City of San Luis Obispo

Community and Municipal Operations
2005 Baseline Greenhouse Gas Emissions Inventory

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Executive Summary

There is increasing scientific evidence that carbon dioxide (CO_2) and other greenhouse gases released into the atmosphere will have a profound effect on the Earth' climate, increasing the risk of increased extreme weather events, changing rainfall and crop productivity patterns, and migration of infectious diseases. It is a well-researched fact that the combustion of fossil fuels releases greenhouse gases into the atmosphere, causing global surface temperatures to increase.

Climate change is quickly becoming a high priority among policy makers and residents alike. In January 2008, the San Luis Obispo City Council made a commitment to determine San Luis Obispo's contribution to global climate change through the development of a *Community and Municipal Operations Baseline Greenhouse Gas Emissions Inventory*. This inventory identifies the major sources of greenhouse gas emissions within the city and provides a baseline against which future progress can be measured. This inventory includes two components: a community-wide analysis and a city government operations analysis. It is important to note that the municipal operations inventory is a subset of the community inventory, meaning that all municipal operations emissions are included in the categories of the community-wide inventory. The municipal operations inventory should not be added to the community analysis; but rather the community-wide inventory should be considered to be inclusive of the municipal operations. Specifically, this inventory does the following:

- Calculates greenhouse gas emissions from community-wide activities, including municipal government operations, within the City's jurisdictional boundary in 2005;
- Identifies the major sources of greenhouse gas emissions from community-wide sources and municipal government operations;
- Provides decision-makers and the community with baseline information to help set the framework for the climate action planning process; and
- Forecasts how emissions will grow in the community under "business-as-usual" conditions

This greenhouse gas emissions inventory represents the completion of the first step in San Luis Obispo's climate protection process. As advised by ICLEI – Local Governments for Sustainability, it is essential to first quantify recent-year emissions to establish: (1) a baseline, against which to measure future progress, and (2) an understanding of where the highest percentages of emissions are coming from, and, therefore, where the greatest opportunities for emissions reductions are.

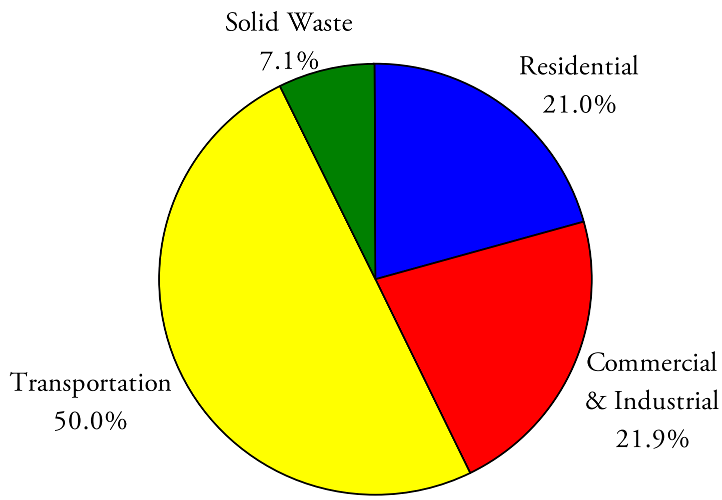
Through energy efficiency in its facilities and vehicle fleet, clean alternative energy sources, sustainable purchasing and waste reduction efforts, land use and transportation planning, San Luis Obispo can achieve multiple benefits, including lower energy bills, improved air quality, economic development, reduced emissions, and a better quality of life throughout the community. Reporting the City's emissions will aid policy makers in forecasting emission trends, identifying the point and mobile sources of emissions generated, and setting future reduction targets and mitigation measures.

Community-wide greenhouse gas inventory results

This greenhouse gas inventory report identifies that the community of San Luis Obispo emitted approximately 264,237 metric tons of carbon dioxide equivalent ($MTCO_2e$) in the baseline year 2005. As shown in Figure 1, the transportation sector was by far the largest contributor to emissions (50.0%), producing approximately 132,137 $MTCO_2e$ in 2005. Emissions from the residential sector accounted for 21.0% of the total emissions, while emissions from the commercial and industrial sector accounted for 21.9% of the total emissions. The solid waste sector generated the remaining 7.1% of community-wide emissions.

The majority of emissions from the transportation sector were the result of gasoline consumption in private vehicles traveling on major and minor arterials and on U.S. 101 through the community. Vehicle miles of travel on U.S. 101 accounted for 30.7% of all transportation sector emissions and 15.3% of community-wide emissions. Greenhouse gas figures from the solid waste sector are the estimated future emissions that will result from the decomposition of waste generated by county residents and businesses in the base year 2005, with methane recovery factor of 60%.

Figure 1:
Community Greenhouse Gas Emissions by Sector



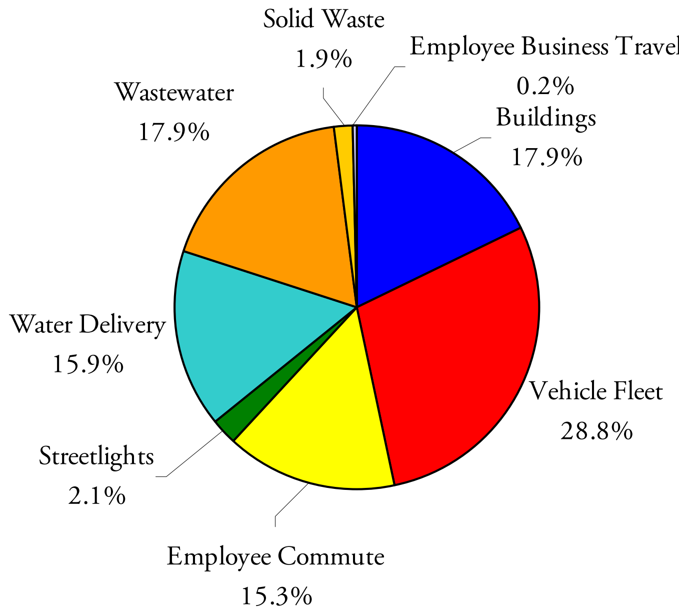
Municipal operations greenhouse gas inventory results

In 2005, the municipal operations of the City of San Luis Obispo generated 6,580 $MTCO_2e$, and consumed approximately 94,483 MMBtu of energy. The total cost associated with annual energy and fuel usage in 2005 was $1.871 million. The city's operations generate approximately 2.5% of all community-wide emissions.

Emissions generated by the municipal operations of the City of San Luis Obispo are comprised of the fuel consumption by the city's vehicle fleet, energy consumption from water and wastewater facilities, building energy, employee commute trips, streetlight electricity, and solid waste. About 96 percent of those emissions were produced by the Vehicle Fleet, Building and Facilities, Water Delivery, Wastewater, and Employee Commute sectors. As displayed in Figure 2, the Vehicle Fleet sector generated 1,898 $MTCO_2e$ (28.8%), the Buildings sector generated 1,178 $MTCO_2e$ (17.9%), the Wastewater sector generated 1,175 $MTCO_2e$ (17.9%), the Water Delivery sector generated

1,043 $MTCO_2e$ (15.9%), and the Employee Commute sector generated 1,009 $MTCO_2e$ (15.3%). The remaining 3 percent of government operations' greenhouse gas emissions were generated from the other three sectors: the municipal Solid Waste sector generated 125 $MTCO_2e$ (1.9%), the Streetlights and Traffic Signals sector generated 141 $MTCO_2e$ (2.1%), and Employee Business Travel sector generated 11 $MTCO_2e$ (0.2%). In 2005, the single largest generator of greenhouse gas emissions was the city's water reclamation facility, which generated about 17.3 percent of all municipal operation emissions.

Figure 2:
Municipal Operations GHG Emissions by Sector



Municipal operations emissions are a subset of the total community-wide emissions. This inventory analyzes municipal emissions separately in order to be able to identify energy cost-saving opportunities and emission reduction strategies appropriate for the community. The municipal operations inventory is guided by the *Local Government Operations Protocol*, which is designed to provide a standardized set of guidelines to assist local governments in quantifying and reporting greenhouse gas emissions associated with their government operations. Developed jointly by the California Air Resources Board (ARB), California Climate Action Registry (CCAR), ICLEI – Local Governments for Sustainability (ICLEI), and The Climate Registry, the *Protocol* provides the principles, approach, methodology, and procedures needed to develop a local government operations greenhouse gas emissions inventory. An additional protocol for community emissions is currently being developed[1].

Data Limitations

Thanks to a grant from the Air Pollution Control District and the concurrent timing of the preparation of greenhouse gas emissions inventories for several jurisdictions the consultant firm preparing the San Luis Obispo County *Community-wide and County Government Operations 2006 Baseline Greenhouse Gas Emissions Inventory* provided technical assistance, among other tasks, regarding the analysis of emission-generators impacting multiple jurisdictions (i.e., commercial air traffic at San Luis Obispo County Regional Airport). It was determined that existing reporting protocols for greenhouse gas emissions were insufficient at this time to accurately assign commercial air traffic's share of passengers who reside in the City of San Luis Obispo to the community

[1] AB 32 *Scoping Plan*, page 27 (2008).

inventory for the baseline year. A similar determination was made regarding passenger rail miles on the Amtrak rail service through San Luis Obispo.

The sources that could not be included due to privacy laws, lack of data availability, and/or a reasonable methodology include the following:

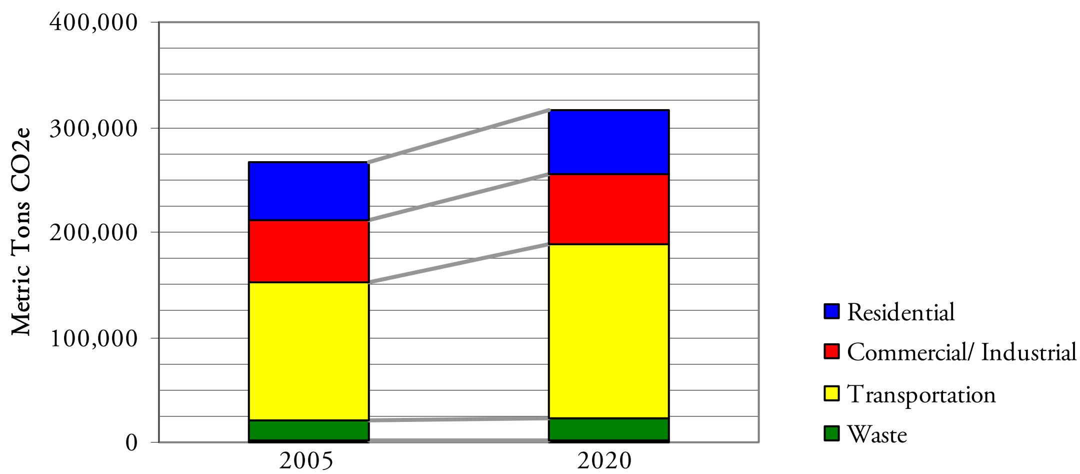
- Commercial air traffic attributable to residents from San Luis Obispo
- Passenger rail traffic attributable to residents from San Luis Obispo
- Freight traffic through San Luis Obispo
- Electricity usage for industrial businesses in San Luis Obispo (information was aggregated with the commercial use sector information)
- Vehicle mileage and fuel usage specific to each vehicle in the city's fleet; figures are instead aggregated for all vehicles
- Refrigerants from municipal facilities and vehicles
- Emissions from construction and demolition activities in San Luis Obispo

These limitations are explained further in this document.

Forecast and Next Steps

If consumption and growth trends continue based on those in 2005, emissions levels will reach 314,832 metric tons of CO_2e by 2020, which is a 19.1 percent increase. This growth, shown in Figure 3, is due to projected increases in household, population, and jobs within the County[2].

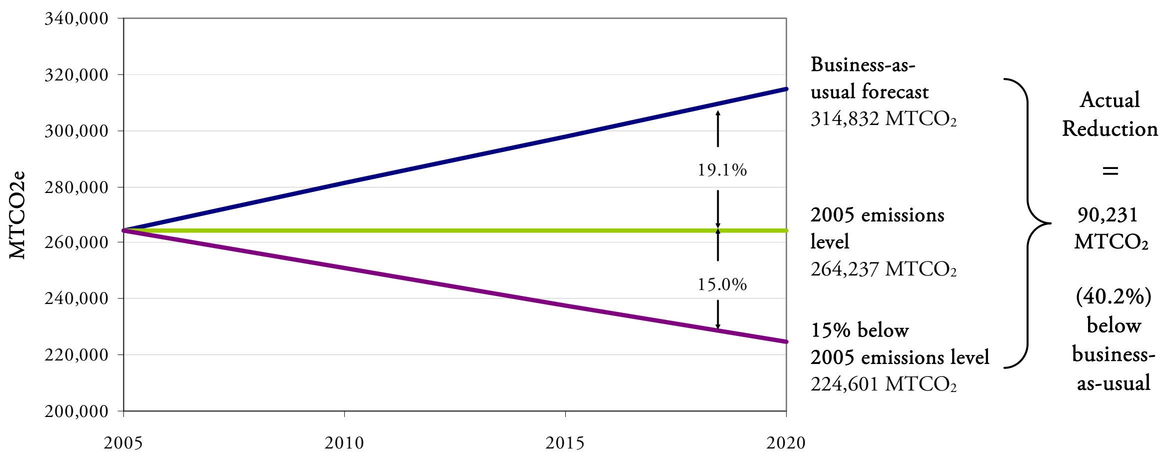
Figure 3: 2020 City of San Luis Obispo
Business-As-Usual GHG Emissions Forecast



[2] See Chapter 5 (Forecast) for more information on the projected increases in emissions in each sector and an explanation of the source of data used to develop this projection.

Given this information, the city can make a determination of a reduction target. In its recently approved AB 32 *Scoping Plan*, ARB encourages local governments to adopt a reduction goal for municipal operations emissions and to establish similar goals for community emissions that parallel the State commitment to reduce greenhouse gas emissions by approximately 15 percent from current levels by 2020[3]. If the City were to conform to this recommended reduction of 15 percent below current levels (to an estimated 224,601 metric tons of carbon dioxide equivalent), it would require a reduction of 90,231 metric tons of carbon dioxide equivalent below the city's 2020 business-as-usual emissions (Figure 4), which is equivalent to a 40.2 percent reduction.

FIGURE 4: Greenhouse Gas Forecast in relation to 15% Reduction Target (2005-2020)



[3] AB 32 *Scoping Plan*, page 27 (2008).

1. Introduction

1.1 Purpose of the Study

The purpose of this study is to inventory greenhouse gas emissions produced by the City of San Luis Obispo's government operations and the community-wide emissions from residents and businesses in San Luis Obispo. Reporting the City's emissions will aid policy makers in forecasting emission trends, identifying the point and mobile sources of emissions generated, and setting goals for future reductions and mitigation. Completion of the greenhouse gas emissions inventory represents the first milestone of ICLEI's CCP Campaign and fulfills a primary action of the U.S. Mayors Climate Protection Agreement.

1.2 Climate Change Background

Over the past 20 years, the extent, cause and impacts of global climate change have been debated with some uncertainty. However, more than 21,500 of the world's top climate scientists have reached consensus that global climate change is a human-created environmental and economic challenge of significant scope. According to the report *"Climate Change 2007" - Working Group I Report: The Physical Science Basis* of the *Fourth Assessment Report* prepared by more than 1,500 scientists of the Intergovernmental Panel on Climate Change (IPCC):

> "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level" (IPCC, 2007).
>
> "Most of the observed increase in globally average temperatures since the mid 20th century is *very likely*[4] due to the observed increase in anthropogenic greenhouse gas concentrations" (IPCC, 2007).
>
> "Continued greenhouse gas emissions at or above current rates would case further warming and induce many changes in the global climate system during the 21st century that would *very likely* be larger than those observed during the 20th century" (IPCC, 2007).

The greenhouse effect is a natural phenomenon whereby certain gases in the earth's atmosphere, known as greenhouse gases, absorb heat that would otherwise escape to space. This heat originates from visible sunlight that warms the earth's surface. Subsequently, heat radiates from the surface to the atmosphere, where some of it is absorbed by greenhouse gases and radiated back to the surface, helping to maintain the surface temperatures and make Earth habitable. Some greenhouse gases

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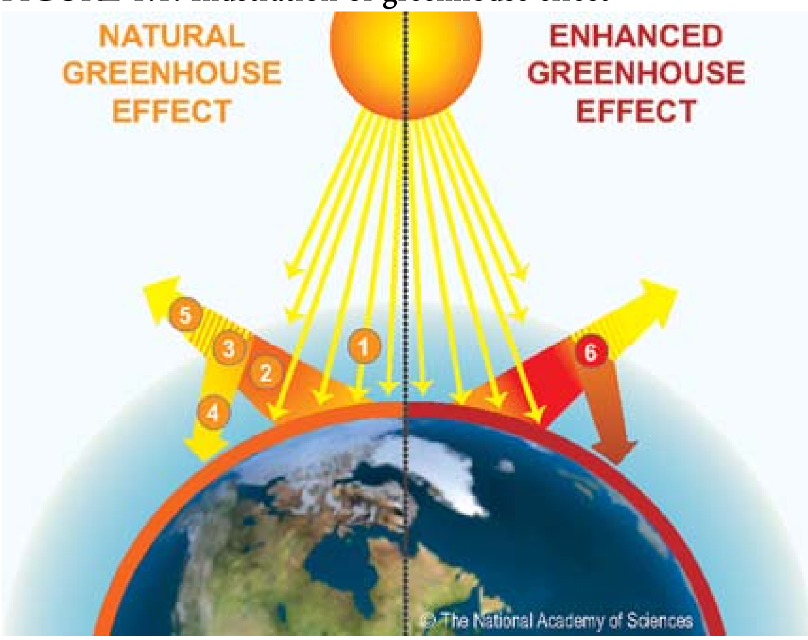
[4] The IPCC defines "very likely" as greater than 90 percent.

occur naturally in the atmosphere, while others result from human activities. Naturally occurring greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, and ozone. Recent progress in climate modeling has generated a consensus among climate scientists that greenhouse gases emitted by human activities are likely (66-90% chance) to have caused most of the observed global temperature rise over the past 50 years[5]. Figure 1.1 illustrates the natural greenhouse effect on the left. Visible sunlight passes through the atmosphere without being absorbed. Some of the sunlight striking the earth is absorbed (1) and converted to infrared radiation (heat), which warms the surface. The surface emits infrared radiation to the atmosphere (2), where some of it is absorbed by the greenhouse gases (3) and redirected toward the surface (4). Some of the infrared radiation is not trapped by greenhouse gases and escapes into space (5). On the right side, the illustration shows how additional emissions generated into the atmosphere by human activities functions to increase the amount of infrared radiation that gets absorbed before escaping to space, which in turn enhances the greenhouse effect and amplifies the warming of the earth[6].

FIGURE 1.1: Illustration of greenhouse effect



Source: Marian Kosbland Science Museum of the National Academy of Sciences

The rise of carbon dioxide gas in our atmosphere has been measured continuously since 1958 and follows an oscillating, upward line known as the "Keeling Curve" (see Figure 1.2), named after Dr. Charles Keeling, who was the first to measure carbon dioxide in the atmosphere on a continuous basis. Before the industrial era, research indicates atmospheric CO_2 concentration was between 275 and 280 parts per million by volume (ppmv) for several thousand years. Carbon dioxide has risen continuously since then, and the average value when Dr. Keeling started his measurements in 1958 was near 315 ppmv. By the year 2000 it has risen to about 367 ppmv, a one-third increase over the

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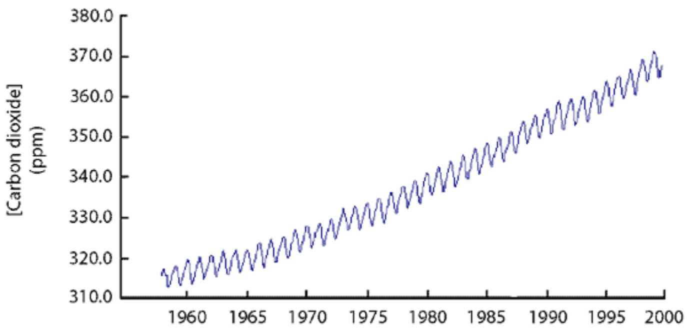
[5] Mitchell, et al. 2001. *Detection of climate change and attribution of causes.*
[6] Pew Center on Global Climate Change, *The Causes of Global Climate Change*, August 2008.

pre-industrial era[7]. As discussed above, as the concentration of atmospheric carbon dioxide and other greenhouse gases continues to rise, it lessens the ability of the earth's surface to radiate heat to space, accelerating the warming of the earth's surface.

FIGURE 1.2: Keeling Curve of Atmospheric Carbon Dioxide (1958-2000)



Carbon dioxide (CO_2) is released to the atmosphere when solid waste, fossil fuels (oil, natural gas, and coal), and wood and wood products are burned.

Methane (CH_4) is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from the decomposition of organic waste in municipal solid waste landfills, and the raising of livestock.

Nitrous oxide (N_2O) is emitted during agricultural and industrial activities, as well as during combustion of solid waste and fossil fuels.

Very powerful greenhouse gases, also known as high global warming potential (GWP) gases that are not naturally occurring, including hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6), are generated in a variety of industrial processes. Each of the six greenhouse gases (the three naturally occurring and the three listed here) differs in its ability to absorb heat in the atmosphere. High GWP gases such as HFCs, PFCs, and SF_6 are the most heat-absorbent. For example, methane traps over 21 times more heat per molecule than carbon dioxide, and nitrous oxide absorbs 310 times more heat per molecule than carbon dioxide. For the purposes of a greenhouse gas emissions inventory, greenhouse gas emissions are presented in carbon dioxide equivalents, which weight each gas by its GWP. Table 1.1 shows the global warming potentials for different greenhouse gases for a 100-year time horizon.

---

[7] University of California, San Diego: http://earthguide.ucsd.edu/globalchange/keeling_curve/01.html

TABLE 1.1: Global Warming Potentials (GWPs) for Greenhouse Gases

Greenhouse Gas	Global Warming Potential
CO_2 (carbon dioxide)	1
CH_4 (methane)	21
N_2O (nitrous oxide)	310
HFCs (hydrofluorocarbons)	140-11,700
PFCs (perfluorocarbons)	6,500-9,200
SF_6 (sulfur hexafluoride)	23,900

Source: Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report (1995)

1.3 Greenhouse Gas Inventories

The greenhouse gas inventory process is relatively new. Greenhouse gas inventories originated as an international response to mitigate global climate change. Fundamentally, a greenhouse gas inventory measures the amount of heat-trapping gases that an entity contributes to the atmosphere. By quantifying emissions, an entity can identify a starting place or benchmark to understand where future efforts will have the greatest impact to reduce areas of higher emissions.

Each year, the U.S. Environmental Protection Agency (EPA) prepares a national greenhouse gas inventory report. The 2008 report, which estimates U.S. greenhouse gas emissions and sinks[8] for the years 1990-2006, defines a greenhouse gas inventory as:

> "A greenhouse gas inventory is an accounting of the amount of greenhouse gases emitted to or removed from the atmosphere over a specific period of time (e.g., one year). A greenhouse gas inventory also provides information on the activities that cause emissions and removals, as well as background on the methods used to make the calculations. Policy makers use greenhouse gas inventories to track emission trends, develop strategies and policies and assess progress. Scientists use greenhouse gas inventories as inputs to atmospheric and economic models" (EPA, 2008).

