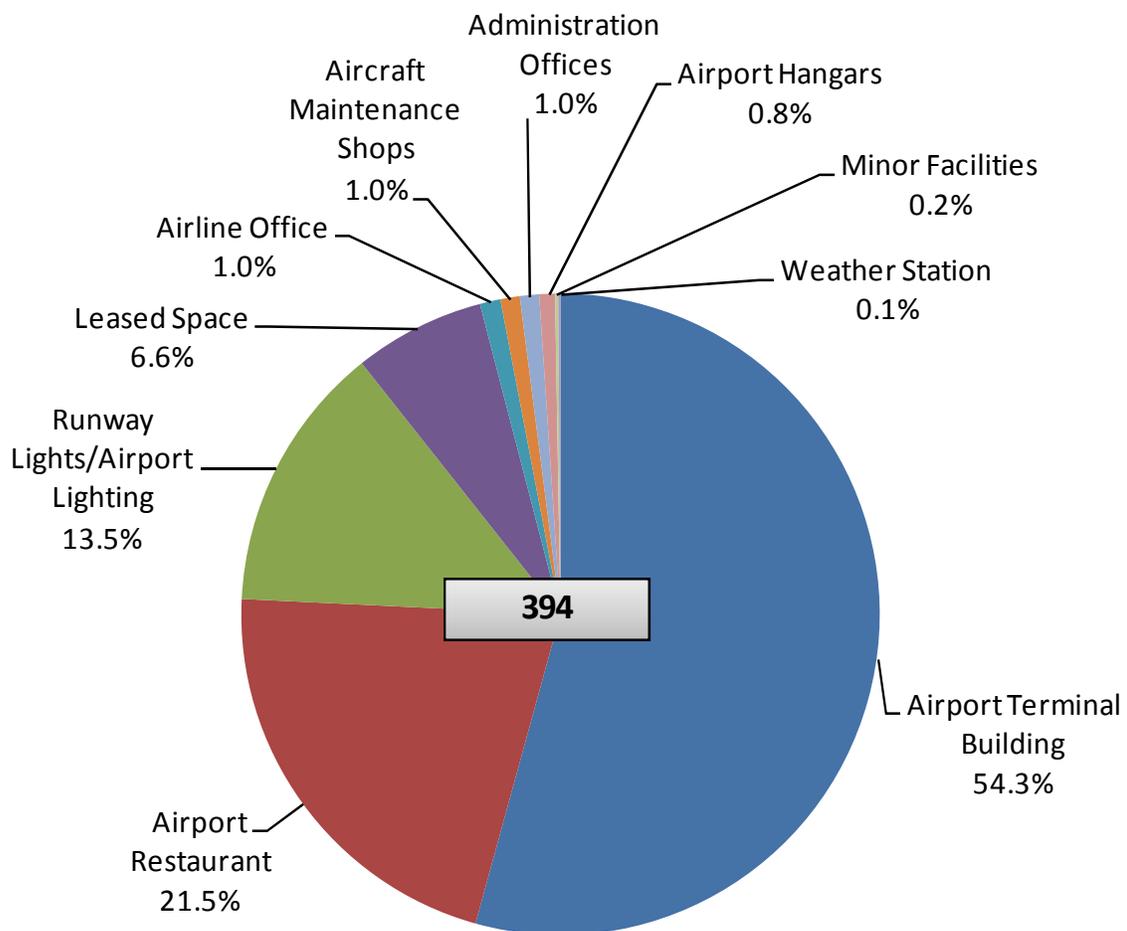


Table 17: Airport Facilities Emissions by Subsector

Subsector	metric tons CO ₂ e	% of Sector Emissions	Electricity Use (kWh)	Electricity Cost (\$)	Natural Gas Use (therms)	Natural Gas Cost (\$)
Airport Terminal Building	214	54.3%	525,991	70,413	18,068	18,396
Airport Restaurant	85	21.5%	119,840	16,912	10,855	11,171
Runway Lights/Airport Lighting	53	13.5%	238,093	24,541	-	-
Leased Space	26	6.6%	116,880	17,881	-	-
Airline Office	4.1	1.0%	10,449	1,719	333	336
Aircraft Maintenance Shops	3.9	1.0%	5,376	986	501	630
Administration Offices	3.8	1.0%	16,871	2,560	-	-
Airport Hangars	3.2	0.8%	14,149	1,944	-	-
Minor Facilities	0.6	0.2%	2,759	869	-	-
Weather Station	0.4	0.1%	1,921	411	-	-
Totals	394	100%	1,052,329	\$138,236	29,757	\$30,533

Table 18: LGO Protocol Report – Airport Facilities Emissions by Scope and Emission Type

AIRPORT FACILITIES					
Scope	Emission Type	Greenhouse Gas Emissions (metric tons)			
SCOPE 1		CO ₂ e	CO ₂	CH ₄	N ₂ O
	Stationary Combustion	158	158	0.0	0.0
SCOPE 2		CO ₂ e	CO ₂	CH ₄	N ₂ O
	Purchased Electricity	235	233	0.0	0.0

Solid Waste Facilities

There are a variety of emissions associated with solid waste management services including the collection, processing, and storage of solid waste generated from residents and businesses. The most prominent source of emissions from solid waste facilities is fugitive methane released by the decomposition of organic waste over time in landfills. The scale of these emissions depends upon the size and type of the landfill and the presence of a landfill gas collection system. Other emissions included in this section are from stationary combustion of fuels and purchased electricity used to generate power for all solid waste management facilities (including recycling centers, transfer stations, etc.) Data relating to electricity and natural gas consumption were obtained from PG&E.

The County owned and operated four landfills in 2005. Of these, two were inactive (no longer accepting waste) and two were still active. The two inactive landfills, Corral Hollow and Harney Lane, were equipped with landfill gas (LFG) monitoring systems, which capture and flare gasses which would otherwise have escaped into the atmosphere. 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. Biogenic CO₂ from flared methane in San Joaquin County, which totaled 16,270 CO₂e in base year, is therefore considered an “Information Item” only. Please refer to Table 5 on page 17 for detailed information.

The Solid Waste Facilities sector produced the largest amount of emissions in the inventory. Overall, these facilities produced 103,722 metric tons of CO₂e (67.1% of total emissions). As illustrated in Figure 9 and Table 19 below, the facility producing the most greenhouse gas emissions in the Solid Waste Facilities sector was the Foothill Sanitary Landfill at 66.6%, followed by the North County Sanitary Landfill at 31.7%. Table 20 reports emissions by scope and emission type, as recommended by the LGO Protocol. In the Solid Waste Facilities sector, Scope 1 Direct Emissions accounted for nearly all of the CO₂e emissions.

Figure 9: Solid Waste Landfill Emissions by Facility

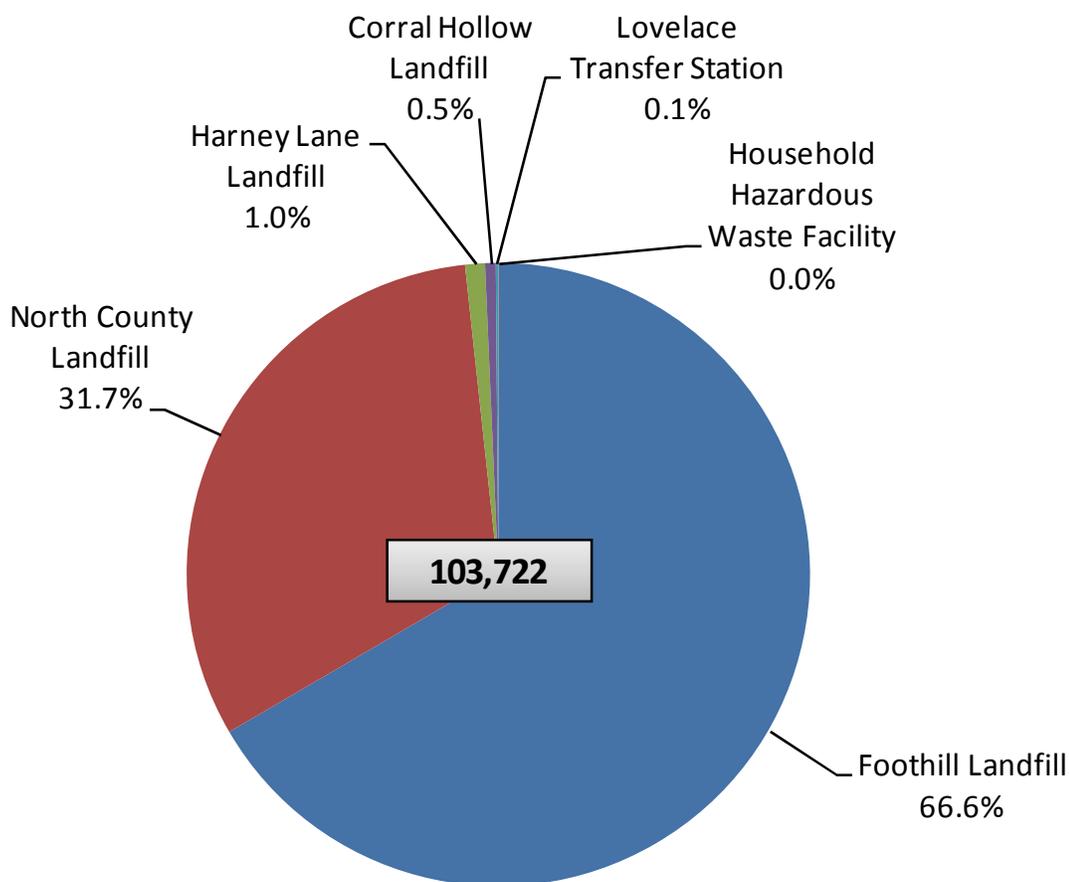


Table 19: Solid Waste Landfill Emissions by Facility

Facility	metric tons CO ₂ e	% of Sector Emissions	Fugitive Emissions (metric tons CH ₄)	Electricity Use (kWh)	Natural Gas Use (therms)	Energy Cost (\$)
Foothill Landfill	69,062	66.6%	3,289	5,358	-	850
North County Landfill	32,883	31.7%	1,563	276,504	-	32,342
Harney Lane Landfill	1,080	1.0%	51	-	-	-
Corral Hollow Landfill	564	0.5%	27	20,158	-	3,109
Lovelace Transfer Station	125	0.1%	-	483,520	3,238	64,591
Household Hazardous Waste Facility	7	0.0%	-	30,640	24	4,844
Totals	103,722	100%	4,930	816,180	3,262	\$105,736

Table 20: LGO Protocol Report – Solid Waste Facilities Emissions by Scope and Emission Type

SOLID WASTE FACILITIES					
Scope	Emission Type	Greenhouse Gas Emissions (metric tons)			
SCOPE 1		CO ₂ e	CO ₂	CH ₄	N ₂ O
	Stationary Combustion	17	17	0.0	0.0
	Fugitive Emissions	103,522	-	4,930	-
	Total Direct Emissions	103,539	17	4,930	0
SCOPE 2		CO ₂ e	CO ₂	CH ₄	N ₂ O
	Purchased Electricity	183	181	0.0	0.0

Vehicle Fleet and Mobile Equipment

The vehicles and mobile equipment used in San Joaquin County’s daily operations include: heavy duty trucks responding to emergency fire calls; heavy duty trucks transporting solid waste from transfer stations to landfills; heavy and light trucks used for landscape and maintenance tasks; passenger cars, light trucks, and sport utility vehicles (SUVs) driven on a variety of site visits, including building inspections; among others. Most vehicles consume gasoline, many consume diesel, some consume compressed natural gas (CNG), and each produces greenhouse gas emissions. Gasoline and diesel-powered maintenance equipment contribute to greenhouse gas emissions as well; however, exact figures for off-road fuel consumption could not be acquired for individual equipment, most of which are included within the general category of “Unclassified” vehicles/equipment. In addition, vehicles with air conditioning or refrigeration equipment use refrigerants that can leak from the vehicle, emitting greenhouse gasses into the atmosphere.

Vehicle Fleet Refrigerants are estimated to have contributed 230 metric tons of CO₂e (2.5% of total emissions). The figure generated here is a conservative estimate in lieu of exact amounts, which were not available. Emissions from ozone depleting chemicals used as refrigerants in vehicles produced before 1995 (e.g. R-12) were included as an information item in this inventory since these chemicals are regulated by the Montreal Protocol and are currently being phased out of use.

The Vehicle Fleet sector produced the fourth-largest amount of emissions in this inventory. Overall, this sector produced 9,250 metric tons of CO₂e (6.0% of total emissions). As illustrated in Figure 10 and Table 21, the source producing the most greenhouse gas emissions in the Vehicle Fleet sector was gasoline at 68.3%, followed by diesel at 27.2%. As illustrated in Figure 11, the operations contributing the largest shares of emissions were the Sheriff's Department (including all divisions) at 24.8%, followed by Public Works at 19.1%. Approximately 11.0% of emissions were generated by vehicles "Unassigned" to a particular department. Unfortunately, these vehicles and equipment – which did not have corresponding mileage or hours of operation records – could not be identified based on fuel records alone. Table 22 reports emissions by scope and emission type, as recommended by the LGO Protocol. In the Vehicle Fleet sector, Scope 1 Direct Emissions accounted for nearly all of the CO₂e emissions.

Figure 10: Vehicle Fleet Emissions by Source

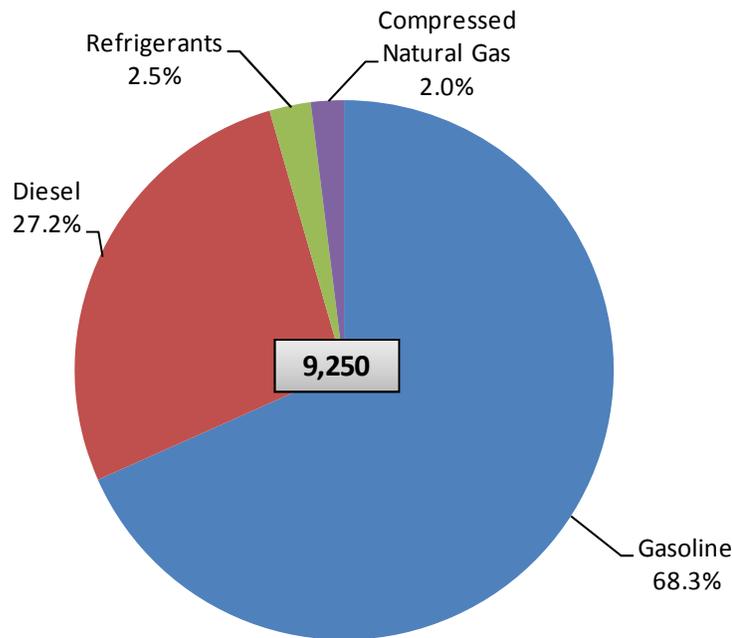


Table 21: Vehicle Fleet Emissions by Source

Source	metric tons CO ₂ e	% of Sector Emissions	Quantity	Units	Cost (\$)
Gasoline	6,321	68.3%	708,222	Gal	1,537,211
Diesel	2,516	27.2%	246,310	Gal	568,487
Refrigerants	230	2.5%	177	kg	-
Compressed Natural Gas	183	2.0%	24,900	Gal	32,743
Totals	9,250	100%			\$ 2,138,441