With the passage of AB 4420 (Sher, Chapter 1506, Statutes of 1988), the California Energy Commission (CEC) was directed to study global warming impacts to the state and develop an inventory of greenhouse gas emissions sources. The first greenhouse gas emissions inventory for the State of California was published in October 1990 by the CEC, covering only one year (1988) and only provided an inventory of CO_2[9]. The second statewide inventory of greenhouse gas emissions was published in March 1997 and was also only for one year (1990) but included an estimate for

[8] Greenhouse gas sinks, also known as "carbon sinks", are any physical unit or process that stores greenhouse gas emissions; the process of absorbing greenhouse gas emissions is commonly referred to as carbon sequestration, which may occur by way of conservation of riparian buffers, grazing land management, forest preservation, or tree planting (Ravin, A., and T. Raine. *Best Practices for Including Carbon Sinks in Greenhouse Gas Inventories*.)

[9] California Energy Commission, October 1990, 1988 *Inventory of California Greenhouse Gas Emissions*, Sacramento, California, Final Staff Report.

methane and nitrous oxide emissions in addition to CO_2[10]. In January 1998, the CEC published a five-year inventory covering years 1990 through 1994[11]. In 2000, Senate Bill 1771 (Sher, Chapter 1018, Statutes of 2000) was passed, requiring the CEC to update the inventory in January 2002 and every five years after that. The first statewide inventory developed under SB 1771, titled *Inventory of California Greenhouse Gas Emissions and Sinks: 1990-1999* was developed following the guidance set forth by the Intergovernmental Panel on Climate Change (IPCC) and was consistent with the methods used by the EPA. The most recent statewide inventory completed by the CEC, the *Inventory of California Greenhouse Gas Emissions and Sinks: 1990-2004*, estimates California produced 492 million metric tons of greenhouse gas emissions in 2004[12].

In January 2007, Assembly Bill 1803 transferred responsibility for developing and maintaining the State's greenhouse gas inventory from the CEC to the Air Resources Board (ARB). Using the CEC's most recent inventory as a starting point, the ARB determined the State's 1990 greenhouse gas emissions level by conducting a comprehensive review of all greenhouse gas emitting sectors to comply with the requirements of AB 32 (discussed below). The ARB determined the 1990 total statewide emissions estimate to be the same identified in the CEC's inventory, but found differing emissions within each sector of the inventory. According to this inventory, the estimated statewide emissions for 1990 are 427 million metric tons of carbon dioxide equivalents ($MMTCO_2e$), while the estimated statewide emissions for 2004 are 484 $MMTCO_2e$ [13]. The preliminary statewide emissions estimate for 2020, assuming no emission-reduction measures are taken, is 596 $MMTCO_2e$. The difference between the proposed 1990 emissions level and ARB's preliminary estimate of 2020 emissions is therefore 169 $MMTCO_2e$ [14].

1.4 Climate Action at the State Level

The State of California has established itself as a leader in climate action planning. In 2005, Governor Schwarzenegger issued Executive Order S-3-05, which established three aggressive deadlines and targets to achieve greenhouse gas emissions reductions. Those goals are as follows:

- By 2010, reduce greenhouse gas emissions to 2000 levels;
- By 2020, reduce greenhouse gas emissions to 1990 levels;
- By 2050, reduce greenhouse gas emissions to 80 percent below 1990 levels.

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[10] California Energy Commission, March 1997, *California's Greenhouse Gas Emissions Inventory 1990*, Sacramento, California, P500-97-004.

[11] California Energy Commission, January 1998, *Appendix A. Historical and Forecasted Emissions Inventories for California*, Sacramento, California, P500-98-011V3.

[12] California Energy Commission, December 2006, *Inventory of California Greenhouse Gas Emissions and Sinks: 1990-2004*, Sacramento, California, CEC-600-2006-013-SF.

[13] California Air Resources Board, November 2007, *California 1990 Greenhouse Gas Emissions Level and 2020 Emissions Limit*, Staff Report

[14] California Air Resources Board, December 2008, AB 32 *Scoping Plan*, Sacramento, California.

To allow for implementation of these aggressive goals, in 2006, the Legislature passed and Governor Schwarzenegger signed AB 32, the Global Warming Solutions Act of 2006, which set the 2020 greenhouse gas emissions reduction goal into law. One of the primary objectives of AB 32 is to reduce statewide greenhouse gas emissions to 1990 emissions levels by 2020. The law directed ARB to begin developing discrete early actions to reduce greenhouse gases while also preparing a Scoping Plan to identify how best to reach the 2020 limit. The reduction measures to meet the 2020 target will go into effect in 2012. There are a number of specific requirements for ARB under AB 32, one of which states: "Ensure early voluntary reductions receive appropriate credit in the implementation of AB 32." The AB 32 *Scoping Plan* was approved in December 2008 with a set of proposed measures and more specific targets for emission reductions in various sectors in order to attempt to achieve the 1990 emissions levels of 427 $MMTCO_2e$ by 2020. For example, the AB 32 *Scoping Plan* estimates the potential reduction of emissions from the Green Building sector to be 26 $MMTCO_2e$[15].

Other significant pieces of state legislation shaping climate action planning in California include SB 97, SB 375, and SB 1078 (California Renewables Portfolio Standard). SB 97 requires the Governor's Office of Planning and Research to develop guidelines for addressing climate change in CEQA documents (guidelines to be approved in 2010). SB 375 (Steinberg) is a complex piece of legislation intended to align separate processes of land use planning, transportation planning, and the regional housing needs allocation process in an effort to reduce statewide greenhouse gas emissions by up to 5 $MMTCO_2e$. The California Renewables Portfolio Standard requires electric corporations to increase their renewable energy portfolio by at least 1% of their retail sales each year until they reach 20% in 2010.

1.5 Climate Action at the Local Level

While international and national efforts to mitigate global climate change are evolving[16], many cities and counties across the country and around the world have initiated local greenhouse gas emissions studies and programs to reduce emissions. Bottom-up initiatives are taking root and growing rapidly in local communities. Lasting reductions in greenhouse gas emissions are possible however when individuals, organizations and energy producers change their behavior and activities, and employ different technologies, something that can be initiated through local action.

Monitoring greenhouse gas emissions is the critical first step to setting a goal for emissions reductions, developing policies and programs to achieve that goal, and measuring progress toward reductions. This work represents the first comprehensive effort to quantify greenhouse gas emissions generated by the City of San Luis Obispo government operations and the community at-large.

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[15] California Air Resources Board, AB 32 *Scoping Plan* (2008).

[16] See section 6.6

On February 16, 2005 the Kyoto Protocol, the international agreement to address climate change, became law for the 141 countries that have ratified it to date. On that same day, Seattle Mayor Greg Nickels launched an initiative called the U.S. Mayors Climate Protection Agreement to advance the goals of the Kyoto Protocol through leadership and action by at least 141 American cities. The City of San Luis Obispo signed the U.S. Mayors Climate Protection Agreement which states:

> "We urge the federal government and state governments to enact policies and programs to meet or beat the target of reducing global warming pollution levels to 7 percent below 1990 levels by 2012…
>
> "… we will strive to meet or exceed Kyoto Protocol targets for reducing global warming pollution by taking actions in our own operations and communities such as:
> (1) **Inventory global warming emissions in City operations and in the communities, set reduction targets and create an action plan;**
> (2) Adopt and enforce land-use policies that reduce sprawl, preserve open space, and create compact, walkable urban communities;
> (3) Promote transportation options such as bicycle trails, commute trip reduction programs, incentives for car-pooling and public transit…"
>
> - The U.S. Mayors Climate Protection Agreement (2005)

The goal of 141 signatories was reached by June 2005, at the annual U.S. Conference of Mayors Annual Meeting. As of May 2009, 944 mayors from the fifty states, the District of Columbia and Puerto Rico have signed the agreement, representing a population of over 81 million citizens[17]. In California alone, 122 cities to date have signed the agreement. Atascadero and Morro Bay are the other cities in San Luis Obispo County that have signed the agreement. The full text of the agreement is in Appendix D.

In 1993, at the invitation of ICLEI – Local Governments for Sustainability[18], municipal leaders met at the United Nations Headquarters in New York and adopted a declaration that called for the establishment of a worldwide movement of local governments to reduce greenhouse gas emissions, improve air quality, and enhance urban sustainability. The resulting Cities for Climate Protection (CCP) Campaign now includes nearly 6,000 local governments worldwide that are integrating climate change mitigation into their decision making processes.

The City of San Luis Obispo adopted a resolution to join ICLEI and the Cities for Climate Protection Campaign in spring 2008. The CCP Campaign provides a framework for local communities to identify and reduce greenhouse gas emissions, and is organized along five milestones:

1. Conduct a baseline emissions inventory and forecast
2. Set an emissions reduction target

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[17] U.S. Mayors Climate Protection Agreement website, http://usmayors.org/climateprotection/

[18] Formally known as International Council for Local Environmental Initiatives

3. Develop an action plan to meet the emissions reduction target
4. Implement the action plan
5. Monitor and verify progress and results

This report represents the completion of the first CCP milestone, and provides a foundation for future work to reduce greenhouse gas emissions in San Luis Obispo. Milestones 2 through 5 are explained in Chapter 6. Additionally, a list of tangible actions the City has already undertaken to conserve energy and support energy efficiency is provided in section 6.5.

1.6 Reasons to Take Action

1. Reduce our contribution to global climate change. The primary reason to quantify emissions and develop a subsequent climate action plan is to reduce the quantity of greenhouse gases emitted by the community and thereby slow our contribution to climate change.

2. Take collective action along with our regional partners. Several other jurisdictions in San Luis Obispo County are starting or nearing completion of their respective greenhouse gas inventories. By working together and sharing ideas as each jurisdiction moves forward in the climate action planning process, all parties will stand to benefit.

3. Reduce costs. By identifying ways to reduce energy consumption, the City and local citizens can save money on energy bills. While energy efficiency initiatives may require an initial capital investment, paybacks within about four to seven years can be expected in many cases and savings will continue beyond the payback period. Furthermore, by reducing energy consumption, the City and its citizens will be less vulnerable to fluctuations in the market price of energy.

4. Provide community leadership. By taking critical and visible steps to address climate change, the City will continue to provide a solid example for the community, county, and state.

5. Maintain and improve quality of life for citizens. The City can use savings generated by improved efficiency to improve and maintain critical community services. Programs that reduce emissions, such as bike paths, public transit, and smart growth, also increase the quality of life by improving air quality, promoting active lifestyles, and creating a more beautiful community. Together, theses measures help build a healthier, more sustainable community.

6. Create jobs and promote locally burgeoning "green economy" sector. San Luis Obispo already has many local businesses promoting and harnessing sustainable practices, such as in building technology and low emissions transportation options. The transition to a low emissions society will require continued innovation and effort. New and different business efforts will result from this transition. The transition to a "climate-friendly economy" will also require new educational programs, new technologies, and new businesses, which will can new jobs in the community.

2. Community and Municipal Operations Inventory Methodology

2.1 Project Organization

The CACP software is divided into two distinct levels of analysis: a government operations analysis and community-wide analysis. The community-wide analysis calculates greenhouse gas emissions that are released into the atmosphere as a result of activities within the jurisdictional boundary of San Luis Obispo within one year (2005). The municipal GHG analysis specifies how City-operated buildings and their associated processes contribute to overall emissions within the community. It is important to point that the municipal analysis is a subset of the community analysis, not a separate addition.

The community analysis provides an estimate of all of the greenhouse gas emissions produced within the community of San Luis Obispo by residents, businesses, and agencies. Five primary sectors are included in the community analysis: Residential, Commercial, Industrial, Transportation, and Solid Waste.

The government analysis covers all buildings and facilities, operations, programs, the employee commute, and vehicles owned and operated directly by the City of San Luis Obispo municipal government. Data acquisition and results have been divided into the following sectors: buildings and facilities, vehicle fleet, employee commute, streetlights and traffic signals, water delivery, wastewater, solid waste, and employee business travel in private vehicles. The baseline year for the government analysis is 2005. Energy, fuel and waste data were collected for 2005. Data for adjacent years (2004, 2006 and 2007) were collected based on availability. The government analysis is more detailed than the community analysis because the data is more refined; it includes detail for more sectors and identifies specific point sources of emissions.

2.2 Baseline and Forecast Years

The baseline year used for both the government operations and community-wide emissions inventory was 2005. The primary reason that 2005 was chosen as the baseline year was that it was a common year of data availability throughout all of the sectors of the inventory for both the community-wide and government operations inventories. Additionally, many communities in California that have already completed an emissions inventory decided to use the same year. As a result, it may be possible to compare the results of this inventory other communities in the region and the state.

2.3 Data Collection and Methodology

Due to the fact that local governments vary in their legal and organizational structures, it is important to establish the local government's organizational boundary for greenhouse gas emissions accounting and reporting. Local governments should report their emissions according to one of two control approaches: operational control or financial control. A protocol developed for the reporting of greenhouse gas emissions at the local government level encourages local governments to utilize operational control (described below) when defining the organizational boundary of the emissions inventory. Operational control is the consolidation approach required under AB 32's mandatory reporting program and is consistent with the requirements of many other environmental and air quality reporting (California Air Resources Board, *et al* 2008, p. 14).

According to the *Local Government Operations Protocol* (discussed in section 2.5), a local government has operational control of an emissions source if the local government has the full authority to introduce and implement policies for the operation. One or more of the following conditions establishes operational control:

- Wholly owning an operation, facility, or source; (such as the city's water reclamation facility)
- Having the full authority to introduce and implement operation and health, safety and environmental policies (such as policies to reduce the use of paper products in city offices)

Under this approach, a local government is responsible for 100 percent of emissions from operations over which it has control.

2.4 Data Sources

We received data from a wide variety of sources to complete the community analysis. Where possible, we collected information for years other than 2005 in order to create a basis of comparison. Where 2005 data was not available, we used a proxy. Data sources and years provided are summarized in Table 2.1 below.

TABLE 2.1: Data Sources for Community Analysis Emissions Inventory

Sector	Emissions Source	What was measured	Unit of Measurement	Data Source	Year(s) of data availability
Residential	Electricity consumption	aggregated residential units	kWh	PG&E	2003 to 2005
	Natural Gas consumption	aggregated residential units	therms	Southern Calif. Gas Co/Sempra Energy	2005 to 2007
Commercial/ Industrial[a]	Electricity consumption	aggregated commercial & industrial	kWh	PG&E	2003 to 2005
	Natural Gas consumption	aggregated commercial & industrial	therms	Southern Calif. Gas Co/Sempra Energy	2005 to 2007
Transportation	Vehicle travel on roadways within city limits	vehicle miles of travel on city-maintained roadways and traffic on U.S. 101 through city[b]	vehicle miles of travel	City of San Luis Obispo, Public Works Dept. Traffic Counts program; Caltrans AADT traffic counts program	2005/2006 Traffic Counts; Caltrans 2005 AADT data
Solid Waste	All Waste Types	Solid waste tonnage sent to landfills from activities in city	tons	San Luis Garbage; City of San Luis Obispo, Utilities Department	2005 to 2007

[a] Industrial sector electricity usage currently included in Commercial Sector due to confidentiality restrictions

[b] Vehicle miles are distributed by type (i.e., percent trucks, passenger vehicles, etc.) based on a distribution of vehicle types provided by the San Luis Obispo County Air Pollution Control District.

The primary sources of data for the government analysis were the Utilities Department and Public Works Department. Data for the employee commute sector was acquired by way of an employee survey administered by way of staff email addresses. Data for employee business travel in private vehicles was collected for five of the city departments. Table 2.2 identifies the data sources utilized in the government-scale emissions inventory.

TABLE 2.2: Data Sources for Municipal Analysis Emissions Inventory

Sector	Emissions Source and Cost Data	What was measured	Units	Data Source	Contact	Year(s)
Buildings/Facilities	Energy usage (electricity & natural gas)	all city buildings and facilities	kWh & therms	Utilities Dept	Alice Carter (Ron Munds)	2005 to 2007
	Energy cost data		$/kWh & $/therm	Utilities Dept	Carter/Munds	2005 to 2007
Vehicle Fleet	VMT for city vehicles	all city vehicles, by fuel type, by vehicle type	VMT by fuel type by vehicle type	Public Works Dept	Dave Smith	FY06-07 & FY 07-08
	Fuel cost data		$/gallon	Public Works Dept	Dave Smith	FY06-07 & FY 07-08
Employee Commute	Annual VMT for Employee Commute	Survey respondents (N=250)	VMT	Employee survey (via online survey)	Kim Murry	2007
Traffic Signals/Streetlights	Streetlight and traffic signal electricity usage	all city-maintained streetlights & traffic signals	kWh	Utilities Dept	Carter/Munds	2005 to 2007
	Energy cost data		$/kWh	Utilities Dept	Carter/Munds	2005 to 2007
Water Delivery System	Water delivery system electricity usage	all water delivery facilities	kWh	Utilities Dept	Carter/Munds	2005 to 2007
	Energy cost data		$/kWh	Utilities Dept	Carter/Munds	2005 to 2007
Wastewater Delivery System	Wastewater delivery system energy usage (electricity & natural gas)	all wastewater delivery facilities	kWh & therms	Utilities Dept	Carter/Munds	2005 to 2007
	Energy cost data		$/kWh & $/therm	Utilities Dept	Carter/Munds	2005 to 2007
Solid Waste	Quantity of waste generated by municipal facilities	Municipal facilities garbage collection	tons	Utilities Dept	Doug Dowden	2007
Employee Business Travel	Annual VMT for Employee Business Travel	all municipal departments with available records	VMT	various departments	Kim Murry, staff in various departments	2005[a]

[a] The year 2008 was used as a proxy year in some cases where data was not available.

2.5 Local Government Operations Protocol

The *Local Government Operations Protocol* (*Protocol*) is designed to provide a standardized set of guidelines to assist local governments in quantifying and reporting greenhouse gas emissions associated with their government operations. The *Protocol* was developed in partnership by the California Air Resources Board (CARB), California Climate Action Registry (CCAR), and

International Council for Local Environmental Initiatives – Local Governments for Sustainability (ICLEI), in collaboration with The Climate Registry and dozens of stakeholders. The *Protocol* provides a standardized mechanism for inventorying emissions, which can help track emission reduction progress over time and in comparison to emission reduction targets.

The partnership organizations involved in developing the *Protocol* have not at this time developed a protocol for use specifically at the community-scale. In the case of community-scale emissions, the *Clean Air Climate Protection* Software provides direction on the collection of data necessary to perform the greenhouse gas emissions inventory at the government- and community-scale, as discussed in section 2.8. Where possible, the methodologies utilized in the *Protocol* were applied to the community-scale inventory.

2.6 Greenhouse Gases to be assessed

All six internationally-recognized greenhouse gas emissions regulated under the Kyoto Protocol are to be assessed by this inventory: carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulfur hexafluoride (SF_6). As will be discussed shortly, the software used to complete the emissions inventory quantifies all greenhouse gas emissions in terms of carbon dioxide equivalency (CO_2e). As the six greenhouse gases have a wide range of heat-trapping ability (i.e., global warming potential), it is necessary to convert all gases to a common baseline, for the purpose to producing a meaningful inventory.

2.7 Greenhouse Gas Emission Scopes

In an effort to provide an effective framework for developing different types of climate policies and goals, the *Protocol* follows the *GHG Protocol Corporate Standard*, developed by the World Resources Institute and the World Business Council for Sustainable Development (WRI/WBCSD), in categorizing direct and indirect emissions into scopes.

Scope 1 emissions are all direct emissions sources located within the jurisdictional boundary of the local government. Examples of Scope 1 sources include use of fuels such as heavy fuel oil, natural gas, or propane used for heating

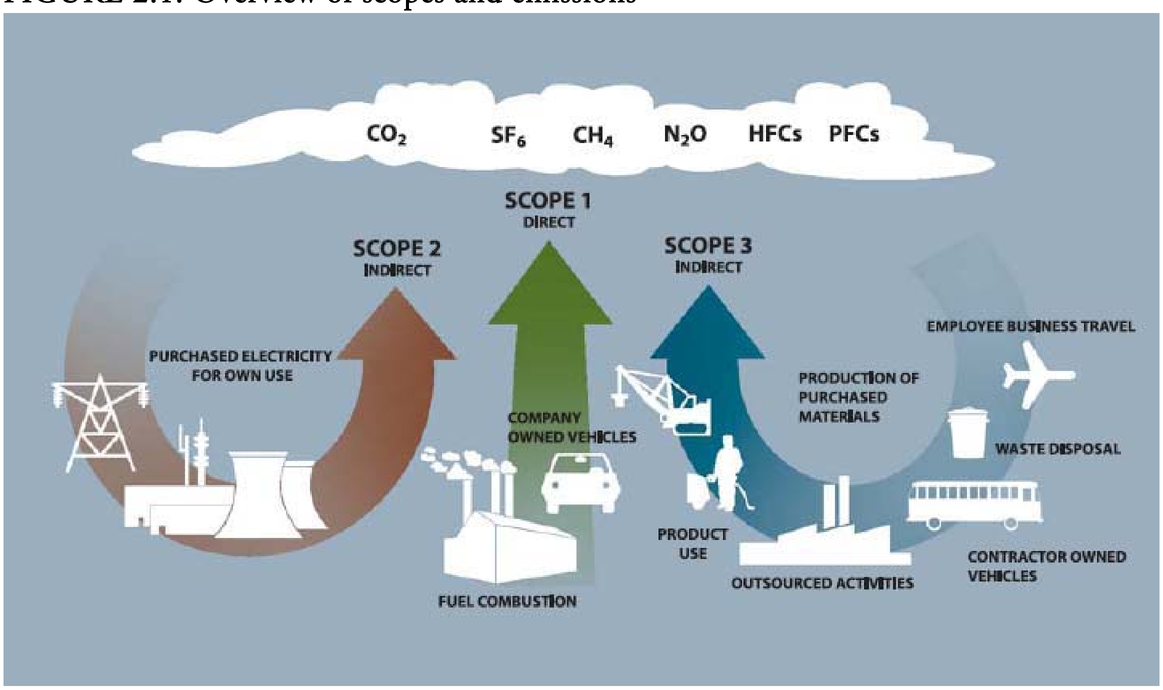
Scope 2 emissions are indirect emissions that result as a consequence of activity within the jurisdictions the jurisdiction's jurisdictional boundary limited to electricity, district heating, steam and cooling consumption. Examples of Scope 2 sources include purchased electricity used within the jurisdictional boundaries of the jurisdiction associated with the generation of greenhouse gases at the power plant. Scope 2 emissions physically occur at the facility where electricity is generated. These emissions should be included in the community-scale analysis, as they are the result of electricity consumption.

Scope 3 emissions are all other indirect and embodied emissions that occur as a result of activity within the jurisdictional boundary. Examples of Scope 3 emissions include methane emissions from solid waste generated within the community which decomposes at landfills either inside or outside of the community's jurisdictional boundary.

Information items are biogenic emissions and other indicators which may be relevant to a complete understanding of a community's energy use and climate impact, but which are not conventionally included in greenhouse gas accounting. Examples of information items are biogenic carbon emissions or quantity of electricity generated from solar photovoltaic panels.

Taken together, the three scopes provide a comprehensive accounting framework for managing and reducing direct and indirect emissions. Local governments should, at a minimum, quantify and report all Scope 1 and Scope 2 emissions (CARB *et al* 2008, et al., p. 22). The reporting of Scope 3 emissions is optional and at the present time lacks a standard practice. Local governments should address the collection of Scope 3 emissions from a policy perspective, and focus on emissions that could be reduced by changes in local government policy. Figure 2.1 provides an overview of the relationship between the scopes and the activities that generate direct and indirect emissions at the local government and community-wide level.

FIGURE 2.1: Overview of scopes and emissions



Source: WRI/WBCSD GHG Protocol - A Corporate Accounting and Reporting Standard (Revised Edition), Chapter 4.