Figure 11: Top 10 Largest Contributors to Emissions from Vehicle Fleet Sector

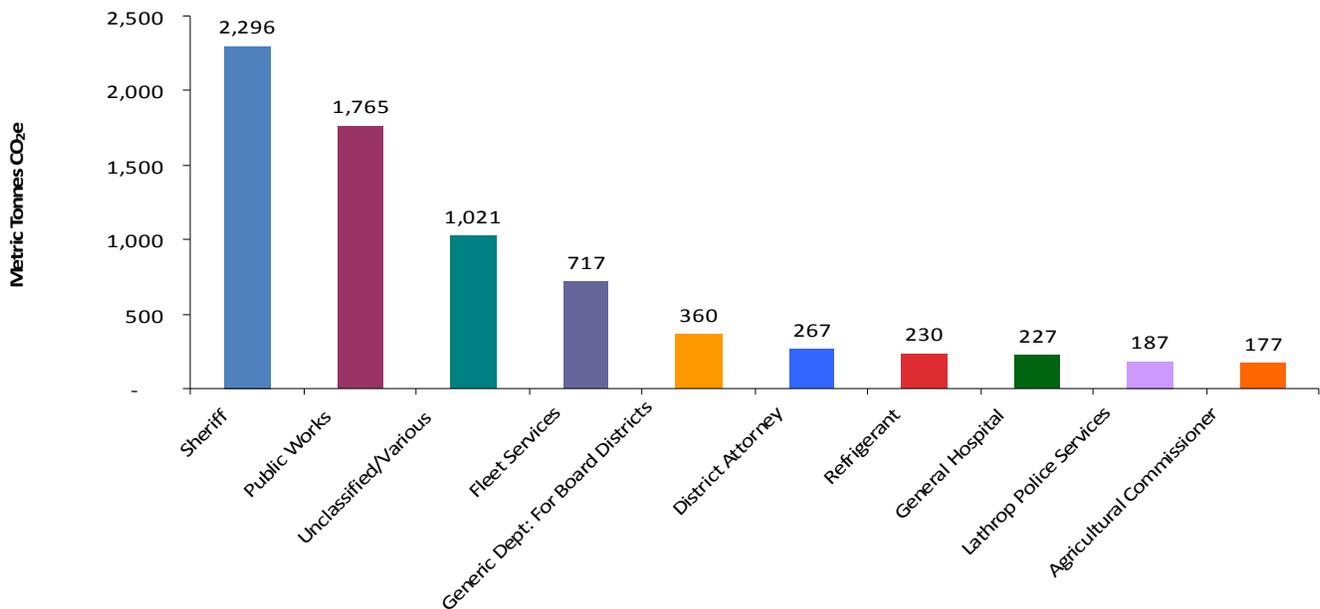


Table 22: LGO Protocol Report - Vehicle Fleet Emissions by Scope and Emission Type

VEHICLE FLEET						
Scope	Emission Type	Greenhouse Gas Emissions (metric tons)				
SCOPE 1		CO ₂ e	CO ₂	CH ₄	N ₂ O	HFC-134A
	Mobile Combustion	9,020	8,896	0.7	0.4	-
	Fugitive Emissions	230	-	-	-	0.2
	Total Direct Emissions	9,250	8,896	1	0	0

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 San Joaquin County. Results from a survey designed by ICLEI and administered by San Joaquin County are shown below. Current full-time County staff members were surveyed and 883 responses were collected, resulting in a sample of approximately 13% of employees at 2012 staff levels. The survey was used to collect the data needed to calculate emissions and also capture other information that will help San Joaquin County set effective policy addressing this sector.

The Employee Commute sector produced the third-largest amount of emissions in this inventory. Overall, this sector produced 18,011 metric tons of CO₂e (11.7% of total emissions). Nearly all Employee vehicles are fueled by gasoline, with only a few using an alternative fuel, such as diesel. Table 23 reports emissions by scope, as recommended by the LGO Protocol. In the Employee Commute sector, all emissions are reported as Scope 3.

Tables 24 through 29 present summary information from more in depth questions included in the survey. This information is intended to inform San Joaquin County about potential transportation options to increase convenience and productivity while reducing the County’s impact on the environment.

Table 23: LGO Protocol Report - Employee Commute Emissions by Scope and Emission Type

EMPLOYEE COMMUTE		
Scope	Emission Type	Greenhouse Gas Emissions (metric tons)
SCOPE 3		CO ₂ e
	Mobile Combustion	18,011

Table 24: Employee Commute - Travel Mode Data

Mode	Percentage
Drive Alone	88.6%
Carpooling/Vanpooling	7.2%
Split Modes	1.2%
Public Transportation	0.3%
Bicycling	0.3%
Walking	0.1%
Telecommute/Other	0.0%

Table 25: Employee Commute - Miles from Work Data

Miles	Percentage
0-5	22.2%
6-10	28.9%
11-15	17.5%
15-20	9.2%
21-25	5.7%
26-30	3.9%
31-35	3.9%
36-40	3.7%
41-45	1.8%
46-50	0.7%
51-75	2.2%
76-100	0.3%
Over 100	0.0%

Table 26: Employee Commute - Time to Work Data

Time (Minutes)	Percentage
Less than 5	3.0%
6 to 15	40.5%
16 to 25	32.9%
26 to 35	10.1%
36 to 45	8.1%
Over 45	5.5%

Table 27: Employee Commute – Reasons for Not Carpooling/Vanpooling

Reason	Percentage
Need to make stops on the way to work or home	53.0%
Other people do not match my schedule or route	48.7%
May not be able to get home quickly in an emergency	41.3%
Dislike being dependent on others	41.3%
Like the privacy when I'm in my own car	34.0%
Work late or irregular hours	28.1%
Difficult to find others to carpool/vanpool	24.7%
Need my car on the job	19.5%
Makes my trip too long	11.1%
Other	8.3%
Never considered carpooling or vanpooling	5.7%
I don't know enough about carpooling or vanpooling	4.6%

Table 28: Employee Commute – Reasons for Not Taking Transit

Reason	Percentage
Transit service doesn't match my route or schedule	50.8%
Need to make stops on the way to work or home	46.7%
It takes too long	43.6%
May not be able to get home quickly during an emergency	39.8%
Like the privacy when I'm in my own car	28.9%
It is not safe or easy to walk to work from the transit stop	23.2%
I work late or irregular hours	22.5%
Need my car on the job	18.0%
It is too far to walk to work from the transit stop	11.2%
Other	8.0%
Never considered using public transit	7.8%
I don't know enough about taking transit	6.7%
It costs too much	6.1%
Not enough parking at the transit stop from which I'd depart	2.7%

Table 29: Employee Commute – Reasons for Not Walking/Biking

Reason	Percentage
I live too far away	65.6%
There isn't a safe or easy route for walking or biking	36.4%
Weather	34.0%
Need to make stops on the way to work or home	32.4%
May not be able to get home quickly in an emergency	31.0%
It's not easy to look good and feel comfortable for work after walking or biking	27.1%
Workplace does not have adequate facilities for showering/changing	23.8%
No place at work to store bikes safely	13.0%
Other	8.7%
Never considered walking or biking to work	8.3%
I don't know enough about walking or biking to work	1.2%

Inventory Methodologies

ICLEI's Clean Air & Climate Protection Software (CACP 2009) software made it possible to calculate greenhouse gas emissions for the following greenhouse gases: Carbon Dioxide, Methane, Nitrous Oxide, Hydrofluorocarbons, Perfluorocarbons, and Sulfur Hexafluoride. Activity data were collected for a number of operations through a number of methods. Activity data were stored in Master Data Workbook (MDWB), which serves as a tool for organizing and conditioning data, and, in some cases, calculating emissions. Data collection methods range from LGO Protocol-recommended, to LGO Protocol-alternative and non-LGO Protocol (but ICLEI-approved) alternatives. The methods used depend on the availability and format of data. Inputting activity data into CACP 2009, along with the correct emission factor, resulted in the calculation of greenhouse gas emissions for San Joaquin County's 2005 government operations.

Buildings and Other Facilities

The Building and Facilities sector of the inventory reports emission from four main sources: electricity, natural gas, backup power generators and refrigerants/fire suppressants. The required data were obtained from the local government departments and regional utility providers. The utility companies that service San Joaquin County government facilities are:

- Pacific Gas and Electric (PG&E) – natural gas and electricity service
- Lodi Electric Utility (LEU) – electricity service

This data were acquired per request and approval from San Joaquin County and each of the utility providers. The data were received in the following formats:

- PG&E electricity data – Excel spreadsheet indicating kilowatt-hour (kWh) consumption and cost by individual account
- PG&E natural gas data – Excel spreadsheet indicating therms of consumption and cost by individual account
- LEU electricity data – Data table indicating monthly kWh consumption by address. Cost information was not provided.

The data were inserted into the corresponding section within the MDWB raw data tabs. The data were then sorted and conditioned in order to use the recommend method for reporting emissions.

Buildings and Other Facilities: Electricity and Natural Gas Related Emission

According to the LGO Protocol, the recommended method for reporting emissions related to electricity consumption and natural gas combustion is summing the total number of kWh or therms (Activity Data) and multiplying the Activity Data by a corresponding emission factor. Emission factors are values that are reported by the utility company and are stored within CACP software.