2.8 Clean Air Climate Protection Software

To facilitate community efforts to reduce greenhouse gas emissions, ICLEI developed the Clean Air and Climate Protection (CACP) software package in partnership with the State and Territorial Air Pollution Program Administrators (STAPPA), the Association of Local Air Pollution Control Officials (ALAPCO)[19], and Torrie Smith Associates. This software calculates emissions resulting from energy consumption, fuel usage, and waste generation. The CACP software determines emissions using specific factors (or coefficients) according to the type of fuel used. Greenhouse gas emissions are aggregated and reported in terms of carbon dioxide equivalency, or CO_2e. Converting all emissions to carbon dioxide equivalents allows for the consideration of different greenhouse gases in comparable terms.

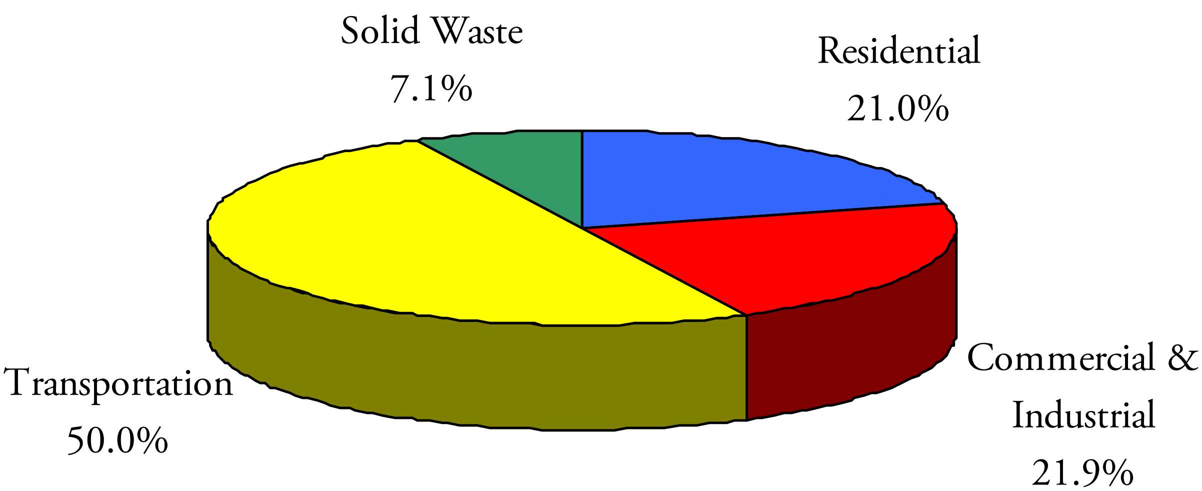
[19] Now the National Association of Clean Air Agencies (NACAA)

3. Community Greenhouse Gas Emissions Inventory Results

3.1 Community Analysis Results

In 2005, the community of San Luis Obispo generated 264,237 metric tons of carbon dioxide equivalents ($MTCO_2e$). Approximately 50.0 percent of those emissions were produced by the transportation sector. The Commercial and Industrial sectors combined for 21.9 percent of communitywide emissions, and the Residential sector contributed 21.0 percent of communitywide emissions. The Solid Waste sector accounted for the remaining 7.1 percent of community-wide emissions. See Figure 3.1 below.

FIGURE 3.1: City of San Luis Obispo Greenhouse Gas Emissions by Sector (2005)



Source: Pacific Gas & Electric; Southern California Gas Company; San Luis Garbage; City of San Luis Obispo: Public Works and Utilities departments; Clean Air and Climate Protection software; and Local Government Operations Protocol.

Table 3.1 provides a summary of energy use and greenhouse gas emissions produced by each sector. The number in the last column of the table represents the amount of energy (MMBtu) per amount of greenhouse gas emissions ($MTCO_2e$). This ratio provides an indicator demonstrating the efficiency of each sector in terms of greenhouse gas emissions (a lower number indicates lower efficiency). The transportation sector scored the lowest rating primarily because the burning of fossil fuels (especially gasoline and diesel) emits large amounts of CO_2 per unit of energy combined with the relatively low efficiency of today's automobile.

TABLE 3.1: Energy Consumption and Greenhouse Gas Emissions

Sector	Energy (MMBtu)	Equivalent CO_2e (metric tons)	Percent of Total Emissions	MMBtu / $MTCO_2e$
Residential	963,839	55,377	21.0%	17.4
Commercial/Industrial	961,796	57,950	21.9%	16.6
Transportation	1,839,962	132,142	50.0%	13.9
Waste	n/a	18,768	7.1%	n/a
Total	3,765,597	264,237	100.0%	14.3

Source: Clean Air and Climate Protection Software, *Local Government Operations Protocol*

3.2 Residential

In 2005, the residential sector generated 55,377 metric tons of carbon dioxide equivalence ($MTCO_2e$); representing 21.0 percent of community-generated GHG emissions (see Table 3.2). On average, each household produced roughly 2.9 $MTCO_2e$ from electricity and natural gas. Despite the residential sector having relatively low aggregated per household emissions, residential GHG emissions from electricity usage have increased 11.7 percent from 2003 to 2005, or nearly 6 percent per year. At the same time, residential GHG emissions from natural gas usage have increased 3.7 percent from 2005 to 2007, or roughly two percent per year.

TABLE 3.2: Residential Sector – Emissions by Fuel Type (2005)

Fuel Type	Residential Energy Usage	Equivalent CO_2 (metric tons)	Equivalent CO_2 (%)	Energy (MMBtu)
Electricity	93,101,466 kWh	20,820	7.9%	317,752
Natural Gas	664,341 Dth	34,557	13.1%	646,087
Total		55,377	21.0%	963,839

Source: Pacific Gas & Electric, Southern California Gas Company

3.3 Commercial & Industrial

Within this report, the Commercial and Industrial sectors have been combined due to a mandatory aggregation of Commercial and Industrial data by PG&E[20] and due to limited presence of industrial activity in San Luis Obispo. In 2005, the commercial and industrial sectors combined generated 57,950 $MTCO_2e$, representing 21.9 percent of the community-generated GHG emissions (See Table 3.3). Greenhouse gas emissions from electricity usage have increased 2.8 percent from 2003 to 2005. At the same time, emissions from natural gas usage have increased 7.1 percent from 2005 to 2007.

[20] The commercial and industrial sectors are combined as a result of the 15/15 rule. The 15/15 rule was adopted by the California Public Utilities Commission in the Direct Access Proceeding (CPUC Decision 97-10-031) to protect customer confidentiality.

TABLE 3.3: Commercial & Industrial Sectors – Emissions by Fuel Type (2005)

Fuel Type	Commercial & Industrial Energy Usage	Equivalent CO_2 (metric tons)	Equivalent CO_2 (%)	Energy (MMBtu)
Electricity	158,400,882 kWh	35,423	13.4%	540,617
Natural Gas	421,179 Dth	22,527	8.5%	421,179
Total		57,950	21.9%	961,796

Source: Pacific Gas & Electric, Southern California Gas Company

3.4 Transportation

In 2005, the transportation sector produced 132,137 $MTCO_2e$, representing 50.0 percent of all community greenhouse gas emissions. Greenhouse gas emissions from the transportation sector in a given community are directly related to vehicle-miles of travel on city roadways. The California Department of Transportation (Caltrans) maintains the Highway Performance Monitoring System (HPMS), a federally mandated inventory system used to analyze the highway system's condition and performance. Through HPMS, Caltrans is able to produce an annual report entitled California Public Road Data. Data available from 1996 through 2007 provides historical information on total maintained roadway mileage and estimated daily vehicle miles of travel within each jurisdiction. The vehicle miles of travel data from this annual report are presented in Table 3.4 below, and graphically in Figure 3.2.

TABLE 3.4: Historical Vehicle Miles of Travel on San Luis Obispo Public Roads (1996-2007)

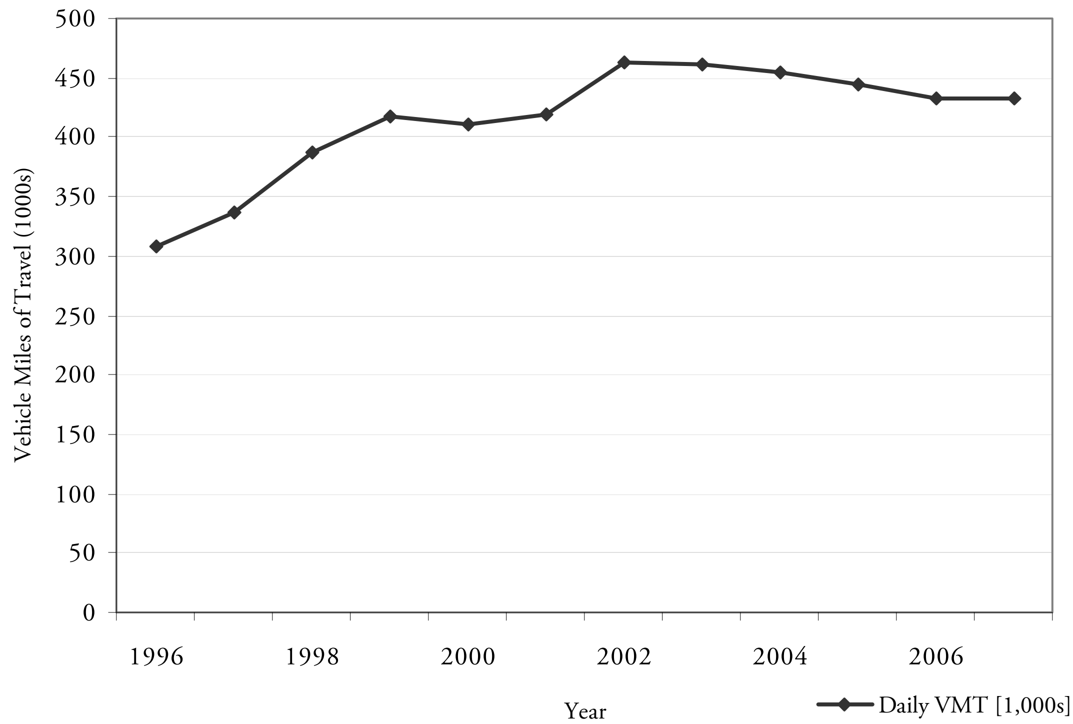
Year	Daily VMT (thousands)	Annual VMT (millions)	Annual Pct Change in VMT (1996-2007)	Accumulated Pct Change in VMT (1996-2007)
1996	308.3	112.5	--	--
1997	335.9	122.6	9.0%	9.0%
1998	387.2	141.3	15.3%	25.6%
1999	417.3	152.3	7.8%	35.4%
2000	410.2	149.7	-1.7%	33.1%
2001	418.7	152.8	2.1%	35.8%
2002	462.8	168.9	10.5%	50.1%
2003	460.7	168.2	-0.4%	49.4%
2004	454.9	166.0	-1.3%	47.6%
2005	443.8	162.0	-2.4%	44.0%
2006	433.4	158.2	-2.3%	40.6%
2007	433.4	158.2	0.0%	40.6%
Total change in VMT	125.1	45.7		
Avg annual % change in VMT			3.39%	

Source: California Department of Transportation, Highway Performance Monitoring System, California Public Road Data, "Table 6. Maintained Mileage Data & Daily Vehicle Miles of Travel Estimates By Jurisdiction" (1996-2007)

For the purposes of a identifying emissions generated by transportation at the community level for a greenhouse gas inventory, no standard practice exists at this time to convert daily vehicle miles of travel into annual vehicle miles of travel to account for less travel on weekend days, so 365 days was used to make this conversion[21].

From Table 3.4, it is evident that daily – and annual – vehicle miles of travel have increased markedly in San Luis Obispo from 1996 to 2007, from 112.5 million annual VMT in 1996 to 158.2 million annual VMT in 2007, an increase of over 40 percent. This is also an average annual increase of 3.38 percent per year. On the positive side, Figure 3.2 below shows that daily vehicle miles of travel have been on the decline since 2002.

FIGURE 3.2: Daily Vehicle Miles of Travel on San Luis Obispo Public Roads (1996-2007)



Source: California Department of Transportation, Highway Performance Monitoring System, California Public Road Data, "Table 6. Maintained mileage data & daily vehicle miles of travel estimates by jurisdiction" (1996-2007)

Because the city's Public Works Department maintains a comprehensive and detailed traffic counts program with 176 counting stations, it was determined that the resulting data was much more detailed than the HPMS data, and allows for further analysis by specific areas of the city. However, the Caltrans HPMS data is included to provide historical trends of the growth in vehicular traffic within the community. Table 3.5 provides a summary of the results of the analysis of the 2005-2006 traffic counts program data.

[21] However, some jurisdictions have used 330 days to compensate for the difference in weekend travel, while Sonoma County used 320 days.

The results of the 2005-2006 traffic counts program suggests that 768,239 daily vehicle miles of travel occurs within the city limits, including traffic on U.S. 101. The total approximate daily vehicle miles of travel on all city roadways are 515,377 daily vehicle miles. An overwhelming majority of the total mileage on city streets (407,816 daily vehicle miles; 77% of all VMT on city streets) occur on major arterials on a given day in the community. These roadways include Santa Rosa, Foothill, Los Osos Valley Road, Madonna, Higuera, Marsh, (most of) Broad, South Higuera, Johnson and Tank Farm. The roadway segments classified as county highways included in this total not within the city limits are Orcutt Road from Johnson to Tank Farm. Total daily vehicle mileage occurring on U.S. 101 is estimated to be 236,057 miles, while vehicle miles occurring on U.S. 101 on- and off-ramps is estimated to be 16,806 daily vehicle miles. Although these vehicle miles occur on state-maintained roadways, they are included in this emissions inventory. In total, the estimated daily vehicle miles of travel of 768,239 miles per day translates into approximately 280.4 million annual vehicle miles of travel in the community of San Luis Obispo. This annual vehicle mileage generates an estimated emissions total of 132,137 metric tons of carbon dioxide equivalents.

TABLE 3.5: Transportation Sector – Summary of Traffic Counts Program (2005-2006)

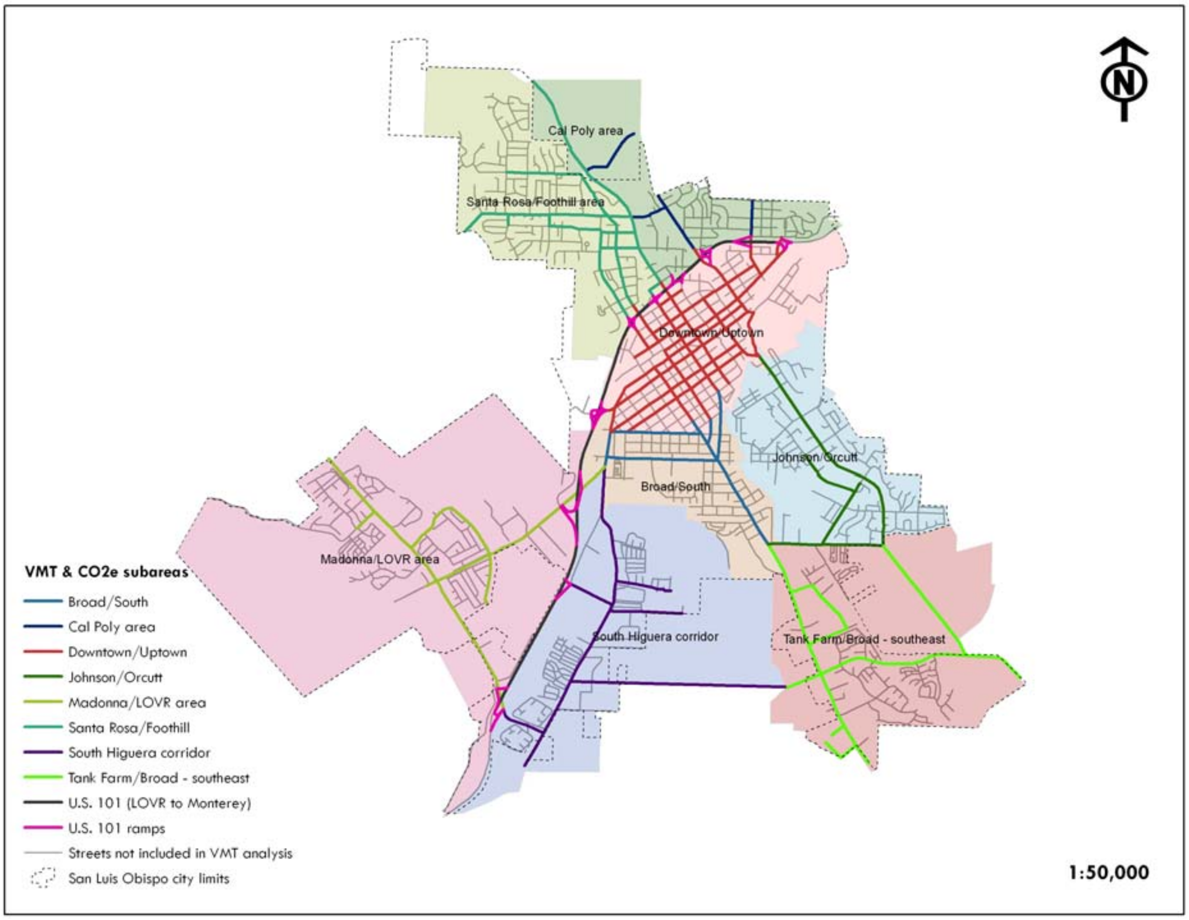
Road Type	Road miles	Average Daily Trips[a]	Daily VMT	Annual VMT[b] (in millions)	Equivalent CO_2 [c] (metric tons)
Collector	10.20	3,925	38,348	14.0	6,492
Minor Arterial	7.37	7,638	54,064	19.7	9,276
Major Arterial	22.42	17,502	407,816	148.9	70,245
County Highway[d]	1.80	13,451	15,149	5.5	2,612
U.S. 101 (Monterey to LOVR)[e]	4.12	55,000	236,057	86.2	40,616
U.S. 101 ramps[f]	3.89	4,108	16,806	6.1	2,896
Total [g]	49.80	20,325	768,239	280.4	132,137

Source: City of San Luis Obispo, Public Works Department, Transportation Division (City-wide Traffic Counts Program, 2005-06)

[a] Average of all traffic count segments of each road class (e.g., it could be said that "the average roadway segment of a Collector street has approximately 3,925 vehicle trips per day")
[b] Annual Vehicle Miles of Travel assumes traffic volume is similar 365 days a year.
[c] Due to rounding in the software, this column does not add up.
[d] County Highways are roadways that are not within City Limits, such as Orcutt Road between Johnson and Tank Farm.
[e] U.S. 101 is a Caltrans-maintained limited-access highway within the city limits with significant through-traffic; all vehicle-miles from Monterey exit to Los Osos Valley Road exit were counted in this inventory.
[f] U.S. 101 on- and off-ramps facilities are maintained by Caltrans. However, any traffic volume on ramps from Los Osos Valley Road to Monterey is assumed to be entering or exiting the local road network in San Luis Obispo. This includes traffic volumes at 32 on- and off-ramps.
[g] The total "Average Daily Trips" is an average value of all average daily trips at all traffic counting stations.

It must be pointed out that no standard protocol exists at the time of this writing as to how to calculate annual vehicle miles of travel in a given community for the purposes of quantifying emissions from mobile sources. Again, however, the robust traffic volume data that the city has maintained offers an opportunity to quantify vehicle miles of travel (and associated emissions) from sample traffic data. Additionally, results can be analyzed in terms of logical traffic subareas. Eight subareas were created for the purposes of analyzing the results of the traffic counts data, which are shown in Figure 3.3 below. The VMT subareas were created by aggregating several existing traffic analysis zones to produce larger analysis zones. The map also identifies the roadways that were included in the calculation of vehicle miles of travel, the roadways that were not included in the calculation of vehicle miles of travel, as well as U.S. 101 and the location of the on- and off-ramps throughout the community.

FIGURE 3.3: Vehicle-miles of travel subareas in San Luis Obispo (2005-2006)



Sources: City of San Luis Obispo Public Works Department, Transportation Division and GIS Division.

Naturally, some of the VMT sub-areas generated a greater intensity of vehicle miles of travel (and corresponding greenhouse gas emissions) than did others. Additional detailed analysis of vehicle miles of travel and emissions analysis by VMT sub-area can be found in Appendix A (Tables A-8 summarizes VMT and emissions by sub-area and Table A-9 provides an analysis of daily and annual vehicle miles of travel per lane-mile in each sub-area, as well as emissions per lane-mile in each sub-area).

Based on the several options presented in this document regarding the methodology to calculate community-wide vehicle miles of travel, it is evident by that a significant level of ambiguity exists as to how to accurately quantify the vehicle miles of travel that are attributable to a single community.

Nearly 31 percent of the community's daily vehicle miles traveled is attributable to travel on U.S. 101 between Los Osos Valley Road and Monterey Street. The associated emissions (40,616 $MTCO_2e$) accounts for about 15 percent of community-wide emissions. The City of San Luis Obispo does not have jurisdictional control to reduce transportation emissions from "pass-through" vehicle travel through the city limits. However, ICLEI and State protocol require that these emissions be included in a local inventory in order to capture all emissions within the area and calculate their effect in the local community.

The nature of mobile emissions from the transportation sector suggests that vehicle miles of travel is best quantified at a regional level. For example, U.S. 101 is the primary transportation facility in San Luis Obispo County and carries a significant volume of traffic between the communities in the county as well as travel associated with tourism coming from outside the community and the county. Again, at this time, no emission reporting protocol is in place to assist in attributing an exact amount of vehicle mileage to one community over another. For purposes of this inventory, any travel occurring within the city limits has been counted as part of the community emissions inventory.

3.5 Solid Waste

In 2005, the community of San Luis Obispo shipped 84,439 tons of waste to the Cold Canyon Landfill. The CACP software calculates methane generation from waste sent to landfills in 2005. This landfill provides a methane recovery factor of 60 percent, which allows the waste sector to produce a net sink in total emissions for the community. As a carbon sink, the waste sector decreased total community emissions by 18,769 metric tons of carbon dioxide equivalence.

The City of San Luis Obispo Utilities Department tracks historic community-wide solid waste tonnage figures. Table 3.6 shows solid waste tonnage in recent years. All commodities are grouped into two main groups – recycling and trash. Recycling commodities include: newspaper, mixed recyclables, cardboard, aluminum, ferrous metal, glass, plastics, and compostable green waste. Trash includes residential, commercial, commercial haulers, "drop box" (used at construction projects), and trash produced from demolition activities. The 2004 California Statewide Waste Characterization Study[22] provides standard waste composition for the State of California. Identifying the different types of waste in the general mix is necessary, because decomposition of some materials generate methane within the anaerobic environment of landfills whereas others do not. Carbonaceous materials such as paper and wood actually act to sequester the methane released in managed landfills, therefore offsetting some or all of the emissions for food and plant waste. Table 3.7 shows the estimated percentages of emissions coming from the various types of waste.

The San Luis Garbage Company (Waste Connections, Inc.) services the San Luis Obispo community and transports most waste generated by the community to the Cold Canyon Landfill on Carpenter Canyon Road/Highway 227, about six miles south of San Luis Obispo. A limited amount

[22] http://www.ciwmb.ca.gov/Publications/default.asp?pubid=1097

of waste is transported to Southern California, by way of the Santa Maria Transfer Station (located between Nipomo and Santa Maria in San Luis Obispo County, adjacent to U.S. 101).

TABLE 3.6: Solid Waste Tonnage in San Luis Obispo (2005-2007)

Commodity Group	Waste (tons)			Annual rate of change (2005-2007)
	2005	2006	2007	
Recycling (paper, aluminum, plastics, greenwaste)	22,739	23,468	21,861	-1.9%
Trash (residential, commercial, haulers, etc.)	61,700	61,724	60,620	-0.9%
Total	84,439	85,192	82,481	-1.2%

Source: City of San Luis Obispo, Utilities Department; San Luis Garbage Company

TABLE 3.7: Solid Waste Emissions in San Luis Obispo (2005)

Waste Emissions Source	Equivalent CO_2 (metric tons) [a]	Equivalent CO_2 from Waste (%)
Paper Products	4,772	25.4%
Food Waste	11,339	60.4%
Plant Debris	1,393	7.4%
Wood/Textiles	1,265	6.7%
Total	18,769	100.0%

Source: City of San Luis Obispo, Utilities Department; San Luis Garbage Company
[a] This column does not add up due to rounding in the software.

3.6 Community-wide Emissions by Scope

The majority of community greenhouse gas emissions were Scope 1 (85.7%), with Scope 2 emissions (15.3%) and Scope 3 (-1.1%) making up the remaining emissions. Scope 1 emissions include transportation-related emissions, and those emissions related to fuel combustion, such as natural gas consumption. All Scope 2 emissions are generated by purchased electricity. Scope 3 emissions are those generated by solid waste, is a net carbon sink. See Table 3.8 below.

TABLE 3.8: Community-wide Emissions by Scope (2005)

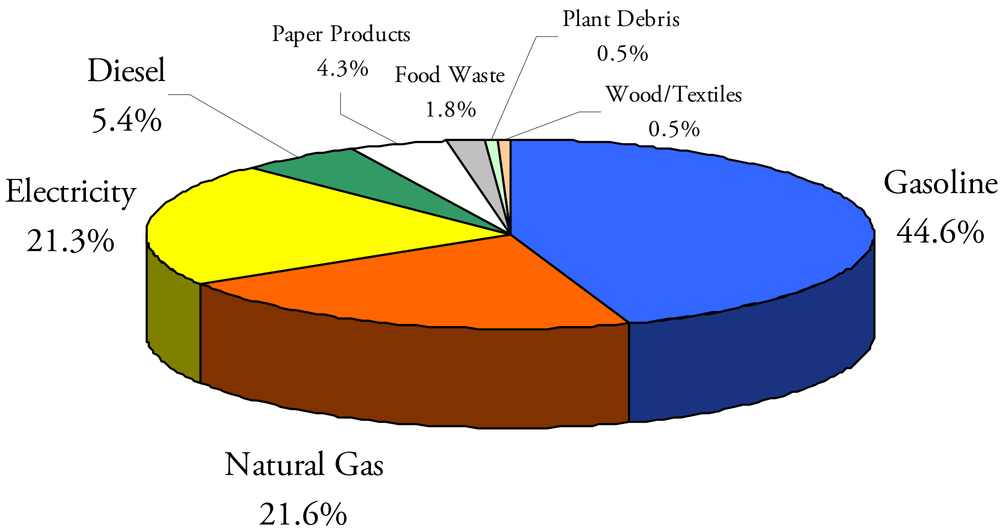
Sector	Scope 1	Scope 2	Scope 3	Total
Residential	34,557	20,820	--	55,377
Commercial/Industrial	22,527	35,423	--	57,950
Transportation	132,142	--	--	132,142
Solid Waste	--	--	18,768	18,768
Total	189,226	56,243	18,768	264,237
Percentage of Total CO2e	71.6%	21.3%	7.1%	100.0%

Source: Pacific Gas & Electric; Southern California Gas Company; San Luis Garbage; City of San Luis Obispo: Public Works and Utilities departments; Clean Air and Climate Protection software; and Local Government Operations Protocol.

3.7 Source of Community Greenhouse Gas Emissions

The largest source of 2005 greenhouse gas emissions generated by the San Luis Obispo community was gasoline, which generated 52.6 percent of all greenhouse gas emissions. Natural gas and electricity accounted for 41.0 percent of community-wide emissions (21.1% and 19.9%, respectively). The fourth largest source of emissions was diesel (9.9%), followed by food waste (1.4%). The remaining sources that were part of this inventory actually accounted for a net carbon sink (-2.5%), which include paper products, plant debris, and wood/textiles.

FIGURE 3.4: Community-wide Greenhouse Gas Emissions by Source (2005)



Source: Pacific Gas & Electric; Southern California Gas Company; San Luis Garbage; City of San Luis Obispo: Public Works and Utilities departments; Clean Air and Climate Protection software; and Local Government Operations Protocol.

3.8 Per capita emissions

As several communities throughout the California are voluntarily conducting greenhouse gas emissions inventory, it is possible to compare the results of this emissions inventory to the results of other jurisdictions in the state. Per capita comparative analysis can provide decision makers and stakeholders with a metric by which to measure the progress made in reducing greenhouse gas emissions. In 2005, San Luis Obispo generated 5.9 $MTCO_2e$ per capita. Table 3.9 compares the results of this inventory with other communities that have recently completed emissions inventories. San Luis Obispo compares favorably with most of the communities or jurisdictions on this list, especially when compared to the State of California, which generated 13.4 $MTCO_2e$ per capita in 2004. However, at this time it is impractical to make meaningful comparisons between cities because of the variation in the scope of inventories conducted, data collection methods, and locations of industrial facilities within the state. For example, a city that contains a large industrial manufacturing plant within its corporate boundaries will most likely show a high per capita emissions rate regardless of whether the community has a great number of persons who bike to work and live in energy efficient houses.

TABLE 3.9: Per capita GHG emissions of selected California jurisdictions

Jurisdiction	Baseline Year of GHG Inventory	Metric tons of CO_2e (from GHG Inventory)	Population[a] (in baseline year of GHG Inventory)	$MTCO_2e$ per capita
City of Arcata	2000	234,703	16,651	14.1
City of Berkeley	2005	634,798	104,010	6.1
City of Chico[b]	2005	610,951	73,614	8.3
City of Davis[c]	1990	225,200	46,209	4.9
City of Menlo Park	2005	491,054	30,558	16.1
City of San Luis Obispo	2005	264,237	44,625	5.9
San Luis Obispo County[d]	2006	1,464,131	101,786	14.4
Marin County[e]	2000	3,113,565	247,289	12.6
Sonoma County[e]	2000	3,739,380	458,614	8.2
State of California[f]	2004	492,000,000	36,675,346	13.4

Source: Greenhouse gas emissions inventories of listed jurisdictions, California Department of Finance, Demographic Research Unit.

[a] State of California, Department of Finance, *E-4 Population Estimates for Cities, Counties and the State, 2001-2008, with 2000 Benchmark. Sacramento, California, May 2008.*

[b] City of Chico's *Greenhouse Gas & Criteria Air Pollutant Emissions Inventory* bases the community population on the "Greater Chico Area". This table relies on figures produced by the California Department of Finance. The City of Chico's emissions inventory concludes that per capita emissions in the community are 5.8 $MTCO_2e$ in 2005.

[c] State of California, Department of Finance, E-4 *Historical Population Estimates for City, County and the State, 1991-2000, with 1990 and 2000 Census Counts.* Sacramento, California, August 2007.

[d] San Luis Obispo County emissions inventory includes only the unincorporated area of the county.

[e] Marin County and Sonoma County emissions inventories include all jurisdictions within each respective county.

[f] California Energy Commission, Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004 (2006), CEC-600-2006-013-SF.

4. Municipal Operations Greenhouse Gas Emissions Inventory Results

4.1 Municipal Analysis Results

In 2005, the municipal operations of the City of San Luis Obispo generated 6,580 metric tons of carbon dioxide equivalents ($MTCO_2e$), and consumed approximately 94,483 MMBtu of energy. Total cost associated with annual energy and fuel usage in 2005 was $1.871 million.

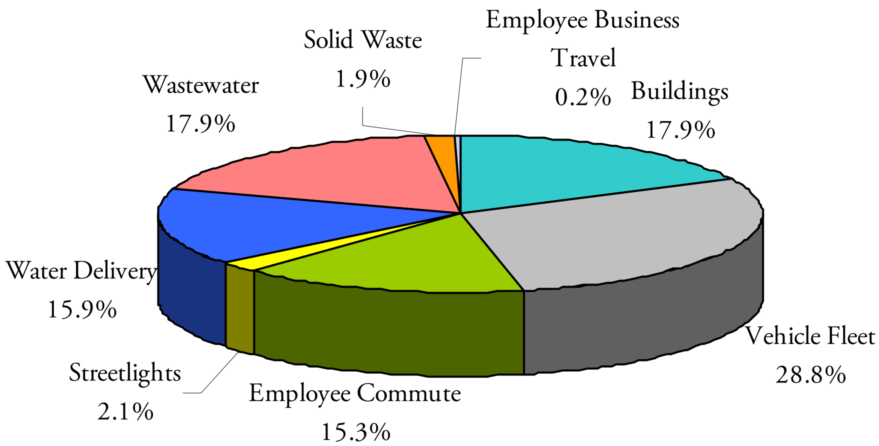
About 96 percent of those emissions were produced by the Vehicle Fleet, Buildings, Water Delivery Wastewater, and Employee Commute sectors. (Refer to Table 4.1 and Figure 4.1 below.) The Vehicle Fleet sector generated 1,898 $MTCO_2e$ (28.8%), the Buildings sector generated 1,178 $MTCO_2e$ (17.9%), the Wastewater sector generated 1,175 $MTCO_2e$ (17.9%), the Water Delivery sector generated 1,043 $MTCO_2e$ (15.9%), and the Employee Commute sector generated 1,009 $MTCO_2e$ (15.3%). The remaining 3 percent of government operations' greenhouse gas emissions were generated from the other three sectors: the municipal Solid Waste sector generated 125 $MTCO_2e$ (1.9%), the Streetlights and Traffic Signals sector generated 141 $MTCO_2e$ (2.1%), and Employee Business Travel sector generated 11 $MTCO_2e$ (0.2%). See Figure 4.1 below.

TABLE 4.1: Summary of Municipal Operations Greenhouse Gas Emissions by Sector (2005)

Sector	Emission Scope(s)	Equivalent CO_2 (metric tons)	Equivalent CO_2e (%)	Energy (MMBtu)
Buildings & Facilities	Scope 1 & 2	1,178	17.9%	19,772
Vehicle Fleet	Scope 1	1,898	28.8%	23,585
Employee Commute	Scope 3	1,009	15.3%	13,418
Streetlights	Scope 2	141	2.1%	2,153
Water Delivery	Scope 2	1,043	15.9%	15,917
Wastewater	Scope 1 & 2	1,175	17.9%	18,583
Solid Waste	Scope 3	125	1.9%	--
Employee Business Travel (in private vehicle)	Scope 3	11	0.2%	90
Total		6,580	100.0%	93,483

Source: City of San Luis Obispo: Utilities Department and Public Works Department, 2007 Employee Commute Survey; Pacific Gas & Electric, Southern California Gas Company

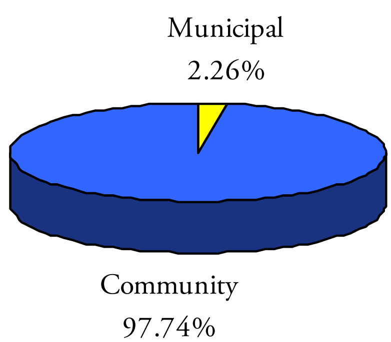
FIGURE 4.1: Municipal Operations Greenhouse Gas Emissions by Sector (2005)



Source: City of San Luis Obispo: Utilities Department and Public Works Department, 2007 Employee Commute Survey; Clean Air and Climate Protection Software, and Local Government Operations Protocol.

Figure 4.2 shows the relative contribution that government operations of the City of San Luis Obispo make to the community at-large. City operations generated an estimated 6,580 metric tons of carbon dioxide equivalent in 2005, which was approximately 2.49% of total community-wide emissions. Interestingly enough, this is the same percentage that was determined to be the County Government's contribution to the County unincorporated area in the *San Luis Obispo County Community-wide and Municipal 2006 Baseline Greenhouse Gas Emissions Inventory*.

FIGURE 4.2: Municipal Operations Contribution to Community-wide Emissions (2005)



4.2 Buildings and Facilities

In 2005, the building sector generated 1,178 metric tons of carbon dioxide equivalent ($MTCO_2e$), representing 17.9 percent of total government-generated emissions (See Figure 4.1). Greenhouse gas emissions generated from this sector originate from purchased electricity and natural gas.

Electricity is primarily used in City buildings for lighting, office equipment and running computer hardware, among other things. In 2005, the City purchased $365,741 of electricity for use at buildings and facilities. See Table 4.2 below. The electricity provider in the area is Pacific Gas &

Electric. In 2005, the City utilized 109,261 therms of natural gas at various city buildings and facilities, for a total cost of $112,454. See Table 4.3 below.

TABLE 4.2: Electricity Usage of Buildings and Facilities and Emissions (2005)

Building/Facility or Location	Annual Electricity Usage (kWh)[a]	Daily Electricity Usage (kWh)	Annual Electricity Cost	Equivalent CO_2 (metric tons) *Scope 2 emissions*	Equivalent CO_2 (%)	Energy (MMBtu)
Office Buildings	879,342	2,409	$ 110,439	199	30.8%	3,002
Parking Structures	444,650	1,218	$ 48,089	101	15.6%	1,518
Swim Center	391,497	1,073	$ 51,035	88	13.6%	1,336
Parks & Recreation Facilities	292,157	800	$ 39,367	66	10.2%	1,007
Corporation Yard	283,202	776	$ 35,513	64	9.9%	967
Miscellaneous Buildings	213,810	586	$ 29,835	48	7.4%	740
Fire Stations	192,351	527	$ 27,881	44	6.8%	726
Cultural/Historical Facilities	158,755	435	$ 23,443	36	5.6%	542
All Municipal Facilities	2,855,764	7,824	$ 365,602	646	100.0%	9,838

Source: City of San Luis Obispo, Utilities Department; Pacific Gas & Electric

[a] Annual electricity usage data is derived from monthly electricity bills. Naturally, monthly billing cycles of utility bills do not automatically correspond to the monthly calendar, so some overlapping results (i.e., the last week of December 2004 may be included in the January 2005 billing cycle). In all cases, approximately 360 to 365 days are included for each facility's annual electricity usage totals.

TABLE 4.3: Natural Gas Usage of Buildings and Facilities and Emissions (2005)

Building/Facility Type[a]	Annual Natural Gas Usage[b] (Therms)	Daily Natural Gas Usage (Therms)	Annual Energy Cost	Equivalent CO_2 (metric tons) *Scope 1 emissions*	Equivalent CO_2 (%)	Energy (MMBtu)
Swim Center	58,391	160.0	$ 57,226	311	58.8%	5,839
Office Buildings	25,535	69.9	$ 26,572	136	25.7%	2,553
Corporation Yard	7,365	20.2	$ 7,759	39	7.4%	737
Fire Stations	4,476	12.2	$ 5,519	24	4.5%	448
Cultural/Historical Facilities	3,065	8.3	$ 4,203	16	3.0%	308
Parks Facilities	496	1.4	$ 773	3	0.6%	49
All Buildings & Facilities	99,328	272.0	$102,052	529	100.0%	9,934

Source: City of San Luis Obispo, Utilities Department; Southern California Gas Company

[a] Not all facilities in Table 4.1 are included in this list as fewer municipal buildings and facilities use natural gas.
[b] Natural gas usage data is available in monthly records. Therefore, limited data manipulation was required.

In 2007, city operations at various city buildings and facilities consumed 89.5 gallons of propane, for a total cost of $314. In 2008, 139.1 gallons of propane was consumed. These two years are used as a proxy year, as propane usage data was not available for 2005. See Table 4.4 below.

TABLE 4.4: Propane Usage of Buildings and Facilities and Emissions (2007 & 2008)

Fuel Type used in Buildings and Facilities	2007			2008		
	Quantity (gallons)	Fuel Price	Equivalent CO_2 (metric tons) *Scope 1 emissions*	Quantity (gallons)	Fuel Price	Equivalent CO_2 (metric tons) *Scope 1 emissions*
Propane	89.5	$ 314	<1	139.1	$ 524	1

Source: City of San Luis Obispo, Finance Department

4.3 Vehicle Fleet

Detailed records of mileage and fuel were not available for each vehicle in the in the city's fleet. The calculation methodology outlined in the *Protocol* of emissions originating from the city's vehicle fleet (which requires information about each vehicle's mileage and fuel consumption in a given calendar year) was not feasible[23]. However, mileage records were available for four different vehicle groups – passenger vehicles, off-road diesel trucks, construction vehicles and police vehicles. Table 4.5 provides a summary of the city's vehicle fleet in 2005, without including transit vehicles. The city's police vehicle fleet accounted for the majority of the city's vehicle fleet mileage, with 528,967 miles logged in that year. The Off-Road Diesel (ORD) trucks logged nearly 75,000 vehicle miles in 2005.

TABLE 4.5: Summary of Vehicle Fleet and Mileage (2005)

Vehicle Type	Number of Vehicles	Fuel Type	Estimated Vehicle Mileage
Passenger Vehicle	26	Gasoline	30,982
Trucks (Off-Road Diesel)	15	Diesel	74,653
Construction Vehicles	31	Diesel	4,393
Police Vehicles	58	Gasoline	528,967
Transit Vehicle (non-bus)	3	Gasoline	27,727
Total[a]	133		666,722

Source: City of San Luis Obispo, Public Works Department

[a] This total does not include Transit Vehicles

The city's Finance Department maintains account payable invoices for all bulk gasoline and diesel purchases to fuel the city's vehicle fleet. Only invoices covering calendar year 2007 and 2008 were collected. For the purposes of this inventory, 2007 was used as a proxy year for 2005. Based on the total gasoline and diesel purchases in 2007, the city's vehicle fleet (other than the city's transit fleet) generated an estimated 1,145 $MTCO_2e$. See Table 4.6 below. However, since it is not clear what types of vehicles (passenger vehicle, light truck/SUV, or heavy truck) consumed what quantity of either fuel, it is not possible to accurately calculate vehicle emissions from the city's vehicle fleet based on the methodology described in the *Protocol.*

[23] The calculation methodology is explained in more detail in the Appendix B (*C.3 Mobile Combustion*)

TABLE 4.6: Vehicle Fleet Fuel Usage (2007 & 2008)

Fuel Type	2007			2008		
	Quantity (gallons)	Fuel Price	Equivalent CO_2 (metric tons) *Scope 1 emissions*	Quantity (gallons)	Fuel Price	Equivalent CO_2 (metric tons) *Scope 1 emissions*
Gasoline	83,440	$ 238,550	768	85,957	$ 291,709	791
Diesel	35,526	$ 99,589	378	39,229	$ 139,176	417
Total	118,966	$ 338,139	1,145	125,186	$ 430,885	1,208

Source: City of San Luis Obispo, Finance Department

In 2005, the city's transit fleet generated 753 $MTCO_2e$. The annual mileage of city's transit fleet was 401,416 vehicle miles, while consuming 113,516 gallons of diesel. See Table 4.7.

TABLE 4.7: Transit Vehicle Fleet Mileage and Emissions (2005)

Vehicle Number	Annual Mileage	Diesel (gallons)	Fuel cost per vehicle (estimated)	Equivalent CO_2 (metric tons) *Scope 1 emissions*
128	8,835	3,210	$ 7,899	17
129	15,155	4,523	$ 11,130	28
130	23,802	6,330	$ 15,576	45
131	6,252	1,772	$ 4,361	12
132	29,381	8,155	$ 20,068	55
140	21,099	8,037	$ 19,777	39
141	18,456	7,626	$ 18,766	35
142	0	0	$ -	-
143	0	0	$ -	-
144	38,430	11,192	$ 27,541	72
145	39,320	10,582	$ 26,039	74
146	40,303	11,565	$ 28,459	75
150	40,902	10,481	$ 25,793	77
151	40,056	10,816	$ 26,616	75
152	26,573	6,585	$ 16,204	50
153	36,679	10,458	$ 25,735	69
Trolley 101	15,995	2,184	$ 5,374	30
Trolley 102	178	0	$ -	<1
Total	401,416	113,516	$ 279,338	753

Source: City of San Luis Obispo, Public Works Department (First Transit Monthly Reports, 2005)

The Public Works Department is in the process of implementing an updated fleet management program. This new program will allow the department to track mileage and fuel usage for each vehicle on an annual basis, which is information that is required to accurately calculate mobile emissions from the vehicle fleet.

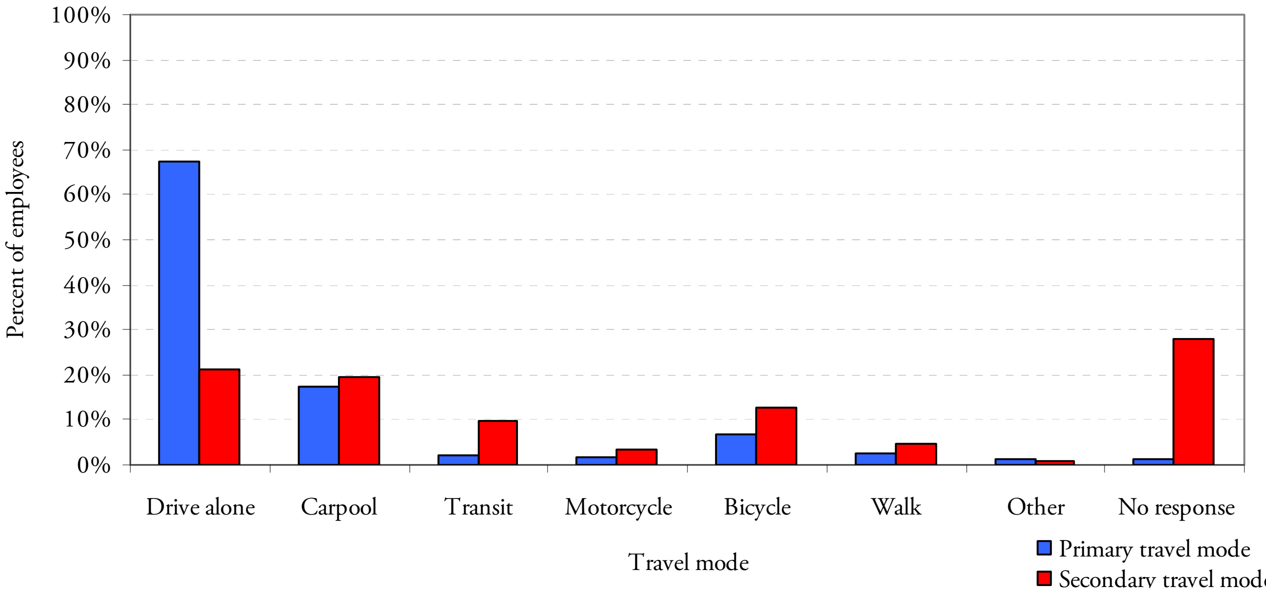
4.4 Employee Commute

The City of San Luis Obispo employee commute sector generates 1,009 $MTCO_2e$ of greenhouse gas emissions a year; representing 15.3 percent of total government-generated emissions (refer to Figure 4.1 above). Figure 4.3 provides a graphical distribution of the mode choice of city employees, including their primary and secondary mode choices. An employee's primary mode choice (e.g., "drive alone" or "bicycle") is assumed to be used eighty percent of the time, while a secondary mode – if used – is assumed to be chosen twenty percent of the time. Assumptions used in the employee commute survey are explained in more detail in Appendix C (C2.3). The single-occupant vehicle is the dominant form of transportation, as 67 percent of all respondents choose to drive alone as their primary travel mode. About one-fifth (18 percent) of respondents carpool, 7 percent bicycle, 3 percent walk, and 2 percent use public transit, 2 percent ride a motorcycle, and the other 2 percent use some other form of transportation.