- Summed Activity (kWh/therm) x Emissions Factor = GHG Emissions

The raw data collected were inserted into the spreadsheet labeled *FA-Utility Raw Data* (raw data must be kept without conditioning as a quality-control reference) and then copied to the spreadsheet labeled *FA-Utility Working Data* in the MDWB to be sorted. The data were sorted within the *FA-Utility Working Data* spreadsheet to isolate building facilities kWh and therm usage; premise type, account numbers, addresses, and service descriptions are categories used to sort the data.

Once sorted, the data was copied to the *Building Working Data* spreadsheet, where it was separated into the different building facilities. The kWh and therms were then summed per individual facility. The values per facility and grand total are reported in the *Building Final Data* spreadsheet.

After the *Building Final Data* spreadsheet was populated with all of the facilities and their kWh/therm usage, the information was entered into CACP. According to LGO Protocol, inventory of kWh emissions for the Building and Facilities sector is reported as Scope 2-purchased electricity while the inventory of therm emission is reported as Scope 1-stationary combustion. A separate record is entered into CACP per facility's kWh and therm usage to ensure the entry is reported under the correct Scope and with the correct emissions factor (differs for each utility provider).

Buildings and Other Facilities: Refrigerant and Fire Suppressant Emissions

In addition to emissions from electricity and natural gas, leaked refrigerants associated with heating, air conditioning and refrigeration units should be reported in this sector. Leaked fire suppressants should be reported likewise. According to LGO Protocol the recommended method for reporting emissions from leaked refrigerants and fire suppressants is the mass balance method where HFC's that have escaped into the atmosphere are summed and then multiplied by the Global Warming Potential (GWP) factor.

- Net leaked HFCs (kg) x GWP Factor = GHG Emissions

This method requires records for any refrigerant recharges, AC system installations, or AC system disposals, as well as suppressant recharges, purchases or disposals, to be acquired. During the course of this inventory, however, these records were not obtained.

- Facility refrigerants – Data not obtained. *See Reporting Inconsistencies below.*
- Fire suppressants – Data not obtained. *See Reporting Inconsistencies below.*

The raw data collected should be inserted into the spreadsheet labeled *RF-Raw Data* and then copied to the spreadsheet labeled *RF-FA Working Data* in the MDWB (raw data must be kept without conditioning as a quality-control reference) to be sorted by refrigerant type. Once sorted and conditioned data can then be entered into the *RF-FA Mass Balance Data* spreadsheet where the total amount of leaked refrigerants and fire suppressants will be reflected.

After the *RF-FA Mass Balance Data* spreadsheet is populated with all of the Refrigerants and their corresponding mass leaked, the information can be entered into CACP. According to LGO Protocol, inventory of Refrigerant emissions for the Building and Facilities sector is reported as Scope 1-fugitive emissions. A separate record is entered into CACP per leaked Refrigerant mass to ensure the entry is reported under the correct Scope and with the correct GWP factor (differs for each refrigerant).

Buildings and Other Facilities: Backup Power Generators

In addition to emissions from the above activities, emissions from stationary combustion of fuels in backup power generators for facilities should be reported in this sector. According to LGO Protocol the recommended method for reporting emissions from stationary combustion of fuels is summing the total quantity of fuels consumed by type (Activity Data) and multiplying the Activity Data by a default emissions factor (pre-set in CACP) corresponding to the type of fuel.

- Summed Activity (quantity of fuel) x Emissions Factor = GHG Emissions

This method requires records for fuel consumption by individual generators to be acquired. During the course of this inventory, however, these records could not be separated from “Unclassified” fuel use reported in the Vehicle Fleet sector.

- Generator fuel consumption – Data included in Vehicle Fleet sector. *See Reporting Inconsistencies below.*

The raw data collected should be inserted into the spreadsheet labeled *FA-Other Fuel Raw Data* and then copied to the spreadsheet labeled *RF-FA Working Data* in the MDWB (raw data must be kept without conditioning as a quality-control reference) to be sorted by facility and fuel type. Once sorted and conditioned data can then be entered into the *Buildings and Facilities Final Data* spreadsheet where the total amount of fuel and cost are reported, corresponding to the facility where the unit is located.

After the *Buildings and Facilities Final Data* spreadsheet is populated, the information can be entered into CACP. According to LGO Protocol, inventory of generator fuel emissions for the Building and Facilities sector is reported as Scope 1-stationary combustion. A separate record is entered into CACP to ensure the entry is reported under the correct Scope and with the correct GWP factor (differs for each refrigerant).

Buildings and Other Facilities: Reporting Inconsistencies and Limitations

During the course of conducting this inventory, some approaches strayed from the LGO Protocol's recommended methods; however, alternative approaches were used in an attempt to align with the protocol's alternative methods and to generate the highest quality inventory possible.

Cost information was not provided by LEU, so electricity costs may be slightly undercounted in this sector. In addition, emissions factors for PG&E were applied to LEU accounts because LEU emissions factors were not available. However, the facilities only accounted for 0.36% of all kWh consumption, so these approaches are not expected to have notable impacts on cost and emissions information reported for this sector.

Facility refrigerants were omitted from the inventory due to unavailability of data. Thus, emissions in this sector may be slightly underestimated.

Fire suppressants were also omitted from the inventory. According to the County's current contracted service-technicians, Golden Bear Fire Extinguisher, the County's extinguishers are inspected twice per year. In the event that a leak is detected, the unit is repaired immediately. Units are recharged on a six-year cycle. Golden Bear uses a recapture system that prevents leakage of suppressant into the atmosphere. Stockton Fire Extinguishers was the County's contracted service-technician during 2005. However, Golden Bear confirmed that the two entities utilize the same technology.

During the course of this inventory, backup power generator fuel records could not be separated from "Unclassified" fuel use reported in the Vehicle Fleet sector. These fuels were aggregated by fuel type and recorded in the Vehicle Fleet sector as Scope 1-mobile combustion emissions. Thus, stationary combustion emissions may be slightly underestimated in this sector.

Streetlights, Traffic Signals, and Other Public Lighting

The Lighting sector of the inventory reports emission from one main source: electricity. The required data was obtained from the local government departments and regional utility providers. The utility company that services San Joaquin County's lighting is:

- PG&E –electricity service

This data were acquired per request and approval from both the San Joaquin County and PG&E. The data were received in the following format:

- PG&E electricity data – Excel spreadsheet indicating kilowatt-hour (kWh) consumption and cost by individual account

The data were inserted into the corresponding section within the MDWB raw data tabs. The data were then sorted and conditioned in order to use the recommend method for reporting emissions.

Public Lighting: Electricity Related Emissions

According to the LGO Protocol, the recommended method for reporting emissions related to electricity consumption is summing the total number of kWh (Activity Data) and multiplying the Activity Data by a corresponding emission factor. Emission factors are values that are reported by the utility company and are stored within CACP software.

- Summed Activity (kWh) x Emissions Factor = GHG Emissions

The raw data collected were inserted into the spreadsheet labeled *FA-Utility Raw Data* (raw data must be kept without conditioning as a quality-control reference) and then copied to the spreadsheet labeled *FA-Utility Working Data* in the MDWB to be sorted. The data were sorted within the *FA-Utility Working Data* spreadsheet to isolate lighting activity (kWh); premise type, account numbers, addresses, and service descriptions are categories used to sort the data.

Once sorted, the data were copied to the *Public Lighting Working Data* spreadsheet to be separated into the different subsectors (traffic signals, streetlights, park lights, and other outdoor lighting). The kWh data were then summed per individual facility. The values per facility and grand total are reported in the *Public Lighting Final Data* spreadsheet.

After the *Public Lighting Final Data* spreadsheet was populated with all of the subsectors and their kWh usage, the information was entered into CACP. According to LGO Protocol, inventory of kWh emissions for the Public Lighting sector is reported as Scope 2-purchased electricity. A separate record is entered into CACP per subsector's kWh usage to ensure the entry is reported under the correct Scope and with the correct emissions factor (differs for each utility provider).