About 70 percent of the respondents have a regular secondary mode of travel to work (approximately 20 percent of the time), which are more evenly distributed among the various modes of travel. "Drive alone" and "carpool" are most frequently used (21 and 20 percent, respectively), while 13 percent of employees choose to bike to work some of the time, and 10 percent of employees choose to take public transit to work some of the time. The other nine percent ride a motorcycle, walk or use another form of transportation at least some of the time.

The City of San Luis Obispo offers employees (other than those in the public safety areas) the opportunity of a flexible work schedule, where an employee works eighty hours in two weeks, but receives one day off in those two weeks in return for working nine-hour days (commonly referred to as "9/80"). About two-thirds of the respondents (64 percent) state that they do participate in this flexible work schedule. Nineteen percent of the respondents work five days a week, and fourteen respondents work three days a week or less. Eight respondents did not answer this question, and were not included in the final calculations. By offering employees the opportunity to have a flexible work schedule, the City is reducing the number of vehicle trips employees are making every year (and hence, reducing the amount of vehicle emissions). Employees who work a "9/80" travel to work 25 fewer times in a given 50-week work-year than an employee that works a regular 5-day work week for 50 week work-year.

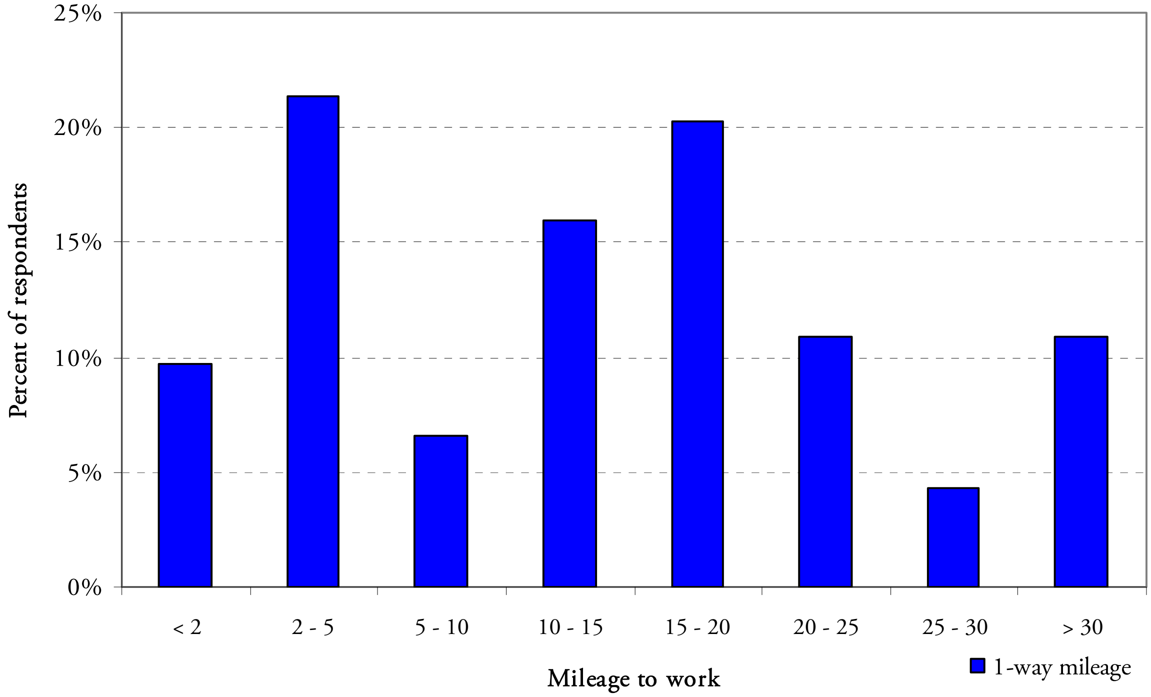
FIGURE 4.3: Employee Commute Mode by Primary and Secondary Mode (2007)



Source: City of San Luis Obispo, Employee Commute Survey (2007)

The average one-way distance traveled to work for respondents to the survey was 13.4 miles. Figure 4.4 shows the distribution of the respondents' one-way distance to work. Sixty-nine percent of survey respondents live more than five miles from work, which would indicate that they live outside the city limits. A distance greater than five miles means that the employee will not have the option to walk to work, will be likely less inclined to bike to work, and will likely live in an area that is not as well-served by public transit. The other 31 percent of respondents likely live within the city limits, as they live less than five miles from work. They therefore have broader transportation options, with more frequent local public transit service, as well as a bikeable and possibly walkable travel distance to work.

FIGURE 4.4: Distribution of distance to work of city employees (2007)



Source: City of San Luis Obispo, Employee Commute Survey (2007)

Table 4.8 provides a summary of the employee commute profile for the City of San Luis Obispo staff that participated in the survey. The results are displayed in terms of mileage by each mode of transportation. For the purposes of determining greenhouse gas emissions generation from the employee commute, only mileage from "Drive alone", "Carpool", and "Motorcycle" mileage was counted[24]. Therefore, about 1.9 million vehicle miles – 91 percent of the total commute mileage – was counted toward the emissions total. Vehicle miles of public transit were not counted, as the bus operates on a scheduled route. No emissions are generated by riding a bike or walking.

[24] "Drive alone" and "Carpool" mileage was entered into the software as "Passenger Vehicle", as a more specific distribution of vehicle types was not available. The *Clean Air and Climate Protection Software Users' Guide* notes that the passenger vehicle type is a composite vehicle category that incorporates all automobile classes (auto – small, medium, and large) as well as light trucks. The survey did not request information about vehicle fuel type, so it was assumed that the eighty percent of employee vehicles operate on gasoline, and twenty percent operate on diesel. "Motorcycle" mileage is entered into a separate category in the software. The software assumes that all motorcycles operate on gasoline.

TABLE 4.8: Summary of Employee Commute Mileage by Mode and Emissions

Employee Travel Mode	Annual Mileage	Percent of total mileage	Equivalent CO_2 [a]
			Scope 3 emissions
Drive alone	1,546,162	76.9%	826
Carpool[b]	316,672	15.7%	169
Transit[c]	51,928	2.6%	0
Motorcycle	39,882	2.0%	14
Bicycle	36,089	1.8%	0
Walk	3,065	0.2%	0
Other	17,900	0.9%	0
Total	2,011,698	100.0%	1,009

Source: City of San Luis Obispo, Employee Commute Survey (2007)

[a] As the survey did request information about vehicle fuel type, it was assumed that 80 percent of vehicles operate on gasoline, and 20 percent operate on diesel, for the purposes of calculating emissions.

[b] Carpool miles are assumed split between two people (i.e., one half-mile is assigned to each the driver and passenger for every vehicle mile)

[c] Public transit miles are assumed not to be counted toward total employee commute, as no new trip is generated

San Luis Obispo offers several viable transportation alternatives to the single-occupant vehicle, as its compact size makes it a very walkable and bikeable town. The city also is able to operate an efficient transit system to serve residents and businesses. Because of these reasons, city employees (and residents) have several transportation options to move around within the city limits and, as shown above, do choose to use several modes of transportation in order to get to work. It is then possible to quantify (or estimate) the total emissions that are averted because employees do use other forms of transportation other than the single-occupant vehicle. Table 4.9 shows how many equivalent CO_2 emissions are averted because some employees are carpooling, taking public transit, biking or walking to work.

As an example, in 2007 city employees logged a total of nearly 52,000 miles on the local and regional public transit system; public transit trips are already scheduled to operate based on a given transit schedule whether an employee chose to take the bus or not. If the employee had instead chosen to drive alone in a vehicle (perhaps assuming there was no public transit system in operation), then those 52,000 miles in a passenger vehicle would have generated 32 metric tons of additional emissions. The calculations in Table 4.9 also assume that if all the city employees that had carpooled had instead elected to drive alone, the nearly 194,000 vehicle miles driven by carpoolers would have doubled to nearly 388,000 vehicle miles, which translates into 119 metric tons of additional emissions. The total single-occupant vehicle mileage averted due to commute patterns of city employees is 309,471 miles, while total emission averted is 180 metric tons of CO_2 equivalents.

TABLE 4.9: Employee Commute Mileage and Emissions Averted (2007)

Employee Travel Mode	Annual Mileage (survey respondents)	Mileage if employee were to drive alone	Single-occupant vehicle mileage averted	Emissions based on survey results	Emissions if employee were to drive alone	Emissions averted
Carpool	193,961	387,922	193,961	119	238	119
Transit	51,928	51,928	51,928	0	32	32
Motorcycle	39,882	39,882	39,882	10	15	5
Bicycle	36,089	36,089	36,089	0	22	22
Walk	3,065	3,065	3,065	0	2	2
Total (selected modes)	324,925	518,886	324,925	129	309	180

Source: City of San Luis Obispo, Employee Survey (2007)

4.5 Streetlights and Traffic Signals

In 2005, the streetlights sector generated 141 metric tons of carbon dioxide equivalent ($MTCO_2e$), representing 2.1 percent of total government-generated emissions (See Figure 4.1). Greenhouse gas emissions generated from this sector originate from purchased electricity used to illuminate roadway lights, traffic control signal lights, and city park lighting.

In 2005, the City purchased 628,574 kilowatt-hours of electricity for the operation of streetlights and traffic signals throughout the community, at a cost of $147,518. Table 4.10 shows the distribution of electricity usage between streetlights and traffic signals.

TABLE 4.10: Streetlights & Traffic Signals Electricity Usage and Emissions (2005)

Streetlights & Traffic Signals	Sub-Category	Annual Electricity Usage (kWh)	Daily Electricity Usage (kWh)	Annual electricity cost	Daily electricity cost	Equivalent CO_2 (metric tons) *Scope 2 emissions*	Energy (MMBTU)[1]
City-owned Streetlights	Streetlights	415,536	1,138.5	$ 114,340	$ 313.26	93	1,419
PG&E-owned Streetlights	Streetlights	93	0.25	no energy cost data		0	7
Johnson Avenue Underpass Lighting	Underpass Lighting	1,876	5.1	$ 403	$ 1.11	< 1	6
City-wide Traffic Signals	Traffic Signals	211,069	578.3	$ 32,775	$ 89.79	47	721
All Streetlights & Traffic Signals		628,574	1,722.2	$ 147,518	$ 404.16	141	2,153

Source: City of San Luis Obispo: Utilities Department; Pacific Gas & Electric

Conventional traffic lighting systems use incandescent bulbs for traffic signals, which typically require 135 watts of power. In the 1990s, light-emitting diodes (LED) lighting technology was developed, which use semiconductor technology to convert excess energy into light; typical power requirements range from 10 to 22 watts per signal color (red, amber, or green)[25]. An economic feasibility study by the Traffic Engineering Division of the City of Little Rock, Arkansas, found that LED signals consume about 90% less energy than conventional signals with incandescent bulbs[26]. By 2000, the City of San Luis Obispo had installed LED lights for all red and green traffic control signal lights at the city's traffic signals.

4.6 Water Delivery

In 2005, the water delivery sector generated 1,043 metric tons of carbon dioxide equivalents ($MTCO_2e$); representing 15.9 percent of total government-generated emissions (see Figure 4.1). Greenhouse gas emissions generated from this sector originate from purchased electricity used to deliver water from the Whale Rock Reservoir in Cayucos to the city's water treatment plant, operate the water treatment plant, and distribute water by way of the water pumping stations throughout the community[27]. Above half (52%) of the emissions generated by the water delivery sector are attributable to the energy needed to deliver water 17.6 miles from Whale Rock Reservoir to the water treatment plant[28].

In 2005, the City purchased 4.67 million kilowatt-hours of electricity for the operation of the water delivery system, at an estimated cost of $487,275. Table 4.11 shows the distribution of electricity usage throughout the water delivery system.

The City of San Luis Obispo fulfills its local water demand from two sources of surface water – Whale Rock Reservoir and Salinas Reservoir (Santa Margarita Lake) – and ground water. The Salinas Dam was originally built in 1941 to supply water to Camp San Luis Obispo and, secondarily, to meet the water needs of the City. In 1947, the Salinas Dam and delivery system was transferred from the regular Army to the U.S. Army Corps of Engineers. Since 1965, the San Luis Obispo County Flood Control and Water Conservation District has operated this water system for the City under a lease from the U.S. Army Corps of Engineers[29]. Water from the reservoir is

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[25] Lighting Research Center, "Summary of LED and Traffic Signal Technology". (http://lrc.rpi.edu/programs/transportation/LED/LEDTrafficSignal.asp)

[26] City of Little Rock, Department of Public Works, Traffic Engineering Divisions, "Conventional vs. LED traffic signals: operational characteristics and economic feasibility" (2003). (http://www.cee1.org/gov/led/little_rock.pdf)

[27] Not all water delivered from the Whale Rock Reservoir in Cayucos is delivered to the City of San Luis Obispo. Water from Whale Rock Reservoir is also delivered to Cal Poly, California Men's Colony, and Dairy Creek Golf Course. In 2005, approximately 84.6% of the water delivered to the City of San Luis Obispo. About 14.5% of the Whale Rock Reservoir water was delivered to Cal Poly; the balance was delivered to California Men's Colony and Dairy Creek Golf Course (0.5% and 0.4%, respectively).

[28] City of San Luis Obispo website, water supply sources: http://www.slocity.org/utilities/sources.asp.

[29] Although the U.S. Army Corps of Engineers owns the Salinas Dam and its associated facilities, it has a formal agreement that provides full operational and financial control to the County of San Luis Obispo. The County manages the facility for recreational use and water supply. At present, the City of San Luis Obispo is the only user of the facility for drinking water. The County manages a water pump station adjacent to northbound U.S. 101 on the north side of the Cuesta Grade. By way of the formal agreement, the City reimburses the County for cost of the operation of the U.S. 101 pump station and other costs related to provision of drinking water to the City. However, any improvements to the facility must be authorized and directed by the County Board of Supervisors.

pumped through the Cuesta Tunnel (a one-mile long tunnel through the mountains of the Cuesta Ridge) and then flows by gravity to the City's Water Treatment Plant on Stenner Creek Road. The City has water rights to store up to 45,000 acre-feet.

TABLE 4.11: Water Delivery Electricity Usage and Emissions (2005)

Water Delivery System Facilities	Annual Electricity Usage (kWh)	Daily Electricity Usage (kWh)	Annual electricity cost	Daily electricity cost	Equivalent CO_2 (metric tons) *Scope 2 emissions*	Energy (MMBtu)
Whale Rock Pump Stations[a]	2,411,225	6,606.0	$ 242,881	$ 665.43	539	8,230
Water Treatment Plant	1,260,042	3,452.0	$ 127,990	$ 350.66	282	4,300
Miscellaneous	813,498	2,229.0	$ 89,179	$ 244.33	182	2,776
Water Pump Stations	178,543	489.0	$ 27,143	$ 74.36	40	609
Water Tanks	427	1.2	$ 367	$ 1.01	0.1	4
All Water Delivery Facilities	4,663,735	12,777.2	$ 487,562	$ 1,335.78	1,043	15,919

Source: City of San Luis Obispo: Utilities Department; Pacific Gas & Electric

[a] The total electricity used by Whale Rock Pump Station reflects the share of water delivered to San Luis Obispo. See footnote 28.

The City has developed a water recycling program in an effort to supplement the city's existing and future water supply. The city's water reclamation facility produces tertiary recycled water suitable for most uses other than swimming and drinking. This recycled water source may reduce the need for the City of San Luis Obispo to identify additional water sources in the future; this would also forego the need to develop additional water delivery systems in the future that requires a significant amount of energy to pump water through the pipelines from distance water sources, thus reducing Scope 2 emissions from purchased electricity.

County Public Works staff indicated that any improvements or other issues at the facility are reviewed and determined through collaboration between City and County staff and generally paid for by the City (personal communication with Mark Hutchinson, County of San Luis Obispo Public Works Department, provided by Tammy Seale, June 18, 2009). After discussions between City and County staff, consultant staff, and ICLEI staff, it was determined that the emissions associated with the operation of the U.S. 101 pump station shall be included in the County's baseline emissions inventory for 2006. In 2006, electricity usage at the U.S. 101 pump station generated 139 metric tons of carbon dioxide equivalents (County of San Luis Obispo "Community-Wide and County Government Operations Baseline Greenhouse Gas Emissions Inventory, 2006", page 43 of detailed report for Government Greenhouse Gas Emissions).

However, it is important to point out that the City of San Luis Obispo holds significant operational and financial control over the quantity of electricity used at the U.S. 101 pump station. As city Utilities Department staff indicated, the City needs to evaluate where and in what quantity to pull water from its two surface water supply sources (Salinas and Whale Rock reservoirs). As a result, the quantity of water that is taken from Salinas Reservoir will fluctuate from year to year, and sometimes wildly. In 2005 and 2006, for instance, significantly more water was taken from Whale Rock Reservoir than from Salinas Reservoir; far less water was taken from Salinas Reservoir than in normal years, which translated into less electricity used at the U.S. pump station for those years (personal communication with Gary Henderson, City of San Luis Obispo Utilities Department, June 19, 2009). Therefore, it is important to keep in mind that although emissions associated with the U.S. 101 pump station are included in the County's baseline emissions inventory, in future emissions inventory analyses, the amount of emissions associated with this pump station may vary significantly due in large part to operational decisions made by another governmental entity.

4.7 Wastewater

In 2005, the wastewater sector generated 1,185 metric tons of carbon dioxide equivalent ($MTCO_2e$), representing 18.1 percent of total government-generated emissions (See Figure 4.1). Greenhouse gas emissions generated from this sector originate from purchased electricity used to provide power to deliver sewage from residences and businesses through the city's sewerage system by way of the sewer lift stations to the water reclamation facility located along U.S. 101 between Prado Road and Los Osos Valley Road. Nearly all (over 97 percent) of the emissions originating from the wastewater sector were generated from the water reclamation facility. This is primarily due to the energy intensive process of wastewater treatment. Eighty-four percent of emissions generated in the wastewater sector originated from purchased electricity. The remaining 16 percent originated from the combustion of natural gas used to heat digesters and other operations.

In 2005, the City purchased 4.44 million kilowatt-hours of electricity for the operation of the wastewater system, at a cost of $490,579. Table 4.12 shows the distribution of electricity consumption through the wastewater system. In the same year, the City utilized 34,279 therms of natural gas at the water reclamation facility, for a total cost of $34,143. See Table 4.13.

TABLE 4.12: Wastewater Electricity Usage and Emissions (2005)

Wastewater Delivery System Facilities	Annual Electricity Usage (kWh)	Daily Electricity Usage (kWh)	Annual Electricity Cost	Daily Electricity Cost	Equivalent CO_2 (metric tons) *Scope 2 emissions*	Energy (MMBtu)
Sewer Lift Stations	134,505	368.6	$ 18,645	$ 51.08	30	458
Water Reclamation Facility	4,302,311	11,787.2	$ 471,934	$1,292.97	962	14,697
All Wastewater Delivery Facilities	4,440,674	12,155.8	$ 490,579	$1,344.05	993	15,155

Source: City of San Luis Obispo: Utilities Department; Pacific Gas & Electric

TABLE 4.13: Wastewater Natural Gas Usage and Emissions (2005)

Wastewater Delivery System Facility	Annual Natural Gas Usage (therms)	Daily Natural Gas Usage (therms)	Total Natural Gas Cost	Daily Natural Gas Cost	Equivalent CO_2 (metric tons) *Scope 1 emissions*	Energy (MMBTU)
Water Reclamation Facility	34,279	93.9	$ 34,143	$ 93.54	182	3,428

Source: City of San Luis Obispo: Utilities Department; Southern California Gas Company

4.8 Solid Waste

Municipal operations generated 276 tons of solid waste, which generated 125 metric tons of carbon dioxide equivalency emissions. This represents 1.9 percent of the total municipal emissions. Paper products represent about half (49%) of the total waste and generates 41 $MTCO_2e$ (33% of municipal waste emissions). Food waste represents 44 percent of total waste and generates 80 $MTCO_2e$ (64% of municipal waste emissions). Plant debris and wood and textiles represent a small amount of the total waste (7% combined), and generates 4 $MTCO_2e$ (3% of municipal waste emissions).

The *Clean Air and Climate Protection* software distributes the waste tonnage of "all other waste" between "paper products" and "food waste" based on the existing distribution of waste. Therefore, the approximately 62 tons of "all other waste" is split between "paper products" and "food waste" in the following manner: 32.8 tons to "paper products" and 29.7 tons to "food waste". Therefore, a total of 135.5 tons (instead of 102.7 tons) of waste is considered paper products, and 122.7 tons (instead of 93.0 tons) of waste is considered food waste.

TABLE 4.14: Solid Waste Tonnage and Emissions (2007)

Waste Type	Annual Tonnage	Percent of total waste	Equivalent CO_2 (metric tons)	Percent of total waste emissions
			Scope 3 emissions	
Paper Products	135.5	49%	41	32.8%
Food Waste	122.7	44%	80	64.0%
Plant Debris	7.6	3%	2	1.6%
Wood/Textiles	10.3	4%	2	1.6%
Total	276.1	100%	125	100.0%

Source: City of San Luis Obispo: Utilities Department

4.9 Other - Employee Business Travel

A limited amount of greenhouse gas emissions may be attributable to employee business travel done in personal vehicles. Of the five departments from which data was received, it was determined that 12,803 miles were driven in personal vehicles to attend various city-related business, while employee air travel to attend various conferences totaled 18,316 miles. The vehicle mileage generated 5.76 $MTCO_2e$, while the air mileage generated 4.9 $MTCO_2e$. Mileage in city vehicles was already counted as Scope 1 emissions in the Vehicle Fleet sector, and therefore was not double-counted here. See Table 4.15.

TABLE 4.15: Employee Business Travel Mileage and Emissions (2005)

Department	Mileage from city vehicles (counted as Scope 1 emissions)	Mileage from personal vehicles (counted as Scope 3 emissions)	Mileage from air travel (counted as Scope 3 emissions)	Equivalent CO_2 from vehicle travel (metric tons)	Equivalent CO_2 from air travel (metric tons) (0.59 lbs CO2 per passenger per mile)
				Scope 3 emissions	*Scope 3 emissions*
Community Development	3,650	600	4,292	0.13	1.15
Fire	5,892	1,473	--	0.68	--
Police	14,936	5,790	3,958	2.67	1.06
Public Works	6,234	1,558	10,066	0.72	2.69
Utilities (2008 data)	14,200	3,382	--	1.56	--
Total	44,912	12,803	18,316	5.76	4.90

Source: City of San Luis Obispo departments: Community Development, Fire, Police, Public Works, and Utilities

4.10 Municipal Operations Emissions by Scope

About 44 percent of the greenhouse gas emissions generated by the municipal operations of the City of San Luis Obispo were Scope 2 emissions, which includes all purchased electricity. About 41 percent of the emissions generated by municipal operations were Scope 1 emissions, which includes natural gas usage, and the consumption of gasoline and diesel. The other 10 percent were Scope 3 emissions, which include employee commute and employee business travel in private vehicles. See Table 4.16 below.

TABLE 4.16: Total Municipal Operations Emissions by Scope (2005)

Sector	Scope 1	Scope 2	Scope 3	Total[a]
Buildings	528	650	--	1,178
Vehicle Fleet	1,898	--	--	1,898
Employee Commute	--	--	1,009	1,009
Streetlights	--	141	--	141
Water Delivery	--	1,043	--	1,043
Wastewater	192	993	--	1,175
Solid Waste	--	--	125	125
Employee Business Travel	--	--	11	11
Total by Emission Scope	2,608	2,827	1,145	6,580
Percentage of Total CO2e	39.6%	43.0%	17.4%	100.0%

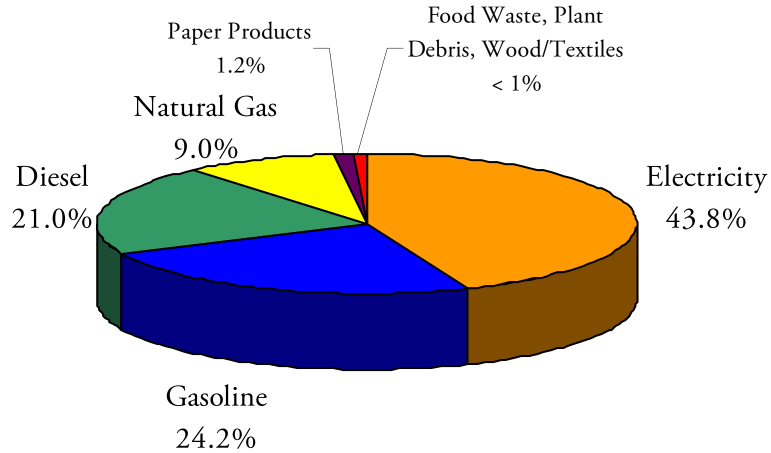
Source: City of San Luis Obispo: Utilities Department and Public Works Department, 2007 Employee Commute Survey; Clean Air and Climate Protection Software, and *Local Government Operations Protocol*.

[a] Due to rounding in the software, this column may not add up.

4.11 Source of Municipal Greenhouse Gas Emissions

Greenhouse gas emissions generated by the City of San Luis Obispo municipal operations originate from five primary sources. Figure 4.5 shows about half of greenhouse gas emissions were generated from purchased electricity (43.8%), followed by gasoline (24.2%), diesel (21.0%), and natural gas (9.0%). Paper products accounted for 1.2% of municipal operations emissions, while food waste, plant debris, and wood/textiles each accounted for less than 1 percent of municipal operations emissions.

FIGURE 4.5: Municipal Operations Greenhouse Gas Emissions by Source (2005)

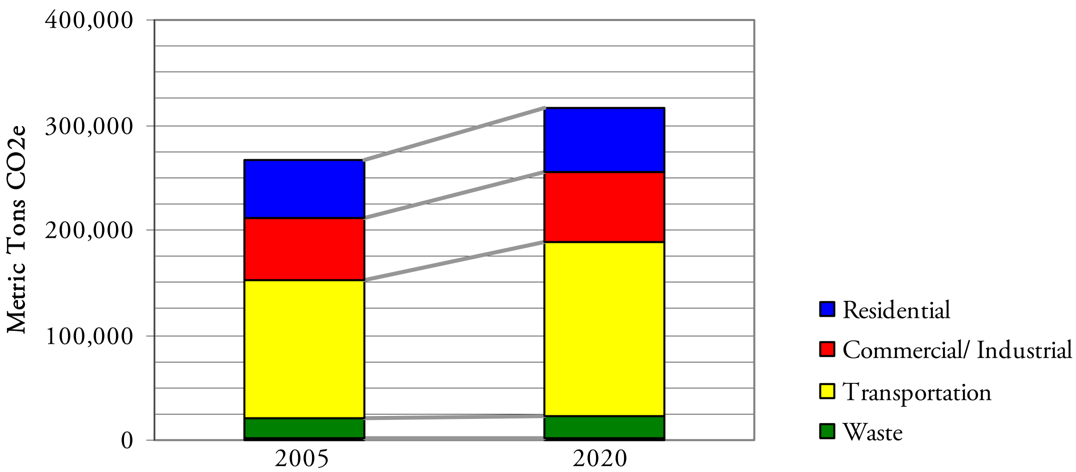


Source: City of San Luis Obispo: Utilities Department and Public Works Department, 2007 Employee Commute Survey; Clean Air and Climate Protection Software, and *Local Government Operations Protocol*.

5. Forecast

The emissions forecast for the City of San Luis Obispo represents a business-as-usual prediction of how community greenhouse gas levels will change over time if consumption trends and behavior continue as they did in 2005. These projections are based on projected growth in population, housing, and employment; projected figures are then derived for gasoline and diesel consumption, electricity and natural gas consumption, and waste tonnage. In 2005, the community produced 264,237 $MTCO_2e$. In a business-as-usual scenario, greenhouse gas emissions are projected to reach 314,832 $MTCO_2e$ by 2020, or a 19.1% increase over baseline levels. See Figure 5.1.

FIGURE 5.1: Business-As-Usual Projected GHG Emissions, San Luis Obispo (2005-2020)



Emissions generated by the transportation sector is expected to rise to 165,416 metric tons of CO_2e (a 25.2 percent increase); emissions from the residential sector are expected to increase to 61,579 metric tons of CO_2e through 2020 (an 11.2 percent increase); emissions from the commercial/industrial sector are expected to increase to 67,551 metric tons of CO_2e through 2020 (a 16.6 percent increase); while emissions from the waste sector are expected to increase to 20,286 metric tons of CO_2e through 2020 (an 8.1 percent increase).

The forecast does not quantify emissions reductions from State or federal activities including AB 32, the renewable portfolio standard, emission reductions achieved from passenger vehicles, light-duty trucks, and non-commercial vehicles under the Pavley bill, and SB 375. Additionally, it does not take into account reduction activities already underway or completed since 2005, the results of which would likely allow the community to have an emission level on a track well below the business-as-usual linear projection.

Forecasts were performed by applying household, population, and job growth rates to 2005 community-wide greenhouse gas emissions levels. Estimates for population growth were obtained from a long-range socio-economic projections report developed by the San Luis Obispo Council of

Governments in 2006. Estimates for employment growth were obtained from a 2009 revision to the 2006 projections report. The "medium growth" scenario for population and employment growth were used in this forecast estimation[30]. Estimates for household growth were obtained and derived from historic housing occupancy figures provided by Community Development staff[31].

City government operations emissions are not separately analyzed as part of this forecast due to a lack of reasonable growth indicators for the city government sector. However, an increase in emissions in not expected for existing facilities and operations in the city government operations sector. The City expects that emissions accounted within the scope of the 2005 City government operations inventory may decrease due to improved energy efficiency, co-generation at the water reclamation facility, and adding several fuel-efficient vehicles to the City's fleet. At the same time, it is likely that the City will have to expand services and infrastructure to accommodate the expected growth in the community, which could add new sources of emissions to the City government operations inventory that did not exist in 2005.

As the City develops its Climate Action Plan, it will use information in this report to assess which efforts might have the greatest impact in helping the City meet greenhouse gas reduction targets. For example, 50 percent of community emissions are attributed to the transportation sector, based on the amount of vehicle miles traveled through the City of San Luis Obispo. This includes trips made on local streets as well as trips on Highway 101 as it passes through the City. Some trips may be related to tourism and pass-through traffic and some is likely related to commuter traffic originating in neighboring communities with a work or shopping destination in the City.

Some of the ways other communities are addressing transportation emissions include improvements to public transit systems to make using public transportation more attractive to commuters. This can include providing shorter headways between buses, increasing the number of routes to serve previously under-served areas, marketing trolley and bus service so that commuters are more familiar with their options, and encouraging employers to provide incentives for employees who use alternative transit to make the work commute.

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30 Projections for population and employment growth for the City of San Luis Obispo were obtained from two San Luis Obispo Council of Governments reports, "Long Range Socio-Economic Projections for San Luis Obispo County (Year 2030)" (Prepared by Economic Research Associates for San Luis Obispo Council of Governments, May 2006), and "Update to Long Range Socio-Economic Projections for San Luis Obispo County (Year 2035)" (Prepared by Economic Research Associates for San Luis Obispo Council of Governments, June 2009).

31 Projections for household growth for the City of San Luis Obispo were generated by assuming a reduction of people per household at the rate of 0.01 people per household per year through 2020, then dividing the projected population by forecasted people per household figure to determine the projected number of households in 2020. For example, in 2020, the projected citywide population of 46,110 would require 22,211 households, assuming 2.076 people per household (46,110 [population] divided by 2.076 [people per households] equals 22,211 [households]). Community Development staff provided guidance in forecasting a figure for people per household for 2020.

For City government operations, the bulk of emissions are related to energy used by municipal buildings and energy associated with the City's vehicle fleet. This information may point to the need to look at ways to make the City's buildings more energy efficient and also investigating options for the City's vehicle fleet through use of alternative fuel vehicles for City operations and for the transit service operated by the City.

The City has identified the development of a Climate Action Plan a City goal for fiscal year 2009-10. In addition to pointing out areas where efforts will have the most impact, this greenhouse gas emissions inventory will provide the base information from which to measure progress.

In its recently approved AB 32 *Scoping Plan*, ARB encourages local governments to adopt a reduction goal for municipal operations emissions and to establish similar goals for community emissions that parallel the State commitment to reduce greenhouse gas emissions by approximately 15 percent from current levels by 2020[32]. If the City were to conform to this recommended reduction of 15 percent below current levels (to an estimated 224,601 metric tons of carbon dioxide equivalent), it would require a reduction of 90,231 metric tons of carbon dioxide equivalent below the city's 2020 business-as-usual emissions (Figure 4), which is equivalent to a 40.2 percent reduction.

[32] AB 32 *Scoping Plan*, page 27 (2008). In recognition of the importance of local governments in the successful implementation of AB 32, ARB added a section in the *Scoping Plan* identifying a Local Government Target -- a greenhouse gas emissions reduction target for local government municipal and community-wide emissions of a 15 percent reduction from current levels by 2020 to parallel the State's target. This was noted as a key change from the Draft *Scoping Plan* and the approved *Scoping Plan*.

6. Next Steps and Existing Local Actions

6.1 Milestone 2: Adopt an Emissions Reduction Target

The establishment of a community emissions baseline and projection prepares the City to complete the next step in the ICLEI process by setting an emissions reduction target. An emissions reduction target will allow the City to develop a reasonable policy and programmatic response to reduce its contribution to global climate change.

When choosing a reduction target, it is important to keep in mind the following:

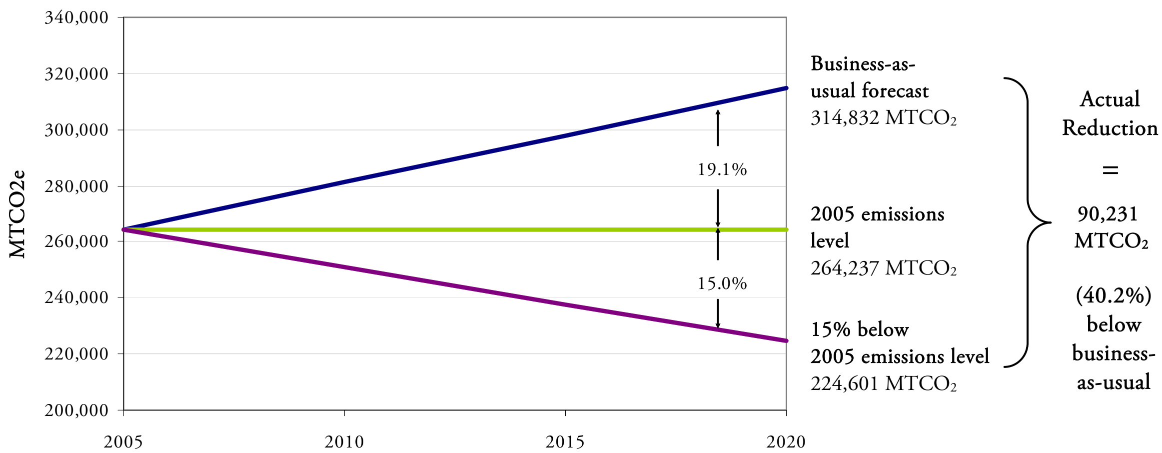
1. The State of California has accepted the following reduction targets:

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

2. Avoid setting a goal that is too distant as it may cause implementation to be delayed.
3. Cities may achieve first-year reductions of emissions as high as 5 percent by pursuing the "low-hanging fruit", while the next 5 percent may take years to achieve.
4. Setting intermittent goals is a good way to monitor progress and stay on track.

Based on the forecast emissions level in 2020, it is possible to estimate the total metric tons of carbon dioxide that needs to be reduced to achieve a 15 percent reduction from the baseline inventory year of 2005. Given that the baseline inventory is 264,237 $MTCO_2e$, the City would have to have an emissions level of 224,601 $MTCO_2e$. The estimated actual emissions reduction to achieve a possible 15 percent reduction target would be 90,231 $MTCO_2e$ in 2020 (Again, the estimated "business-as-usual" emission forecast is 314,832 $MTCO_2e$ in 2020). This translates into a 40.2 percent reduction in emissions in 2020 assuming no other emission reduction measures are introduced and implemented. Figure 6.1 illustrates this possible reduction scenario.

FIGURE 6.1: Greenhouse Gas Forecast in relation to 15% Reduction Target (2005-2020)



Source: Pacific Gas & Electric; Southern California Gas Company; San Luis Garbage; City of San Luis Obispo: Public Works and Utilities departments; Clean Air and Climate Protection software; and *Local Government Operations Protocol*.

6.2 Milestone 3: Develop a Local Climate Action Plan

After determining an agree-upon reduction target, the City of San Luis Obispo will develop a cohesive action plan based on the information revealed in this study. Developing an action plan will likely involve multiple steps, such as:

1. Compile a list of existing emission reduction measures already implemented in the community,
2. Quantify emissions reductions of existing measures,
3. Evaluate progress relative to the target,
4. Select new emission-reduction measures,
5. Quantify emission reductions of new measures, and
6. Develop a comprehensive emission reduction strategy.

The City should consider the formation of a community task force composed of decision-makers, key city staff, technical experts, and interested members of the public. The task force should consider splitting up tasks in a steering sub-committee and a technical advisory sub-committee. Overall, it is important to encourage strong public involvement and facilitate community buy-in throughout the process of developing the Climate Action Plan.

6.3 Milestone 4: Implementation Policies and Measures

The implementation of the policies and measures will not be able to happen all at one time, as is the case with the implementation of many programs. It may be necessary to categorize implementation measures in the following way:

1. "Ready-to-go" actions that can be made to existing projects without requiring additional funding
2. "Ready-to-go" actions that will require new expenditures
3. Long-term programs and measures that may require phasing in or identifying new expenditures.

To the last point in particular, it is important to develop a timeline for implementation of the programs and measures of the Climate Action Plan, while keeping in mind the reduction goal and the target year(s).

The City should strive to maintain strong public involvement, including attracting volunteers and interns, to assist in the implementation of the measures and programs of the action plan.

6.4 Milestone 5: Monitor and Verify Results

It is important to continue to quantify emissions periodically in order to make sure that implementation measures and programs are achieving the desired results. For example, as existing and proposed measures are implemented, appropriate data can be collected and entered into the *Clean Air Climate Protection* software to verify that emissions are being reduced. City staff will be able to perform this work using the software to obtain timely results. A full emissions inventory at the community-wide and municipal operations scale should be completed in five-year increments.

6.5 Existing City Actions to Address Climate Change

The following is a list of projects, programs, actions and policies that the City of San Luis Obispo has implemented in an effort to improve energy efficiency in city services and processes, to promote sustainable land use and transportation policies, to develop sustainable business practices, and make energy conservation a regular part of everyday municipal operations.

- Conservation and Open Space Element of the General Plan contains policies that support energy efficiency
- Energy audits have been conducted for several city facilities to identify areas where improvements may be made to achieve greater energy efficiency.
- Recycled water has been developed to meet community needs for landscape irrigation for public parks and city facilities.
- Greenbelt program to acquire open space
- "Pay as you throw" rate system for solid waste encourages recycling
- High efficiency boilers are used at City Hall and the Police Station, resulting in lower heating costs.
- Installation of one 60 kW micro-turbine at the SLO Swim Center generates almost enough electricity to power the complex while adding 500,000 Btus of heat to the pool.

- Electronic ballasts are used in all fluorescent lighting (low energy and no PCBs). No incandescent lamps are used because they waste energy and burn out more often.
- Motion-detection lighting controls are installed in common areas.
- Only fluorescent lamps (T8 and biax) or High Intensity Discharge (HID) lamps (such as high pressure sodium and metal halide) are used. They use much less power, have no PCBs and contain little, if any, mercury.
- Solar panels are located on the Utilities Administration Building and the Ludwick Community Center that each generates about 8 kW
- High-technology energy management systems are installed at seven major City office buildings (City Hall, Palm Street Parking Garage/City Offices, Police Department, Parks and Recreation, the Swim Center, Fire Station One headquarters, and the Corporation Yard).
- Energy efficient pumps and motors have been installed on City water pumping facilities.
- Installation of eight 30 kW micro-turbines and other energy saving measures at the Water Reclamation Facility that will save about 50,000 kWh of electricity and about $200,000 per year.
- Four hybrid vehicles were recently added to the City's vehicle fleet.
- City program provides cash or vacation day incentives to employees for automobile trip reduction efforts.
- Extensive bike trail system to encourage use of bicycle commuting
- Recycled oil used in city fleet vehicles.
- Purchasing policies support use of recycled materials and City recycles paper and other supplies. In addition, the City's policy requires double-sided printing if hard copy or electronic distribution of public materials.

6.6 Evolving Federal Climate Action Policy

Until recently, limited decisive action has been taken at the federal level to address climate change and the reduction of greenhouse gas emissions. In the last two years, several pieces of legislation have been proposed to establish targets for the reduction of greenhouse gas emissions. Proposed legislation includes incremental reductions of greenhouse gas emissions over a long time-horizon by instituting a "cap-and-trade" system for greenhouse gas emissions. Although each piece of legislation varies, proposed emission reductions range from at or below 2005 levels by 2012, up to 20 percent below 2005 levels by 2020, and up to 80 percent below 2005 levels by 2050. Under a federal cap-and-trade system, the federal government would auction off emissions allowances to emitters, as well as distributing emissions allowances to specified recipients, such as public transit agencies, which could then be sold. The total amount of emissions allowances available to emitters would decline each year in order to reach the target reductions set forth in the legislation (Pew Center for Global Climate Change).

In May 2009, a national fuel efficiency standard was established for all new passenger vehicles and non-commercial trucks sold in the United States. The new standards cover model years 2012 through 2016 and ultimately require an average fuel economy standard of 35.5 mpg in 2016. This action surpasses the Corporate Average Fuel Economy standards passed in 2007, which required an average fuel economy of 35 mpg in 2020. The new fuel economy standard is projected to save 1.8 billion barrels of oil over the life of the program, and would lead to a reduction of approximately 900 million metric tons of greenhouse gas emissions[33].

[33] White House Press Release, "President Obama Announces National Fuel Efficiency Policy", May 19, 2009.

Appendix A – Detailed Community Emission Inventory Notes

Table A.1: Buildings & Facilities Electricity Usage and Emissions (2005)

Building/Facility	Category	Address/Location	Annual Electricity Usage (kWh)*	Daily Electricity Usage (kWh)	Annual electricity cost*	Daily electricity cost	Equivalent CO_2 (metric tons)	Energy (MMBTU)
Corporation Yard	Corp Yard	25 Prado Rd	281,289	770.7	$ 35,122	$ 96.22	64.0	960
Corporation Yard Well	Corp Yard	25 Prado Rd	1,913	5.2	$ 391	$ 1.07	0.4	7
Canet Adobe	Cultural	466 Dana St - Unit Res	514	1.4	$ 86	$ 0.24	0.1	2
City/County Library	Cultural	995 Palm St	33,897	92.9	$ 4,908	$ 13.45	7.7	116
Jack House	Cultural	536 Marsh St	6,322	17.3	$ 1,029	$ 2.82	1.4	22
Ludwick Community Center	Cultural	864 Santa Rosa St	46,097	126.3	$ 7,141	$ 19.57	10.5	157
Rodriguez Adobe	Cultural	1341 Purple Sage Ln	711	1.9	$ 185	$ 0.51	0.2	2
Senior Citizen Center	Cultural	1445 Santa Rosa St	18,326	50.2	$ 3,419	$ 9.37	4.2	63
SLO County Historical Museum	Cultural	690 Monterey St	11,505	31.5	$ 2,060	$ 5.64	2.6	39
Little Theatre/Old City Library	Cultural	888 Morro St	41,383	113.4	$ 4,615	$ 12.64	9.4	141
Fire Station #1	Fire Station	2160 Santa Barbara St	122,282	335.0	$ 17,504	$ 47.96	27.8	417
Fire Station #2	Fire Station	136 N Chorro St	19,807	54.3	$ 2,776	$ 7.60	4.5	175
Fire Station #3	Fire Station	1284 Laurel Lane	19,300	52.9	$ 2,959	$ 8.11	4.4	68
Fire Station #4	Fire Station	1395 Madonna Rd	30,962	84.8	$ 4,642	$ 12.72	7.0	66
1940 Santa Barbara St.	Misc.	1940 Santa Barbara St.	29,430	80.6	$ 4,373	$ 11.98	6.6	100
Amtrak Station	Misc.	Amtrak Station	1,054	2.9	$ 244	$ 0.67	0.2	4
Fishing Facility Building	Misc.	Cypress Mountain Dr	0	0.0	$ 95	$ 0.26	0	10
Fountain (Osos & Railroad)	Misc.	Osos & Railroad	4,069	11.1	$ 625	$ 1.71	0.9	14
Hydro Building	Misc.	at bottom of dam	0	0.0	$ 0	$ 0.00	0	0
Lot 2 Restrooms	Misc.	736 Marsh St	2,762	7.6	$ 498	$ 1.36	0.6	9
Office & shop buildings	Misc.	Old Creek Rd	7,843	21.5	$ 1,357	$ 3.72	1.8	27
Portola Fountain	Misc.	Archer & Marsh	7,911	21.7	$ 1,266	$ 3.47	1.8	27
Pump house adjacent to Pacific HS	Misc.	11950 LOVR (near Pacific HS)	100,534	275.4	$ 12,082	$ 33.10	22.9	343
Range	Misc.	at Reservoir Cyn & Fox Hollow	4,517	12.4	$ 748	$ 2.05	1.0	15
Rented office	Misc.	1260 Chorro St #A	50,293	137.8	$ 7,583	$ 20.77	11.4	172
Spanish Oaks & Sweet Bay	Misc.	Spanish Oaks & Sweet Bay	4,343	11.9	$ 719	$ 1.97	1.0	15
Tank Farm & Wavertree	Misc.	4542 Wavertree St	1,054	2.9	$ 245	$ 0.67	0.2	4
City Hall	Office	990 Palm St	313,026	857.6	$ 42,800	$ 117.26	70.0	1,068
Parks & Rec Office	Office	1341 Nipomo St	48,522	132.9	$ 6,909	$ 18.93	11.0	166
Police Dept. auxiliary building	Office	1016 Walnut St	11,396	31.2	$ 1,656	$ 4.54	2.6	39
Police Dept. Building	Office	1042 Walnut St	426,572	1,168.7	$ 56,209	$ 154.00	97.0	1,456

Table A.1: Buildings & Facilities Electricity Usage and Emissions (2005) (cont'd.)