Water Transport Facilities

The Water Transport sector of the inventory reports emission from two main sources: electricity and natural gas. This sector of the inventory consisted of electricity and limited natural gas consumption for the operation of sprinkler systems, lift stations, and well pumps associated with non-waste water transport. The required data were obtained from the local government departments and regional utility providers. The utility company that services San Joaquin County's water transport infrastructure is:

- PG&E – natural gas and electricity service

This data were acquired per request and approval from both the San Joaquin County and PG&E. The data were received in the following formats:

- PG&E electricity data – Excel spreadsheet indicating kilowatt-hour (kWh) consumption and cost by individual account

- PG&E natural gas data – Excel spreadsheet indicating therms of consumption and cost by individual account

The data were inserted into the corresponding section within the MDWB raw data tabs. The data were then sorted and conditioned in order to use the recommend method for reporting emissions.

Water Transport Facilities: Electricity Related Emissions

According to the LGO Protocol, the recommended method for reporting emissions related to electricity consumption and natural gas combustion is summing the total number of kWh or therms (Activity Data) and multiplying the Activity Data by a corresponding emission factor. Emission factors are values that are reported by the utility company and are stored within CACP software.

- Summed Activity (kWh/therms) x Emissions Factor = GHG Emissions

The raw data collected were inserted into the spreadsheet labeled *FA-Utility Raw Data* (raw data must be kept without conditioning as a quality-control reference) and then copied to the spreadsheet labeled *FA-Utility Working Data* in the MDWB to be sorted. The data were sorted within the *FA-Utility Working Data* spreadsheet to isolate lighting activity (kWh); premise type, account numbers, addresses, and service descriptions are categories used to sort the data.

Once sorted, the data were copied to the *Water Transport Working Data* spreadsheet to be separated into the different subsectors (water delivery pumps, sprinklers/irrigation, storm water, and others). The kWh and therms were then summed per individual facility. The values per facility and grand total are reported in the *Water Transport Final Data* spreadsheet.

After the *Water Transport Final Data* spreadsheet was populated with all of the subsectors and their kWh usage, the information was entered into CACP. According to LGO Protocol, inventory of kWh emissions for the Water Transport sector is reported as Scope 2-purchased electricity. A separate record is entered into CACP per subsector's kWh usage to ensure the entry is reported under the correct Scope and with the correct emissions factor (differs for each utility provider).

Wastewater Treatment Facilities

The Wastewater Treatment Facilities sector of the inventory reports emission from three main sources: electricity, natural gas, and wastewater processes. This sector of the inventory consisted of electricity and limited natural gas consumption for the operation of treatment facilities, wastewater pumps, and wastewater lift stations. In addition, emissions from the County's anaerobic digesters and facultative lagoons should also be reported in this sector of the inventory. The required data were obtained from the local government departments and regional utility providers. The utility company that services San Joaquin County's wastewater treatment infrastructure is:

- PG&E – natural gas and electricity service

This data were acquired per request and approval from both the San Joaquin County and PG&E. The data were received in the following formats:

- PG&E electricity data – Excel spreadsheet indicating kilowatt-hour (kWh) consumption and cost by individual account
- PG&E natural gas data – Excel spreadsheet indicating therms of consumption and cost by individual account

The data were inserted into the corresponding section within the MDWB raw data tabs. The data were then sorted and conditioned in order to use the recommend method for reporting emissions.

Wastewater Treatment Facilities: Electricity and Natural Gas Related Emissions

According to the LGO Protocol the recommended method for reporting emissions related to electricity consumption and natural gas combustion is summing the total number of kWh or therms and multiplying them by their corresponding emission factor. Emission factors are values that are reported by the utility company and are stored within CACP software.

- Summed Activity (kWh/therm) x Emissions Factor = GHG Emissions

The raw data collected were inserted into the spreadsheet labeled *FA-Utility Raw Data* (raw data must be kept without conditioning as a quality-control reference) and then copied to the spreadsheet labeled *FA-Utility Working Data* in the MDWB to be sorted. The data were sorted within the *FA-Utility Working Data* spreadsheet to isolate the wastewater facility kWh and therm usage as well as wastewater transport kWh; premise type, account numbers, addresses, and service descriptions are categories used to sort the data.

Once sorted, the data were copied to the *WW-Energy Use Working Data* spreadsheet, where it was separated into the different facilities. The kWh and therms were then summed per individual facility. The values per facility and grand total are reflected in the *WW-Energy Use Final Data* spreadsheet.

After the *WW-Energy Use Final Data* spreadsheet was populated with all of the facilities and their kWh/therm usage, the information was entered into CACP. According to LGO Protocol, inventory of kWh emissions for the Wastewater Treatment Facilities sector is reported as Scope 2-purchased electricity, the inventory of therm emission is reported as Scope 1-stationary combustion, and the inventory of wastewater treatment is reported as Scope 1-process emissions. A separate record is entered into CACP per facility's kWh and therm usage to ensure the entry is reported under the correct Scope and with the correct emissions factor (differs for each utility provider)

Wastewater Treatment Facilities: Wastewater Treatment Related Emissions

According to the LGO Protocol, the recommended method for reporting emissions related to wastewater treatment processes is to obtain site-specific measurements and apply a standard equation (below) based on the type of treatment system in place. The alternative method is to utilize population estimates, which applies a standard per-capita emissions

rate. In 2005 the County maintained two anaerobic digester package systems⁸ and two anaerobic facultative lagoon systems.

As outlined in LGO Protocol Equation 10.1 below, quantifying emissions from anaerobic digesters requires collection of the following data: quantity of digester gas produced per day, and fraction of digester gas as CH₄. The anaerobic digestion process creates CH₄, which is captured and combusted. Due to minimal destruction inefficiencies, some gasses escape the system. Emissions from digester gas are calculated using the following formula, which is built into the MDWB.

Figure 12: LGO Protocol Equation 10.1 - Stationary CH₄ from Incomplete Combustion of Digester Gas (site-specific digester gas data)⁹

- Annual CH₄ emissions (metric tons CO₂e) = (Digester Gas x FCH₄ x ρ(CH₄) x (1-DE) x 0.0283 x 365.25 x 10⁻⁶) x GWP

Where:

ITEM	DESCRIPTION	VALUE
Digester Gas	= measured standard cubic feet of digester gas produced per day [ft ³ /day]	user input
F CH ₄	= measured fraction of CH ₄ in biogas	user input
ρ(CH ₄)	= density of methane at standard conditions [g/m ³]	662.00
DE	= CH ₄ Destruction Efficiency	.99
0.0283	= conversion from ft ³ to m ³ [m ³ /ft ³]	0.0283
365.25	= conversion factor [day/year]	365.25
10 ⁻⁶	= conversion from g to metric ton [metric ton/g]	10 ⁻⁶
GWP	= Global Warming Potential	21

Source: EPA *Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2007*, Chapter 8, 8-7 (2009).

As outlined in LGO Protocol Equation 10.3 below, quantifying emissions from lagoons requires collection of the following data: annual average wastewater flows per day and BOD₅ content. Lagoon-related process emissions are calculated using the following formula, which is built into the MDWB.

Figure 13: LGO Protocol Equation 10.3 - Process CH₄ from Anaerobic and Facultative Wastewater Treatment Lagoons (site-specific data)¹⁰

- Annual CH₄ emissions (tonnes CO₂e)=(BOD₅ load x (1-FP) x Bo x MCF anaerobic x 365.25 x 10⁻³) x GWP

Where:

ITEM	DESCRIPTION	VALUE
BOD ₅ load	= BOD ₅ produced per day (influent to wastewater treatment process)[kg BOD ₅ /day]	user input
FP	= fraction of BOD ₅ removed in primary treatment, if present	user input
Bo	= maximum CH ₄ -producing capacity for domestic wastewater [kg CH ₄ /kg BOD ₅ removed]	0.6
MCF anaerobic	= CH ₄ correction factor for anaerobic systems	0.8
365.25	= conversion factor [day/year]	365.25
10 ⁻³	= conversion from kg to metric ton [metric ton/kg]	10 ⁻³
GWP	= Global Warming Potential	21

Source: EPA *Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2007*, Chapter 8, 8-7 (2009).

⁸ Package systems are pre-fabricated wastewater treatment systems which are more effective than septic systems. Obtained from http://www.sjgov.org/commdev/cgi-bin/cdyn.exe/handouts-planning_GP-V3-II-D?grp=handouts-planning&obj=GP-V3-II-D

⁹ Source: *Local Government Operations Protocol*, Version 1.1 (May 2010) p. 109

¹⁰ Source: *Local Government Operations Protocol*, Version 1.1 (May 2010) p. 111

During the course of the inventory, activity data could not be obtained for the three wastewater treatment systems. *See Reporting Inconsistencies below.*

Wastewater Treatment Facilities: Reporting Inconsistencies and Limitations

During the course of conducting this inventory, some LGO Protocol-recommended emissions were omitted due to unavailability of data. Activity data could not be obtained for the four wastewater treatment systems operated by the County. Because each system serves a small unincorporated community, or portions of a single, it was difficult to obtain a verifiable population estimate in lieu of activity data. Thus, these emissions were not quantified for the Wastewater Treatment sector.

Airport Facilities

The Airport Facilities sector of the inventory reports emission from two main sources: electricity, and natural gas. The required data were obtained from the local government departments and regional utility providers. The utility company that services San Joaquin County's airport facilities is:

- PG&E – natural gas and electricity service

This data were acquired per request and approval from both the San Joaquin County and PG&E. The data were received in the following formats:

- PG&E electricity data – Excel spreadsheet indicating kilowatt-hour (kWh) consumption and cost by individual account
- PG&E natural gas data – Excel spreadsheet indicating therms of consumption and cost by individual account

The data were inserted into the corresponding section within the MDWB raw data tabs. The data were then sorted and conditioned in order to use the recommend method for reporting emissions.

Airport Facilities: Electricity and Natural Gas Related Emissions

According to the LGO Protocol the recommended method for reporting emissions related to electricity consumption and natural gas combustion is summing the total number of kWh or therms and multiplying them by their corresponding emission factor. Emission factors are values that are reported by the utility company and are stored within CACP software.

- Summed Activity (kWh/therm) x Emissions Factor = GHG Emissions

The raw data collected were inserted into the spreadsheet labeled *FA-Utility Raw Data* (raw data must be kept without conditioning as a quality-control reference) and then copied to the spreadsheet labeled *FA-Utility Working Data* in the MDWB to be sorted. The data were sorted within the *FA-Utility Working Data* spreadsheet to isolate airport facilities

kWh and therm usage; premise type, account numbers, addresses, and service descriptions are categories used to sort the data.

Once sorted, the data were copied to the *Airport Working Data* spreadsheet, where it was separated into the different building facilities. The kWh and therms were then summed per individual facility. The values per facility and grand total are reflected in the *Airport Final Data* spreadsheet.

After the *Airport Final Data* spreadsheet was populated with all of the facilities and their kWh/therm usage, the information was entered into CACP. According to LGO Protocol, inventory of kWh emissions for the Building and Facilities sector is reported as Scope 2-purchased electricity while the inventory of therm emission is reported as Scope 1-stationary combustion. A separate record is entered into CACP per facility's kWh and therm usage to ensure the entry is reported under the correct Scope and with the correct emissions factor (differs for each utility provider).

Solid Waste Facilities

The Solid Waste Facilities sector of the inventory reports emission from three main sources: electricity, natural gas and solid waste processes. The required data were obtained from the local government departments and regional utility providers. The utility company that services San Joaquin County's airport facilities is:

- PG&E – natural gas and electricity service

This data were acquired per request and approval from both the San Joaquin County and PG&E. The data were received in the following formats:

- PG&E electricity data – Excel spreadsheet indicating kilowatt-hour (kWh) consumption and cost by individual account
- PG&E natural gas data – Excel spreadsheet indicating therms of consumption and cost by individual account

The data were inserted into the corresponding section within the MDWB raw data tabs. The data were then sorted and conditioned in order to use the recommend method for reporting emissions.

Solid Waste Facilities: Electricity and Natural Gas Related Emissions

According to the LGO Protocol the recommended method for reporting emissions related to electricity consumption and natural gas combustion is summing the total number of kWh or therms and multiplying them by their corresponding emission factor. Emission factors are values that are reported by the utility company and are stored within CACP software.

- Summed Activity (kWh/therm) x Emissions Factor = GHG Emissions

The raw data collected were inserted into the spreadsheet labeled *FA-Utility Raw Data* (raw data must be kept without conditioning as a quality-control reference) and then copied to the spreadsheet labeled *FA-Utility Working Data* in the MDWB to be sorted. The data were sorted within the *FA-Utility Working Data* spreadsheet to isolate building facilities kWh and therm usage; premise type, account numbers, addresses, and service descriptions are categories used to sort the data.

Once sorted, the data was copied to the *SWL-Energy Use Working Data* spreadsheet, where it was separated into the different facility groups. The kWh and therms were then summed per individual facility. The values per facility and grand total are reported in the *SWL-Energy Use Final Data* spreadsheet.

After the *SWL-Energy Use Final Data* spreadsheet was populated with all of the facilities and their kWh/therm usage, the information was entered into CACP. According to LGO Protocol, inventory of kWh emissions for the Building and Facilities sector is reported as Scope 2-purchased electricity while the inventory of therm emission is reported as Scope 1-stationary combustion. A separate record is entered into CACP per facility's kWh and therm usage to ensure the entry is reported under the correct Scope and with the correct emissions factor (differs for each utility provider).

Solid Waste Facilities: Solid Waste Landfill Emissions

This subsector within the Solid Waste sector of the inventory reports values of CH₄ and CO₂ emission from material historically deposited at municipal landfill sites. According to LGO Protocol the recommended method for reporting emissions from landfill waste depends on whether there is a Landfill Gas (LFG) collection system in place. During 2005, two of the County's four municipal landfills operated LFG collection systems (Corral Hollow and Harney Lane Landfills), while two did not (North County and Foothill Landfills).

For those landfills with LFG systems in place, emissions occur as a result of incomplete combustion of captured CH₄ and as a result of inefficiencies in the LFG collection process. LGO Protocol recommends using the following equation for these calculations, which are preset in MDWB:

Figure 14: LGO Protocol Equation 9.1 - Landfills with Comprehensive LFG Collection Systems¹¹

- CH_4 emitted (metric tons CO_2e) = $\text{LFG collected} \times \text{CH}_4\% \times \{(1 - \text{DE}) + [((1 - \text{CE}) / \text{CE}) \times (1 - \text{OX})]\}$ x unit conversion x GWP

Where:

Term	Description	Value
LFG collected	= Annual LFG collected by the collection system (MMSCF)	user input
CH ₄ %	= Fraction of CH ₄ in LFG	0.5, if no facility-specific value is available
DE	= CH ₄ Destruction Efficiency, based on the type of combustion/flare system.	.99 ¹
CE	= Collection Efficiency	0.75
OX	= Oxidation Factor	0.10 ²
Unit conversion	= Applies when converting million standard cubic feet of methane into metric tons of methane (volume units to mass units)	19.125
GWP	= Global Warming Potential to convert metric tons of methane into metric tons of CO ₂ equivalents (CO ₂ e).	21

Sources:

¹ EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2006*, Chapter 8, 8-4 (April 2008).

² IPCC *Guidelines for National Greenhouse Gas Inventories*, Chapter 3, 3.15, 3.19 (2006).

This method requires records for LFG per landfill facility to be acquired. The records were acquired through the County's Solid Waste division, and came in the following format:

- 2011 report to CARB, including LFG system performance, historical disposal amounts and historical LFG generation rates.

The data were copied into the *SWL-Landfill Raw Data* spreadsheet (raw data must be kept without conditioning as a quality-control reference). The following data were then entered into the corresponding cells within the *SWL-Landfill Final Data* spreadsheet.

- Quantity of LFG collected¹²
- % of methane collected
- destruction of methane efficiency
- collection system efficiency
- and methane oxidation factor (default value)

For those landfills without LFG systems in place, emissions occur as a result of CH₄ leakage from landfill sites. LGO Protocol recommends using a first order kinetics model based on the amount of waste disposed annually, its

¹¹ Source: *Local Government Operations Protocol*, Version 1.1 (May 2010) p. 99

¹² Historical LFG data had to be converted to the units specified by the equation in MDWB. The following ratio was provided by the Landfill Engineer to determine inventory year LFG collection: (Total 2011 recovery/2011 LFG generation rate)*inventory year LFG generation rate = Total inventory year collection.

composition, and the climate and operational conditions of the landfill. A First Order Decay (FOD) model¹³ is available through CARB and was used to calculate fugitive CH₄ emissions from landfill sites.