Building/Facility	Category	Address/Location	Annual Electricity Usage (kWh)*	Daily Electricity Usage (kWh)	Annual electricity cost*		Daily electricity cost	Equivalent CO_2 (metric tons)
Public Works Admin	Office	955 Morro St	66,442	182.0	no energy cost data		15.1	227
Utilities Admin	Office	879 Morro St	13,384	36.7	$ 2,865	$ 7.85	3.0	46
Damon-Garcia Sports Field	Parks/Rec	680 Industrial	51,140	140.1	$ 6,506	$ 17.82	11.6	175
French Park	Parks/Rec	Fuller St/French Park/Irr. P	11,847	32.5	$ 1,791	$ 4.91	2.7	40
Golf Maintenance Shop	Parks/Rec	11175 Los Osos Valley Rd	1,310	3.6	$ 2,390	$ 6.55	0.3	4
Golf Pro Shop	Parks/Rec	11175 Los Osos Valley Rd	21,030	57.6	$ 4,169	$ 11.42	4.8	72
Islay Hill Park	Parks/Rec	1511 Tank Farm Rd	9,377	25.7	$ 1,499	$ 4.11	2.1	32
Johnson Park	Parks/Rec	2875 Augusta St	946	2.6	$ 207	$ 0.57	0.2	3
Johnson Ranch	Parks/Rec	5182 Ontario Rd	5,150	14.1	$ 659	$ 1.81	1.2	18
Laguna Lake	Parks/Rec	Madonna Rd at Laguna Lake	2,662	7.3	$ 477	$ 1.31	0.6	19
Meadow Park	Parks/Rec	2333 Meadow St	18,817	51.6	$ 1,953	$ 5.35	4.3	64
Meadow Park (end of King St.)	Parks/Rec	south end of King St	2,791	7.6	$ 367	$ 1.01	0.6	10
Mirada Court Park	Parks/Rec	Mirada Court Park	1,041	2.9	$ 243	$ 0.67	0.2	4
Mission Plaza (1)	Parks/Rec	Monterey & Chorro	3,333	9.1	$ 580	$ 1.59	0.8	11
Mission Plaza (2)	Parks/Rec	Monterey & Broad	21,617	59.2	$ 2,469	$ 6.76	4.9	74
RST (end of Del Campo Rd)	Parks/Rec	end of Del Campo Rd	4,347	11.9	$ 725	$ 1.99	1.0	15
Santa Rosa Park (1)	Parks/Rec	Santa Rosa St (Murray St)	25,602	70.1	$ 2,845	$ 7.79	5.8	87
Santa Rosa Park (2)	Parks/Rec	Santa Rosa St	11,958	32.8	$ 1,442	$ 3.95	2.7	41
Santa Rosa Park (3)	Parks/Rec	190 Santa Rosa St #C	7,056	19.3	$ 1,225	$ 3.35	1.6	24
Sinsheimer Park (1)	Parks/Rec	Sinsheimer Park (Laurel Ln)	34,863	95.5	$ 4,256	$ 5.64	7.9	119
Sinsheimer Park (2)	Parks/Rec	Southwood Dr (Sinsheimer)	57,270	156.9	$ 5,564	$ 12.64	13.0	195
SLO Swim Center	Parks/Rec	902 Southwood Dr	391,497	1,072.6	$ 51,035	$ 139.82	89.1	1,336
Marsh St Pkg Structure	Pkg Structure	871 Marsh/1260 Chorro Ste B	134,646	368.9	$ 14,923	$ 40.88	30.6	460
Marsh St Pkg Structure Expansion	Pkg Structure	860 Pacific St	177,289	485.7	$ 17,577	$ 48.16	40.3	605
Palm St Parking Structure	Pkg Structure	842 Palm St	132,715	363.6	$ 15,589	$ 42.71	30.2	453
All Buildings & Facilities			2,855,764	7,823.9	$ 365,602	$ 993.04	647.8	9,838

Source: City of San Luis Obispo, Utilities Department

* Extrapolated over 365 days when annual energy bill data is incomplete

Table A.2: Buildings & Facilities Natural Gas Usage and Emissions (2005)

Building/Facility	Category	Address/Location	Annual Natural Gas Usage (therms)	Daily Natural Gas Usage (therms)	Total Natural Gas Cost	Daily Natural Gas Cost	Equivalent CO_2 (metric tons)	Energy (MMBTU)
Corporation Yard	Corp Yard	25 Prado Rd	7,365	20.2	$ 7,759	$ 21.26	39.2	737
Jack House	Cultural	535 Marsh Street	156	0.4	$ 287	$ 0.79	0.8	16
Ludwick Community Center	Cultural	864 Santa Rosa St	1,126	3.1	$ 1,437	$ 3.94	6.0	113
Senior Citizen Center	Cultural	1445 Santa Rosa St	1,291	3.5	$ 1,668	$ 4.57	6.9	129
SLO County Historical Museum	Cultural	696 Monterey St	256	0.7	$ 424	$ 1.16	1.4	26
SLO Little Theatre/Old City Library	Cultural	888 Morro St	236	0.6	$ 387	$ 1.06	1.3	24
Fire Station #1	Fire Station	2160 Santa Barbara	2,407	6.6	$ 2,802	$ 7.68	12.8	241
Fire Station #3	Fire Station	1284 Laurel Ln	1,110	3.0	$ 1,458	$ 3.99	5.9	111
Fire Station #4	Fire Station	1395 Madonna	959	2.6	$ 1,259	$ 3.45	5.1	96
City Hall	Office	990 Palm St	9,933	27.2	$ 10,402	$ 28.50	52.8	993
Parks & Recreation offices	Office	1341 Nipomo St	693	1.9	$ 923	$ 2.53	3.7	69
Police Department	Office	1042 Walnut St	14,344	39.3	$ 14,484	$ 39.68	76.3	1,434
PW/CDD offices	Office	919 Palm St	off-line	off-line	--	--	--	--
Utilities Administration	Office	879 Morro St	565	1.5	$ 763	$ 2.09	3.0	57
Laguna Lake Golf Course	Parks/Rec	11175 LOVR	352	1.0	$ 512	$ 1.40	1.9	35
Meadow Park	Parks/Rec	2333 Meadow	144	0.4	$ 261	$ 0.71	0.8	14
Southwood Pool	Swim Center	900 Southwood	58,391	160.0	$ 57,226	$ 156.78	310.6	5,839
All Buildings & Facilities			99,328	272.0	$102,052	$ 279.59	528.5	9,934

Source: City of San Luis Obispo, Utilities Department

Table A.3: Streetlights Electricity Usage and Emissions (2005)

Streetlight	Category	Annual Electricity Usage (kWh)*	Daily Electricity Usage (kWh)	Annual electricity cost*	Daily electricity cost	Equivalent CO_2 (metric tons)	Energy (MMBTU)
City-owned street lighting	Streetlights	415,536	1,138.5	$114,340	$ 313.26	93.0	1,419
PG&E-owned street lighting	Streetlights	1,921	5.3	no energy cost data		0.0	7
Johnson Ave underpass	Underpass lighting	1,876	5.1	$ 403	$ 1.11	0.4	6
Broad & Buchon	Traffic Signal	1,828	5.0	$ 363	$ 1.00	0.4	6
Broad & Pismo	Traffic Signal	1,991	5.5	$ 354	$ 0.97	0.4	7
California & Mill	Traffic Signal	2,884	7.9	$ 470	$ 1.29	0.6	10
California & Monterey	Traffic Signal	3,452	9.5	$ 544	$ 1.49	0.8	12
Chorro & Palm	Traffic Signal	1,092	3.0	$ 236	$ 0.65	0.2	4
Foothill & California	Traffic Signal	4,237	11.6	$ 645	$ 1.77	0.9	14
Foothill & Chorro	Traffic Signal	6,815	18.7	$ 976	$ 2.67	1.5	23
Foothill & Patricia	Traffic Signal	2,620	7.2	$ 438	$ 1.20	0.6	9
Foothill & Tassajara	Traffic Signal	2,944	8.1	$ 482	$ 1.32	0.7	10
Grand & Palm	Traffic Signal	3,596	9.9	$ 563	$ 1.54	0.8	12
Higuera & Broad	Traffic Signal	5,867	16.1	$ 848	$ 2.32	1.3	20
Higuera & Chorro	Traffic Signal	6,017	16.5	$ 866	$ 2.37	1.3	21
Higuera & High	Traffic Signal	8,307	22.8	$ 1,173	$ 3.21	1.9	28
Higuera & Marsh	Traffic Signal	2,979	8.2	$ 484	$ 1.33	0.7	10
Higuera & Morro	Traffic Signal	6,038	16.5	$ 870	$ 2.38	1.4	21
Higuera & Nipomo	Traffic Signal	5,675	15.5	$ 922	$ 2.53	1.3	19
Higuera & Osos	Traffic Signal	5,865	16.1	$ 850	$ 2.33	1.3	20
Johnson & Bishop	Traffic Signal	3,317	9.1	$ 527	$ 1.44	0.7	11
Johnson & Laurel	Traffic Signal	5,797	15.9	$ 887	$ 2.43	1.3	20
Johnson & Lizzie	Traffic Signal	4,666	12.8	$ 699	$ 1.92	1.0	16
Johnson & San Luis	Traffic Signal	4,778	13.1	$ 713	$ 1.95	1.1	16
LOVR & Calle Joaquin	Traffic Signal	off-line	off-line	--	--	--	--
LOVR & Descanso	Traffic Signal	3,334	9.1	$ 530	$ 1.45	0.7	11
LOVR & Froom Ranch	Traffic Signal	3,593	9.8	$ 563	$ 1.54	0.8	12
LOVR & Laguna	Traffic Signal	3,328	9.1	$ 529	$ 1.45	0.7	11
LOVR & Madonna	Traffic Signal	8,651	23.7	$ 1,220	$ 3.34	1.9	30
LOVR & Royal	Traffic Signal	4,281	11.7	$ 652	$ 1.79	1.0	15

Table A.3: Streetlights Electricity Usage and Emissions (2005) (cont'd)

Streetlight	Category	Annual Electricity Usage (kWh)*	Daily Electricity Usage (kWh)	Annual electricity cost*	Daily electricity cost	Equivalent CO_2 (metric tons)	Energy (MMBTU)
Madonna & Dalidio	Traffic Signal	3,270	9.0	$ 519	$ 1.42	0.7	11
Madonna & El Mercado	Traffic Signal	3,727	10.2	$ 578	$ 1.58	0.8	13
Madonna & Oceanaire	Traffic Signal	4,603	12.6	$ 696	$ 1.91	1.0	16
Marsh & Broad	Traffic Signal	4,257	11.7	$ 649	$ 1.78	1.0	15
Marsh & Chorro	Traffic Signal	3,962	10.9	$ 613	$ 1.68	0.9	14
Marsh & Johnson	Traffic Signal	2,971	8.1	$ 495	$ 1.36	0.7	10
Marsh & Morro	Traffic Signal	6,354	17.4	$ 910	$ 2.49	1.4	22
Marsh & Nipomo	Traffic Signal	3,707	10.2	$ 578	$ 1.58	0.8	13
Marsh & Osos	Traffic Signal	4,112	11.3	$ 623	$ 1.71	0.9	14
Monterey & Chorro	Traffic Signal	1,198	3.3	$ 253	$ 0.69	0.3	4
Monterey & Johnson	Traffic Signal	5,750	15.8	$ 843	$ 2.31	1.3	20
Monterey & Morro	Traffic Signal	1,302	3.6	$ 284	$ 0.78	0.3	4
Monterey & Osos	Traffic Signal	1,567	4.3	$ 301	$ 0.82	0.4	5
Osos & Buchon	Traffic Signal	3,145	8.6	$ 504	$ 1.38	0.7	11
Osos & Pismo	Traffic Signal	4,943	13.5	$ 737	$ 2.02	1.1	17
South Higuera & LOVR	Traffic Signal	3,458	9.5	$ 545	$ 1.49	0.8	12
South Higuera & Margarita	Traffic Signal	2,735	7.5	$ 452	$ 1.24	0.6	9
South Higuera & Prado	Traffic Signal	5,696	15.6	$ 899	$ 2.46	1.3	19
South Higuera & Suburban	Traffic Signal	3,116	8.5	$ 545	$ 1.49	0.7	11
South Higuera & Tank Farm	Traffic Signal	5,909	16.2	$ 864	$ 2.37	1.3	20
Santa Barbara & Upham	Traffic Signal	2,282	6.3	$ 534	$ 1.46	0.5	8
Santa Rosa & Higuera	Traffic Signal	5,295	14.5	$ 785	$ 2.15	1.2	18
Santa Rosa & Marsh	Traffic Signal	1,540	4.2	$ 297	$ 0.81	0.3	5
Santa Rosa & Mill	Traffic Signal	4,343	11.9	$ 653	$ 1.79	1.0	15
Santa Rosa & Monterey	Traffic Signal	4,282	11.7	$ 653	$ 1.79	1.0	15
Santa Rosa & Palm	Traffic Signal	3,592	9.8	$ 562	$ 1.54	0.8	12
All Streetlights & Traffic Signals		630,401	1,727.5	$147,519	$ 404.15	140.5	2,153

Source: City of San Luis Obispo, Utilities Department

* Extrapolated over 365 days when annual energy bill data is incomplete

Table A.4: Water Delivery Electricity Usage and Emissions (2005)

Water Delivery Facility	Category	Location/Address	Annual Electricity Usage (kWh)*	Daily Electricity Usage (kWh)	Annual electricity cost*	Daily electricity cost	Equivalent CO_2 (metric tons)	Energy (MMTBU)
108 E. 13th St	Misc.	Old Creek Rd (Cayucos)	2,268	6.2	$ 285	$ 0.78	0.5	8
Bishop Tank Cathodic Prot	Misc.	Flora St @ Viewmont	110	0.3	$ 96	$ 0.26	0.0	0
CL2 Bldg #2 Reservoir	Misc.	Upper Stenner Creek Wtr Plant	17,113	46.9	$ 2,185	$ 5.99	3.8	58
Fire St #4 Well	Misc	Los Osos Valley Rd & Madonna	128	0.4	$ 203	$ 0.56	0.0	0
Hydro Bldg #2 Reservoir	Misc.	Stenner Creek Rd	0	0.0	$ 87	$ 0.24	0.0	0
Radio repeater site	Misc.	Old Creek Rd	1,809	5.0	$ 96	$ 0.26	0.4	6
Reservoir #1	Misc.	Hwy 101 Reservoir 2 pump	6,670	18.3	$ 1,028	$ 2.82	1.5	23
South St. Hill repeater site	Misc.	0 Higuera St	11,022	30.2	$ 1,721	$ 4.72	2.5	38
Transfer Pump House	Misc.	Stenner Creek Rd .75mile	759,112	2,079.8	$ 82,783	$ 226.80	169.8	2,591
Valve Vault	Misc.	Old Creek Rd	59	0.2	$ 402	$ 1.10	0.0	0
Water Wells	Misc.	11175 Los Osos Valley Rd	15,207	41.7	$ 293	$ 0.80	3.4	52
Water Pump Stn (Alrita)	Pump Stn	Laurel Ln & Flora St	2,081	5.7	$ 449	$ 1.23	0.5	7
Water Pump Stn (Bishop)	Pump Stn	Bishop St & Flora St	47,121	129.1	$ 5,567	$ 15.25	10.5	161
Water Pump Stn (Bressi)	Pump Stn	Bressi Pl 400 S/Serrano	69,351	190.0	$ 11,107	$ 30.43	15.5	237
Water Pump Stn (Felmar)	Pump Stn	Between 171 & 183 Fel Mar	22,121	60.6	$ 3,632	$ 9.95	4.9	75
Water Pump Stn (Ferrini)	Pump Stn	Hwy 1 (¼ mil n/o Westmont)	15,203	41.7	$ 2,480	$ 6.79	3.4	52
Water Pump Stn (McCollom)	Pump Stn	Bond St Station McCollom	20,422	56.0	$ 3,270	$ 8.96	4.6	70
Water Pump Stn (Old Creek)	Pump Stn	108 Old Creek Rd	694	1.9	$ 224	$ 0.61	0.2	2
Water Pump Stn (Poly Vault)	Pump Stn	Mustang Dr	268	0.7	$ 127	$ 0.35	0.1	1
Water Pump Stn (Rosemont)	Pump Stn	2 Highland Dr	1,282	3.5	$ 287	$ 0.79	0.3	4
Highland Tank	Water Tank	W Highland Dr	167	0.5	$ 111	$ 0.30	0.0	1
Main Power Edna Tank	Water Tank	Broad St Edna Saddle	3	0.0	$ 131	$ 0.36	0.0	0
Terrace Hill Tank	Water Tank	Terrace Hill Water Tank	257	0.7	$ 125	$ 0.34	0.1	1
Water Treatment Plant	Treatment	Stenner Canyon Dr	1,260,042	3,452.2	$ 127,990	$ 350.66	281.9	4,300
Whale Rock Pump Stn #1	Whale Rock	Hwy 1 Pump Stn #1 (Chaney)	1,192,765	3,267.8	$ 118,163	$ 323.73	266.8	4,071
Whale Rock Pump Stn #2	Whale Rock	Hwy 1 Pump Stn #2 (Gilardi)	1,218,460	3,338.2	$ 124,718	$ 341.69	272.4	4,159
All Water Delivery Facilities			4,663,735	12,777.6	$ 487,560	$ 1,335.78	1,043.3	15,917

Source: City of San Luis Obispo, Utilities Department

* Extrapolated over 365 days when annual energy bill data is incomplete

Table A.5: Wastewater Electricity Usage and Emissions (2005)

Wastewater Facility	Category	Location/Address	Annual Electricity Usage (kWh)*	Daily Electricity Usage (kWh)	Annual electricity cost*	Daily electricity cost	Equivalent CO_2 (metric tons)	Energy (MMTBU)
Sewer Lift Station (Airport)	Lift Station	Hwy 227 (s/o Tank Farm)	3,830	10.5	$ 800	$ 2.19	0.9	13
Sewer Lift Station (Calle Joaquin)	Lift Station	LOVR & Hwy 101	19,743	54.1	$ 3,066	$ 8.40	4.5	67
Sewer Lift Station (Foothill)	Lift Station	Foothill Blvd	3,552	9.7	$ 732	$ 2.00	0.8	12
Sewer Lift Station (Madonna Inn)	Lift Station	Madonna Rd at Madonna Inn	8,279	22.7	$ 1,334	$ 3.66	1.9	28
Sewer Lift Station (Margarita)	Lift Station	Margarita & South Higuera	2,624	7.2	$ 526	$ 1.44	0.6	9
Sewer Lift Station (Rockview)	Lift Station	Broad & Rockview	51,459	141.0	$ 6,356	$ 17.41	11.5	176
Sewer Lift Station (Silver City)	Lift Station	South Higuera/Silver City	8,054	22.1	$ 1,324	$ 3.63	1.8	27
Sewer Lift Station (Tank Farm)	Lift Station	Edna Rd & Tank Farm Rd	36,964	101.3	$ 4,507	$ 12.35	8.2	126
Effluent Structure LOVR	Reclamation	35 Prado Rd	4,963	13.6	$ 778	$ 2.13	1.1	17
Water Reclamation Facility	Reclamation	35 Prado Rd (Bldg Electric)	4,301,206	11,784.1	$ 471,156	$ 1,290.84	961.3	14,680
All Wastewater Facilities			4,440,674	12,166.3	$ 490,579	$ 1,344.05	992.6	15,155

Source: City of San Luis Obispo, Utilities Department
* Extrapolated over 365 days when annual energy bill data is incomplete

Table A.6: Wastewater Natural Gas Usage and Emissions (2005)

Wastewater Facility	Address/Location	Annual Natural Gas Usage (Therms)	Daily Natural Gas Usage (Therms)	Total Natural Gas Cost	Daily Natural Gas Cost	Equivalent CO_2 (metric tons)	Energy (MMBTU)
Water Reclamation Facility	35 Prado Rd	34,279	93.9	$ 34,143	$ 93.54	182.4	3,428

Source: City of San Luis Obispo, Utilities Department

Table A.7: Community-wide Transportation Sector Emissions (2005)

Count Location	Street	Segment	VMT Sub-area	Street Classification	Segment Length (miles)	ADT	Daily VMT (Length x Volume)	Annual VMT (Daily VMT x 365)	Equivalent CO_2 (metric tons)
1	Broad	Ramona to Murray	Santa Rosa/Foothill	Collector	0.13	5,051	648	236,388	112
2	Broad	Murray to Mission	Santa Rosa/Foothill	Collector	0.17	4,255	711	259,434	123
3	Broad	Mission to Lincoln	Santa Rosa/Foothill	Collector	0.32	3,855	1,238	451,703	213
4	Broad	Lincoln to Hwy 101	Santa Rosa/Foothill	Collector	0.06	4,506	254	92,825	44
5	Broad	HWY 101 to Palm	Downtown/Uptown	Collector	0.17	2,583	441	161,061	76
6	Broad	Higuera to Marsh	Downtown/Uptown	Major Arterial	0.06	7,532	489	178,593	84
7	Broad	Marsh to Pismo	Downtown/Uptown	Major Arterial	0.13	9,402	1,197	436,766	206
8	Broad	Pismo to Church	Downtown/Uptown	Major Arterial	0.27	10,728	2,885	1,053,091	497
9	Broad	Church to South	Broad/South	Major Arterial	0.33	13,801	4,506	1,644,776	777
10	Broad	South to Lawrence	Broad/South	Major Arterial	0.45	29,103	12,959	4,729,871	2,234
11	Broad	Lawrence to Orcutt	Broad/South	Major Arterial	0.23	28,176	6,468	2,360,701	1,115
12	Broad	Orcutt to Capitolio	Tank Farm/Broad	Major Arterial	0.37	30,549	11,421	4,168,723	1,969
13	Broad	Capitolio to Industrial	Tank Farm/Broad	Major Arterial	0.39	24,935	9,757	3,561,219	1,682
14	Broad	Industrial to Tank Farm	Tank Farm/Broad	Major Arterial	0.22	21,700	4,772	1,741,610	822
15	Broad	Tank Farm to Fuller	Tank Farm/Broad	Major Arterial	0.32	20,598	6,554	2,392,177	1,130
16	Broad	Fuller to Aero	Tank Farm/Broad	Major Arterial	0.24	19,476	4,578	1,670,823	789
17	Broad	Aero to City Limits	Tank Farm/Broad	Major Arterial	0.16	17,708	2,784	1,016,030	480
18	Buena Vista	Loomis to Monterey	Downtown/Uptown	Collector	0.15	4,509	656	239,387	113
19	California	Campus to Foothill	Cal Poly area (e/o Santa Rosa)	Major Arterial	0.10	9,266	909	331,804	157
20	California	Foothill to Hathway	Cal Poly area (e/o Santa Rosa)	Major Arterial	0.22	9,617	2,146	783,148	370
21	California	Hathway to Taft	Cal Poly area (e/o Santa Rosa)	Major Arterial	0.13	11,798	1,548	565,198	267
22	California	Taft to Phillips	Downtown/Uptown	Major Arterial	0.27	13,645	3,646	1,330,943	629
23	California	Phillips to Monterey	Downtown/Uptown	Major Arterial	0.20	9,290	1,842	672,390	318
24	California	Monterey to Marsh	Downtown/Uptown	Major Arterial	0.11	11,343	1,285	468,908	221
25	California	Marsh to San Luis	Downtown/Uptown	Major Arterial	0.04	10,218	453	165,288	78
26	Capitolio	Broad to Sacramento	Tank Farm/Broad	Collector	0.17	4,252	711	259,545	123
27	Chorro	Highland to Foothill	Santa Rosa/Foothill	Collector	0.33	6,913	2,274	830,090	392
28	Chorro	Foothill to Murray	Santa Rosa/Foothill	Minor Arterial	0.25	7,228	1,780	649,562	307
29	Chorro	Murray to Center	Santa Rosa/Foothill	Minor Arterial	0.28	7,606	2,123	775,020	366
30	Chorro	Center to Lincoln	Santa Rosa/Foothill	Minor Arterial	0.15	8,038	1,168	426,189	201
31	Chorro	Lincoln to Palm	Downtown/Uptown	Minor Arterial	0.31	7,974	2,477	904,022	427
32	Chorro	Monterey to Higuera	Downtown/Uptown	Minor Arterial	0.06	8,016	466	170,120	80