This method requires records for LFG per landfill facility to be acquired. The same records were obtained from the Solid Waste division for landfills without LFG capture systems. Historical deposit amounts were entered into the FOD model to calculate emissions. Calculated CH₄ values for the inventory year were then copied to the MDWB.

After the *SWL-Landfill Final Data* spreadsheet was populated with the CH₄ values, the information was entered into CACP as direct CH₄ emissions. According to LGO Protocol, inventory of Process emissions for the Solid Waste Landfill sector is reported as Scope 1-process emissions. A separate record is entered into CACP per landfill site.

Vehicle Fleet and Mobile Equipment

The Vehicle Fleet sector of the inventory reports emission from two main sources: fuel combustion and refrigerants. The recommended method for reporting vehicle related emission varies according to the emission source. For fuels, the recommended method requires individual vehicle fuel data in order to build a detailed fuel consumption record. Incomplete combustion of fuels is also estimated, which requires gathering individual vehicle miles travelled (VMT) and descriptive vehicle information. Finally, refrigerant data must be obtained similar to the methods employed in the Buildings and Facilities sector. Data records were acquired through the Fleet Services division in the following format:

- Detailed fuel consumption records by vehicle/equipment number, including fuel type, quantity and cost
- Detailed vehicle records by vehicle/equipment number, including VMT and/or operating hours for the inventory year, department assignment, model, make, and year
- Aggregate refrigerant purchases per year by refrigerant type

Vehicle Fleet and Mobile Equipment: Fuel and VMT Related Emissions

According to LGO Protocol, the emission from vehicle fleet must be reported according to CO₂ emissions, calculated directly from fuel combustion, and NO_x/ CH₄ emissions, calculated from VMT.

- Fuel (gallons) x Emissions Factor = CO₂ Emissions
- VMT (miles) x Emissions Factor = N₂O/ CH₄ Emissions

The raw data collected were inserted into the spreadsheet labeled *VF-Raw Data* (raw data must be kept without conditioning as a quality-control reference) and then copied to the spreadsheet labeled *VF-Working Data* in the MDWB to be sorted by;

- Department
- Vehicle type

¹³ Available at <http://www.arb.ca.gov/cc/protocols/localgov/localgov.htm>

- Fuel type

Once sorted and conditioned, data can then be entered into the *VF-Detailed Fuel Final Data* and *VF-Detailed VMT Final Data* spreadsheets where the total amount fuel and VMT will be reflected per department and vehicle type.

After the *VF-Detailed Fuel Final Data* and *VF-Detailed VMT Final Data* spreadsheets were populated, the information was entered into CACP. According to LGO Protocol, inventory of fuel and VMT emissions for the Vehicle Fleet sector is reported as Scope 1-mobile combustion. A separate record is entered into CACP per department making sure that the records are entered as follows:

- Fuel related emissions:
 - Fuel type
 - Vehicle type
 - Model year
 - Fuel CO₂ coefficient - *Default*
 - Transport Average - *Highway Fuel CO₂ only*
- VMT related emissions:
 - Fuel type
 - Vehicle type
 - Model year
 - Fuel CO₂ coefficient - *Highway VMT N₂O, CH₄, and CAP*
 - Transport Average - *Default* for VMT emissions.

Vehicle Fleet and Mobile Equipment: Refrigerant Related Emissions

This sector of the inventory required refrigerant charge information. For leaked refrigerants, the recommended method requires individual data per vehicle on the amount (lbs or kg) of refrigerant recharged into the vehicle. In the event that there is not sufficient information to complete the recommended method, alternative methods can be used to calculate the amount of leaked refrigerants. In this inventory, aggregate refrigerant purchases were used as an indicator of the amount of refrigerant recharged into vehicles throughout the year. According to the Fleet Services division, a recycling unit is used to service vehicles; some refrigerant is recycled, and some new refrigerant is added.

According to LGO Protocol, the recommended method for reporting emissions from leaked refrigerants and is the mass balance method where HFC's that have escaped into the atmosphere are summed and then multiplied by the Global Warming Potential (GWP) factor. A simplified version of the mass balance method was used in this sector of the inventory, with purchased refrigerants serving as a proxy measure of leaked refrigerants.

- Total purchased HFCs (kg) x GWP Factor = GHG Emissions

The raw data collected were inserted into the spreadsheet labeled *RF-Raw Data* and then copied to the spreadsheet labeled *RF-VF Working Data* in the MDWB (raw data must be kept without conditioning as a quality-control reference) to be sorted by refrigerant type. Once sorted and conditioned, the data were then entered into the *RF-VF Mass Balance Data* spreadsheet.

Once the *RF-VF Mass Balance Data* spreadsheet was populated, the information was entered into CACP. According to LGO Protocol, inventory of refrigerant emissions for the Vehicle Fleet sector is reported as Scope 1-fugitive emissions. A separate record is entered into CACP per leaked refrigerant mass to ensure the entry is reported under the correct Scope and with the correct GWP factor (differs for each refrigerant).

Certain refrigerant types which are categorized as ozone-depleting chemicals by international protocols, but not the LGO Protocol, have been included in the inventory as Information Items only. The most commonly used of these chemicals are R-12, R-22, and Halons (HCFCs), all of which have high global warming potentials. Emissions from ozone-depleting chemicals are not included in the inventory as they are being phased out under an internationally accepted agreement called the Montreal Protocol. Thus, R-12 emissions from vehicle refrigerant systems were not accounted for in Scope 1-fugitive emissions.

Vehicle Fleet and Mobile Equipment: Reporting Inconsistencies and Limitations

Scope 3 emissions from fuel combustion by employees during business travel were omitted from the inventory due to unavailability of data. Quantifying emissions from business travel requires identifying fuel consumption and fuel economy by vehicle. Travel-related reimbursements often include parking, air fare, food and hotel charges, which cannot be reliably separated from mileage reimbursements unless records are itemized.

Government-Generated Solid Waste

The Government-Generated Solid Waste sector of the inventory reports emission from one main source: solid waste. This sector of the inventory requires data pertaining to the amount of waste collected from County operations.

Government-Generated Solid Waste: Solid Waste Related Emissions

According to LGO Protocol the recommended method for reporting emissions associated with solid waste is to acquire the volume of waste collected per department within the local government operations. This information was entered into the *WG-Solid Waste by Volume* spreadsheet. The volumes are converted to tons of waste that are ultimately sent to landfill. The totals are then pasted into the *WG-Solid Waste Final Input Data* spreadsheet and used to create a record within CACP. The government-generated waste was entered into CACP as Scope 3 – waste related emissions. The following waste characterization¹⁴ is preset in CACP with different emissions factors for each waste type:

- Paper Products – 39.4%
- Food Waste – 9.8%
- Plant Debris – 7.0%

¹⁴ Default Waste Characterization provided by the CIWMB 1999 Waste Characterization Study -- Public Administration Group: <http://www.ciwmb.ca.gov/WasteChar/BizGrpCp.asp>. Waste categories in the report were bundled to fit the waste categories of the Clean Air and Climate Protection 2009 software (CACP 2009).

- Wood and Textiles – 6.7%
- All other waste – 27.1%

Government-Generated Solid Waste: Reporting Inconsistencies and Limitations

Detailed government-generated solid waste data was not obtained for this inventory. However, emissions related to solid waste decomposition has been quantified for all municipal landfills in the County. *See Solid Waste Facilities above.*

Employee Commute

The Employee Commute sector of the inventory reports emission from one main source: fuel combustion. The recommended method for reporting vehicle related emission varies according to the emission source. For fuels, the recommended method requires individual vehicle fuel data in order to build a detailed fuel consumption record. Incomplete combustion of fuels is also estimated, which requires gathering individual vehicle miles travelled (VMT) and descriptive vehicle information.

Employee Commute: Fuel and VMT Related Emissions

Employee commute data were acquired through an online survey of current employees' commute habits. A survey designed by ICLEI was administered by San Joaquin County staff. Survey results were automatically recorded to an exportable spreadsheet, and then entered into the *EC-Raw Data* spreadsheet of MDWB. Annual fuel consumption by fuel type was automatically calculated within MDWB. Mileage and descriptive vehicle information responses were conditioned to calculate VMT by vehicle and fuel type. All calculated values were reported in the *EC-Emissions Final Data* spreadsheet.

The results of current employee responses were used as a sample of total employees' commute habits. Annual fuel consumption and VMT were extrapolated to 2005 employee levels using the ratio of responses to 2005 staff-levels (approximately 1:7.8).

The adjusted VMT for each vehicle type was entered into CACP as Scope 3 – employee commute. The Total VMT value was entered with the transport average set coefficients set to default and the fuel set coefficients set to Highway VMT (N₂O, CH₄). The Total Fuel value was entered into CACP as Scope 3 – employee commute. For this data the transport average set coefficients set to Highway Fuel CO₂ only and the fuel set coefficients set to default.

Next Steps

ICLEI’s Five Milestone Process

While San Joaquin County has already begun to reduce greenhouse gas emissions through its actions, this inventory represents the first step in a systematic approach to reducing San Joaquin County’s emissions. This system, developed by ICLEI, is called the Five Milestones for Climate Mitigation. This Five Milestone process involves the following steps:

- Milestone One:** Conduct a baseline emissions inventory and forecast
- Milestone Two:** Adopt an emissions reduction target for the forecast year
- Milestone Three:** Develop a local climate action plan
- Milestone Four:** Implement the climate action plan
- Milestone Five:** Monitor progress and report results

Figure 15: ICLEI’s Five Milestones for Climate Mitigation



ICLEI staff are available to local governments who are members and should be contacted to discuss the full range of resources available at each stage of the Milestone process. The following sections provide a glimpse at next steps and help capture the lessons learned in conducting this inventory.

Setting Emissions Reduction Targets

This inventory provides an emissions baseline that can be used to inform Milestone Two of ICLEI's Five-Milestone process—setting emissions reduction targets for San Joaquin County's municipal operations. The greenhouse gas emissions reduction target is a level of emissions a certain percentage below the base year level to be achieved 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 towards which to strive and against which to measure progress. It allows a local government to quantify its commitment to fighting global warming—demonstrating that San Joaquin County 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. San Joaquin County should give itself enough time to implement chosen emissions reduction measures— noting that the farther out the target year is, the more San Joaquin County should pledge to reduce. ICLEI recommends that regardless of the chosen long-term emissions reduction target (e.g., 15-year, 40-year), San Joaquin County 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, San Joaquin County should plan to re-inventory its emissions on a regular basis; many jurisdictions are electing to perform annual inventories. ICLEI recommends conducting an emissions inventory every three to five years.

The Long-Term Goal

ICLEI recommends that 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, San Joaquin County 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 in order for local governments to reduce emissions by 80 to 95 percent, state and federal policy changes that create new incentives and new sources of funding for emissions reduction projects and programs are essential. Throughout the next 15 years, there is much that local governments can do to reduce emissions independently, as well. It is very important that San Joaquin County 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 reduction 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, ICLEI recommends that San Joaquin County consider department-specific targets for each of the departments that generate emissions within its operations. This allows San Joaquin County staff to do a more in-depth analysis of what is achievable in each sector in the near, mid and long-term, and also encourages department leaders to consider their departments’ impact on the climate and to institute a climate-conscious culture within their operations.

Creating an Emissions Reduction Strategy

This inventory identifies the major sources of emissions from San Joaquin County’s operations and, therefore, where policymakers will need to target emissions reduction activities if they are to make significant progress toward adopted targets. For example, since the Solid Waste Facilities sector was a major source of emissions from San Joaquin County’s operations, it is possible that San Joaquin County could meet near-term targets by implementing a few major actions within the Solid Waste Facilities sector. Medium-term targets could be met by focusing emissions reduction actions on the following sectors: Buildings and Facilities, Employee Commute, Vehicle Fleet, and Public Lighting. 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, ICLEI recommends that San Joaquin County focus on the following tasks in order to significantly reduce emissions from its government operations:

General across-the-board recommendations

- Participate in Phase II of Green Communities: Community-Wide Inventories, in order to gather necessary data to develop effective policies which result in extensive reductions through implementation of a Climate Action Plan for the larger community.
- Develop an equipment database to help with the reuse of old furniture and fixtures.
- Procure solar or other low-carbon based electricity.
- Promote training, education, rewards, incentives, encouragement and support for emissions reductions across the board.
- Review feasibility of alternative energy production at County facilities.

Improving energy efficiency in buildings and facilities

- Change procurement policy to specify energy star compliant HVAC systems and refrigerators.
- Install smart lighting fixtures with occupancy sensors.
- Perform a comprehensive energy retrofit of existing buildings, especially the older buildings, including lighting, insulation, windows and HVAC systems for improved energy efficiency, cost savings, and building performance.
- Utilize the U.S. EPA's Energy Star facility benchmarking program, Portfolio Manager, to track facility energy efficiency on a monthly basis and compare results to national energy efficiency standards.

Improving energy efficiency in public lighting

- Analyze reduction potential for streetlights and other public lighting.
- Analyze reduction potential for the LS-1 designated streetlights.
- Switch traffic signals and public lighting from incandescent bulbs to Light Emitting Diodes (LEDs)

Reducing emissions from vehicle fleet

- Explore feasibility of biofuels to replace vehicle fleet fuel usage.
- Explore implementing a no-idling policy for fleet vehicles.
- Promote procurement of plug-in hybrids where practical, which can reduce vehicle emissions by up to 50% in PG&E territory.
- Reduce usage of county-owned vehicles, replace those which are not fuel efficient, and change procurement policy to specify high fuel efficiency for each vehicle class.
- Specify high fuel efficiency during procurement for new vehicles of all classes.
- Switch to refrigerants that have a lower GWP (global warming potential)

Reducing emissions from employee commute

- Implement employee commute programs aimed at reducing greenhouse gas emissions.
- Encourage and incentivize telecommuting to reduce emissions from employee commute.
- Encourage employees to use alternative modes of transportation by offering enhanced commuter benefits.
- Explore various policies to encourage walking and biking in good weather by employees that live within 5 miles and encourage carpooling by all employees
 - Give incentives for employees to use the transit system or carpool.
 - Implement a Commute Trip Reduction (CTR) program (e.g. carpooling and biking incentives). (<http://www.vtppi.org/tdm/tdm9.htm>).

Reducing solid waste

- Change procurement policy to recommend recycled, reusable and recyclable materials, including office supplies (e.g. paper, cardboard, cans, toner cartridges).
- Implement paper and toner reduction strategies to reduce excess paper and toner usage, e.g. double-sided printing and fonts that use less ink (i.e., Century Gothic, Times New Roman and Calibri).
- Perform a Comprehensive analysis of waste stream.

Using a variety of these strategies as a basis for a more detailed overall emissions reductions strategy, or climate action plan, San Joaquin County 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, San Joaquin County staff identified the following gaps in data that, if resolved, would allow San Joaquin County to meet the recommended methods outlined in LGO Protocol in future inventories.

- Improve the method of tracking the amount of waste generated by division, department or facility. During the inventory, attempts were made to obtain government-generated solid waste data from the county's contracted waste-hauler; however, private sector companies do not often maintain records as far back as five years. It is recommended that the county record this data internally for future inventory use.

- Ask the county’s HVAC/refrigeration maintenance division (or external contractor) to determine exact original charge, recharge, and leakage of refrigerants in building HVAC systems and refrigeration equipment (e.g. vending machines, domestic refrigerators, etc.)
- Differentiate between routine vehicle fuel purchases for specific vehicles and the purchase of fuels for re-fueling canteens, and track usage by vehicle/equipment.
- Direct tracking of refrigerants recharged into vehicles in the vehicle fleet
- Direct tracking of street light conversion to LED
- Track employee business travel reimbursements and require vehicle detail (e.g. make, model, year, fuel economy) to be noted, along with mileage, on reimbursement forms
- Track the amount of fire suppressant equipment discharged each year, and record recharge quantities
- Track utility invoices by department and reconcile with total utility costs
- Track separate fuel consumption for off-road vehicles and equipment, including backup generators

ICLEI encourages staff to 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 San Joaquin County 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
- Access to an online account for staff to access PG&E energy and greenhouse gas emission data for the jurisdiction: <http://greencommunities.pge-smartrate.com/user>