Table A.7: Community-wide Transportation Sector Emissions (2005) (cont'd)

Count Location	Street	Segment	VMT Sub-area	Street Classification	Segment Length (miles)	ADT	Daily VMT (Length x Volume)	Annual VMT (Daily VMT x 365)	Equivalent CO_2 (metric tons)
33	Chorro	Higuera to Marsh	Downtown/Uptown	Minor Arterial	0.06	7,910	499	182,087	86
34	Chorro	Marsh to Pismo	Downtown/Uptown	Minor Arterial	0.13	5,890	761	277,689	131
35	Chorro	Pismo to Upham	Downtown/Uptown	Minor Arterial	0.33	3,879	1,272	464,437	219
36	Chorro	Upham to Broad	Broad/South	Minor Arterial	0.18	2,061	366	133,499	63
37	Foothill	City Limits to Patricia	Santa Rosa/Foothill	County Highway	0.33	11,699	3,869	1,412,056	667
38	Foothill	Patricia to Tassajara	Santa Rosa/Foothill	Major Arterial	0.31	13,491	4,157	1,517,367	717
39	Foothill	Tassajara to Ferrini	Santa Rosa/Foothill	Major Arterial	0.24	16,629	3,930	1,434,629	677
40	Foothill	Ferrini to Broad	Santa Rosa/Foothill	Major Arterial	0.12	17,072	2,102	767,108	362
41	Foothill	Broad to Chorro	Santa Rosa/Foothill	Major Arterial	0.05	20,611	1,042	380,425	180
42	Foothill	Chorro to Santa Rosa	Santa Rosa/Foothill	Major Arterial	0.16	18,562	2,988	1,090,693	515
43	Foothill	Santa Rosa to California	Cal Poly area (e/o Santa Rosa)	Major Arterial	0.26	19,545	5,060	1,846,984	872
44	Grand	Slack to Hwy 101	Cal Poly area (e/o Santa Rosa)	Major Arterial	0.29	14,681	4,218	1,539,573	727
45	Grand	Hwy 101 to Mill	Downtown/Uptown	Minor Arterial	0.17	9,346	1,563	570,487	269
46	Grand	Mill to Monterey	Downtown/Uptown	Minor Arterial	0.08	8,314	696	254,034	120
47	Higuera	California to Johnson	Downtown/Uptown	Collector	0.17	563	94	34,327	16
48	Higuera	Johnson to Santa Rosa	Downtown/Uptown	Major Arterial	0.19	3,794	737	269,094	127
49	Higuera	Santa Rosa to Osos	Downtown/Uptown	Major Arterial	0.10	8,306	801	292,260	138
50	Higuera	Osos to Chorro	Downtown/Uptown	Major Arterial	0.15	9,518	1,406	513,215	242
51	Higuera	Chorro to Broad	Downtown/Uptown	Major Arterial	0.12	10,331	1,250	456,354	215
52	Higuera	Broad to Nipomo	Downtown/Uptown	Major Arterial	0.08	10,019	787	287,430	136
53	Higuera	Nipomo to Marsh	Downtown/Uptown	Major Arterial	0.33	10,105	3,324	1,213,375	573
54	Higuera	Marsh to Pismo/High	Downtown/Uptown	Major Arterial	0.17	15,377	2,624	957,757	452
55	Higuera	Pismo/High to South	Broad/South	Major Arterial	0.18	16,279	2,849	1,039,821	491
56	Higuera	South to Madonna	Broad/South	Major Arterial	0.07	29,587	2,023	738,358	347
57	Higuera	Madonna to Margarita	South Higuera corridor	Major Arterial	0.82	16,644	13,649	4,982,009	2,353
58	Higuera	Margarita to Prado	South Higuera corridor	Major Arterial	0.17	15,047	2,568	937,203	444
59	Higuera	Prado to Granada	South Higuera corridor	Major Arterial	0.27	17,315	4,706	1,717,645	812
60	Higuera	Granada to Tank Farm	South Higuera corridor	Major Arterial	0.34	17,964	6,076	2,217,908	1,047
61	Higuera	Tank Farm to Suburban	South Higuera corridor	Major Arterial	0.21	20,257	4,297	1,568,383	740
62	Higuera	Suburban to LOVR	South Higuera corridor	Major Arterial	0.19	21,282	4,119	1,503,565	710
63	Higuera	LOVR to City Limits	South Higuera corridor	Major Arterial	0.23	6,782	1,541	562,598	265
64	Industrial	Broad to Sacramento	Tank Farm/Broad	Minor Arterial	0.29	4,244	1,243	453,863	214

Table A.7: Community-wide Transportation Sector Emissions (2005) (cont'd)

Count Location	Street	Segment	VMT Sub-area	Street Classification	Segment Length (miles)	ADT	Daily VMT (Length x Volume)	Annual VMT (Daily VMT x 365)	Equivalent CO_2 (metric tons)
65	Laurel	Johnson to Augusta	Johnson/Orcutt	Minor Arterial	0.12	7,068	859	313,683	148
66	Laurel	Augusta to Southwood	Johnson/Orcutt	Minor Arterial	0.12	8,645	1,076	392,635	149
67	Laurel	Southwood Orcutt	Johnson/Orcutt	Minor Arterial	0.30	8,676	2,641	963,817	455
68	LOVR	City Limits to Descanso	Madonna/LOVR area	Major Arterial	0.37	23,020	8,585	3,133,358	1,480
69	LOVR	Descanso to Prefumo Canyon	Madonna/LOVR area	Major Arterial	0.12	27,893	3,302	1,205,131	569
70	LOVR	Prefumo Canyon to Oceanaire	Madonna/LOVR area	Major Arterial	0.36	27,093	9,683	3,534,174	1,669
71	LOVR	Oceanaire to Royal Way	Madonna/LOVR area	Major Arterial	0.12	26,606	3,270	1,193,667	564
72	LOVR	Royal Way to Madonna	Madonna/LOVR area	Major Arterial	0.17	29,573	5,007	1,827,645	863
73	LOVR	Madonna to Froom Ranch	Madonna/LOVR area	Major Arterial	0.49	23,589	11,513	4,202,260	1,985
74	LOVR	Froom Ranch to Calle Joaquin	Madonna/LOVR area	Major Arterial	0.34	24,970	8,366	3,053,552	1,442
75	LOVR	SB 101 Ramp to NB 101	Madonna/LOVR area	Major Arterial	0.15	24,890	3,639	1,328,315	627
76	LOVR	Calle Joaquin to SB US Ramp	Madonna/LOVR area	Major Arterial	0.05	24,065	1,253	457,486	216
77	LOVR	NB US 101 to Higuera	South Higuera corridor	Major Arterial	0.34	20,132	6,875	2,509,236	1,185
78	Madonna	Tonnini to Los Osos Valley	Madonna/LOVR area	Collector	0.08	5,872	445	162,370	77
79	Madonna	Los Osos Valley to Pereira	Madonna/LOVR area	Major Arterial	0.08	19,937	1,495	545,775	258
80	Madonna	Pereira to Oceanaire	Madonna/LOVR area	Major Arterial	0.34	21,651	7,291	2,661,146	1,258
81	Madonna	Oceanaire to Dalidio	Madonna/LOVR area	Major Arterial	0.29	24,735	7,289	2,660,605	1,258
82	Madonna	Dalidio to El Mercado	Madonna/LOVR area	Major Arterial	0.10	25,199	2,606	951,119	447
83	Madonna	El Mercado to US 101SB	Madonna/LOVR area	Major Arterial	0.20	27,999	5,685	2,074,896	980
84	Madonna	US 101 SB to US 101 NB	Madonna/LOVR area	Major Arterial	0.19	32,871	6,319	2,306,417	1,088
85	Madonna	US 101 NB Ramps to Higuera	Madonna/LOVR area	Major Arterial	0.22	26,658	5,932	2,165,331	1,025
86	Marsh	US 101 to Broad	Downtown/Uptown	Major Arterial	0.45	12,273	5,544	2,023,476	956
87	Marsh	Broad to Chorro	Downtown/Uptown	Major Arterial	0.12	13,033	1,545	563,998	266
88	Marsh	Chorro to Osos	Downtown/Uptown	Major Arterial	0.15	11,515	1,675	611,342	289
89	Marsh	Osos to Santa Rosa	Downtown/Uptown	Major Arterial	0.10	12,609	1,280	467,202	221
90	Marsh	Santa Rosa to Johnson	Downtown/Uptown	Major Arterial	0.19	7,476	1,437	524,559	248
91	Marsh	Johnson to California	Downtown/Uptown	Major Arterial	0.19	3,608	674	245,925	116
92	Mill	Chorro to Osos	Downtown/Uptown	Collector	0.15	3,358	490	178,976	85
93	Mill	Osos to Santa Rosa	Downtown/Uptown	Collector	0.10	2,769	264	96,474	46
94	Mill	Santa Rosa to California	Downtown/Uptown	Collector	0.38	3,276	1,248	455,649	215
95	Mill	California to Grand	Downtown/Uptown	Collector	0.24	1,488	353	128,785	61
96	Monterey	Chorro to Osos	Downtown/Uptown	Minor Arterial	0.14	4,368	630	230,089	109

Table A.7: Community-wide Transportation Sector Emissions (2005) (cont'd)

Count Location	Street	Segment	VMT Sub-area	Street Classification	Segment Length (miles)	ADT	Daily VMT (Length x Volume)	Annual VMT (Daily VMT x 365)	Equivalent CO_2 (metric tons)
97	Monterey	Osos to Santa Rosa	Downtown/Uptown	Minor Arterial	0.09	5,892	559	204,061	96
98	Monterey	Santa Rosa to Johnson	Downtown/Uptown	Minor Arterial	0.20	11,854	2,342	854,689	404
99	Monterey	Johnson to California	Downtown/Uptown	Minor Arterial	0.19	13,785	2,566	936,740	442
100	Monterey	California to Grand	Downtown/Uptown	Minor Arterial	0.24	14,869	3,517	1,283,817	606
101	Monterey	Grand to Hwy 101	Downtown/Uptown	Collector	0.23	9,527	2,221	810,724	383
102	Johnson	Mill to Monterey	Downtown/Uptown	Collector	0.15	3,962	581	211,990	100
103	Johnson	Monterey to Marsh	Downtown/Uptown	Minor Arterial	0.11	11,537	1,304	476,131	225
104	Johnson	Marsh to Pismo	Downtown/Uptown	Minor Arterial	0.13	13,716	1,847	674,149	318
105	Johnson	Pismo to San Luis Drive	Downtown/Uptown	Minor Arterial	0.18	15,110	2,782	1,015,289	479
106	Johnson	San Luis Drive to Ella	Johnson/Orcutt	Major Arterial	0.26	19,994	5,203	1,899,089	897
107	Johnson	Ella to Bishop	Johnson/Orcutt	Major Arterial	0.26	17,034	4,400	1,606,164	703
108	Johnson	Bishop to Sydney	Johnson/Orcutt	Major Arterial	0.24	15,789	3,723	1,358,886	642
109	Johnson	Sydney to Laurel	Johnson/Orcutt	Major Arterial	0.39	15,655	6,140	2,241,259	1,058
110	Johnson	Laurel to Southwood	Johnson/Orcutt	Major Arterial	0.29	15,277	4,438	1,620,027	765
111	Johnson	Southwood to Orcutt	Johnson/Orcutt	Major Arterial	0.24	14,682	3,504	1,278,836	604
112	Aero Loop	W/O Broad	Tank Farm/Broad	Collector	0.29	2,282	666	242,938	115
113	Aero Vista	W/O Broad	Tank Farm/Broad	Collector	0.11	3,076	332	121,205	57
114	Augusta	Sydney to Laurel	Johnson/Orcutt	Collector	0.45	2,590	1,162	423,975	200
115	Buchon	High to Broad	Downtown/Uptown	Collector	0.42	1,403	586	214,052	101
116	Buchon	Broad to Chorro	Downtown/Uptown	Collector	0.12	2,118	254	92,827	44
117	Buchon	Chorro to Osos	Downtown/Uptown	Collector	0.14	2,131	304	110,927	53
118	Buchon	Osos to Santa Rosa	Downtown/Uptown	Collector	0.10	5,466	525	191,574	90
119	Buchon	Santa Rosa to Johnson	Downtown/Uptown	Collector	0.21	4,727	995	363,043	171
120	High	Higuera to Buchon	Downtown/Uptown	Collector	0.12	5,582	652	238,086	113
121	High	Buchon to Broad	Downtown/Uptown	Collector	0.52	2,436	1,262	460,568	218
122	Highland	Patricia to Ferrini	Santa Rosa/Foothill	Collector	0.51	6,956	3,581	1,306,977	617
123	Highland	Santa Rosa to Mt. Bishop	Cal Poly area (e/o Santa Rosa)	Collector	0.46	9,436	4,330	1,580,521	747
124	La Entrada	Foothill to Ramona	Santa Rosa/Foothill	Collector	0.08	1,221	92	33,678	16
125	Margarita	Higuera to City Limits	South Higuera corridor	Collector	0.47	453	211	77,130	36
126	Meinecke	Chorro to Santa Rosa	Santa Rosa/Foothill	Collector	0.13	1,393	182	66,541	31
127	Murray	Chorro to Santa Rosa	Santa Rosa/Foothill	Collector	0.16	2,063	332	121,221	57
128	Oceanaire	LOVR to Balboa	Madonna/LOVR area	Collector	0.34	1,759	591	215,592	102

Table A.7: Community-wide Transportation Sector Emissions (2005) (cont'd)

Count Location	Street	Segment	VMT Sub-area	Street Classification	Segment Length (miles)	ADT	Daily VMT (Length x Volume)	Annual VMT (Daily VMT x 365)	Equivalent CO_2 (metric tons)
129	Oceanaire	Balboa to Lake View	Madonna/LOVR area	Collector	0.26	1,561	401	146,218	69
130	Oceanaire	Lake View to Madonna	Madonna/LOVR area	Collector	0.25	2,502	623	227,443	107
131	Oceanaire	Madonna to Oceanaire	Madonna/LOVR area	Collector	0.34	626	211	77,115	36
132	Olive	US 101 SB Ramp to Santa Rosa	Santa Rosa/Foothill	Collector	0.14	21,519	3,093	1,129,075	534
133	Orcutt	Broad to Laurel	Johnson/Orcutt	Major Arterial	0.38	14,696	5,569	2,032,849	960
134	Orcutt	Laurel to Johnson	Johnson/Orcutt	Major Arterial	0.42	2,569	1,087	396,740	187
135	Orcutt	Johnson to Tank Farm	Tank Farm/Broad	County Highway	0.97	7,981	7,715	2,815,963	1,330
136	Orcutt	Tank Farm to City Line	Tank Farm/Broad	County Highway	0.43	3,523	1,520	554,786	262
137	Osos	US 101 to Palm	Downtown/Uptown	Minor Arterial	0.23	2,920	664	242,429	114
138	Osos	Palm to Monterey	Downtown/Uptown	Minor Arterial	0.07	3,727	274	99,965	47
139	Osos	Monterey to Higuera	Downtown/Uptown	Minor Arterial	0.06	4,608	271	98,749	47
140	Osos	Higuera to Marsh	Downtown/Uptown	Minor Arterial	0.07	5,807	378	138,092	65
141	Osos	Marsh to Pismo	Downtown/Uptown	Minor Arterial	0.13	8,398	1,109	404,639	191
142	Osos	Pismo to Leff	Downtown/Uptown	Minor Arterial	0.20	11,288	2,223	811,539	383
143	Palm	Nipomo to Chorro	Downtown/Uptown	Collector	0.20	2,333	467	170,309	80
144	Palm	Chorro to Osos	Downtown/Uptown	Collector	0.14	4,275	610	222,531	19
145	Palm	Osos to Santa Rosa	Downtown/Uptown	Collector	0.10	2,528	245	89,301	9
146	Pismo	Higuera to Broad	Downtown/Uptown	Minor Arterial	0.51	2,669	1,374	501,668	237
147	Pismo	Broad to Osos	Downtown/Uptown	Minor Arterial	0.26	3,622	939	342,776	162
148	Pismo	Osos to Santa Rosa	Downtown/Uptown	Minor Arterial	0.09	6,181	583	212,788	100
149	Pismo	Santa Rosa to Johnson	Downtown/Uptown	Minor Arterial	0.21	4,165	865	315,850	149
150	Prado	US 101 to Higuera	South Higuera corridor	Minor Arterial	0.32	7,271	2,351	857,999	405
151	Prado	Higuera to City Line	South Higuera corridor	Minor Arterial	0.48	2,894	1,402	511,750	241
152	Prefumo Canyon	Del Rio to Los Osos Valley	Madonna/LOVR area	Collector	0.18	3,075	540	197,266	93
153	Ramona	Tassajara to Broad	Santa Rosa/Foothill	Collector	0.36	3,193	1,145	418,059	198
154	Tassajara	Foothill to Ramona	Santa Rosa/Foothill	Collector	0.08	1,906	153	55,734	26
155	Sacramento	Capitolio to Industrial	Tank Farm/Broad	Collector	0.39	2,481	969	353,651	167
156	San Luis	California to Johnson	Downtown/Uptown	Major Arterial	0.33	11,662	3,861	1,409,203	665
157	Santa Barbara	Leff to High	Broad/South	Minor Arterial	0.30	14,392	4,323	1,577,914	744
158	Santa Barbara	High to Broad	Broad/South	Minor Arterial	0.18	13,940	2,469	901,018	425
159	Santa Rosa	Highland to City Line	Santa Rosa/Foothill	County Highway	0.07	30,599	2,046	746,691	353
160	Santa Rosa	Highland to Foothill	Santa Rosa/Foothill	Major Arterial	0.38	31,087	11,899	4,343,142	2,052

Table A.7: Community-wide Transportation Sector Emissions (2005) (cont'd)

Count Location	Street	Segment	VMT Sub-area	Street Classification	Segment Length (miles)	ADT	Daily VMT (Length x Volume)	Annual VMT (Daily VMT x 365)	Equivalent CO_2 (metric tons)
161	Santa Rosa	Foothill to US 101	Santa Rosa/Foothill	Major Arterial	0.57	38,197	21,876	7,984,909	3,773
162	Santa Rosa	US 101 to Walnut	Downtown/Uptown	Major Arterial	0.06	23,765	1,535	560,210	266
163	Santa Rosa	Walnut to Palm	Downtown/Uptown	Major Arterial	0.20	21,080	4,288	1,565,070	738
164	Santa Rosa	Palm to Monterey	Downtown/Uptown	Major Arterial	0.08	21,388	1,604	585,497	277
165	Santa Rosa	Monterey to Higuera	Downtown/Uptown	Major Arterial	0.06	21,563	1,274	465,075	219
166	Santa Rosa	Higuera to Marsh	Downtown/Uptown	Major Arterial	0.06	17,777	1,114	406,767	193
167	Santa Rosa	Marsh to Pismo	Downtown/Uptown	Major Arterial	0.13	7,983	1,033	376,917	178
168	Santa Rosa	Pismo to Buchon	Downtown/Uptown	Major Arterial	0.07	5,134	345	125,992	59
169	Santa Rosa	Buchon to Leff	Downtown/Uptown	Minor Arterial	0.13	2,346	302	110,118	52
170	South Street	Higuera to Broad	Broad/South	Major Arterial	0.78	17,458	13,570	4,952,914	2,338
171	Tank Farm	Higuera to Santa Fe	South Higuera corridor	Major Arterial	1.51	19,835	29,910	10,917,252	5,156
172	Tank Farm	Santa Fe to Broad	Tank Farm/Broad	Major Arterial	0.25	19,410	4,941	1,803,365	853
173	Tank Farm	Broad to UPRR	Tank Farm/Broad	Major Arterial	0.48	10,306	4,897	1,787,515	844
174	Tank Farm	UPRR to Orcutt	Tank Farm/Broad	Major Arterial	0.58	8,386	4,884	1,782,621	841
175	Walnut	Osos to Santa Rosa	Downtown/Uptown	Collector	0.10	4,142	402	146,602	69
176	Walnut	Santa Rosa to Toro	Downtown/Uptown	Collector	0.09	8,597	803	292,990	138
CT01	Hwy 101	S/O Los Osos Valley	U.S. 101 (LOVR to Monterey)	Highway		62,000			0
CT02	Hwy 101	Los Osos Valley to Prado	U.S. 101 (LOVR to Monterey)	Highway	0.79	62,000	49,201	17,958,277	8,443
CT03	Hwy 101	Prado to Madonna	U.S. 101 (LOVR to Monterey)	Highway	0.66	54,000	35,826	13,076,540	6,143
CT04	Hwy 101	Madonna to Marsh	U.S. 101 (LOVR to Monterey)	Highway	0.57	54,000	30,610	11,172,733	5,306
CT05	Hwy 101	Marsh to Broad	U.S. 101 (LOVR to Monterey)	Highway	0.76	70,000	53,534	19,539,943	9,170
CT06	Hwy 101	Broad to Osos	U.S. 101 (LOVR to Monterey)	Highway	0.21	65,000	13,776	5,028,082	2,353
CT07	Hwy 101	Osos to Toro	U.S. 101 (LOVR to Monterey)	Highway	0.23	65,000	14,637	5,342,618	2,577
CT08	Hwy 101	Toro to California	U.S. 101 (LOVR to Monterey)	Highway	0.26	55,000	14,188	5,178,438	2,465
CT09	Hwy 101	California to Grand	U.S. 101 (LOVR to Monterey)	Highway	0.26	43,000	11,173	4,078,322	1,927
CT10	Hwy 101	Grand to Monterey	U.S. 101 (LOVR to Monterey)	Highway	0.37	35,000	13,112	4,785,786	2,232
CT11	Hwy 101	N/O Monterey	U.S. 101 (LOVR to California)	Highway		40,000			0
CT12	Hwy 101 / LOVR	NB on	U.S. 101 on- and off-ramps	Highway Ramp	0.11	3,650	417	152,149	72
CT13	Hwy 101 / LOVR	NB off	U.S. 101 on- and off-ramps	Highway Ramp	0.18	6,550	1,152	420,645	199
CT14	Hwy 101 / LOVR	SB on	U.S. 101 on- and off-ramps	Highway Ramp	0.20	6,650	1,305	476,256	225
CT15	Hwy 101 / LOVR	SB off	U.S. 101 on- and off-ramps	Highway Ramp	0.07	5,450	355	129,603	61
CT16	Hwy 101 / Prado	NB on	U.S. 101 on- and off-ramps	Highway Ramp	0.05	1,450	78	28,567	13
CT17	Hwy 101 / Prado	NB off	U.S. 101 on- and off-ramps	Highway Ramp	0.15	4,400	653	238,467	112

Table A.7: Community-wide Transportation Sector Emissions (2005) (cont'd)

Count Location	Street	Segment	VMT Sub-area	Street Classification	Segment Length (miles)	ADT	Daily VMT (Length x Volume)	Annual VMT (Daily VMT x 365)	Equivalent CO_2 (metric tons)
CT18	Hwy 101 / Madonna	NB on	U.S. 101 on- and off-ramps	Highway Ramp	0.12	9,600	1,131	412,782	195
CT19	Hwy 101 / Madonna	NB off	U.S. 101 on- and off-ramps	Highway Ramp	0.14	4,225	599	218,760	103
CT20	Hwy 101 / Madonna	SB on	U.S. 101 on- and off-ramps	Highway Ramp	0.30	4,450	1,332	486,352	229
CT21	Hwy 101 / Madonna	SB off	U.S. 101 on- and off-ramps	Highway Ramp	0.16	10,925	1,788	652,520	309
CT22	Hwy 101 / Higuera	NB on	U.S. 101 on- and off-ramps	Highway Ramp	0.09	5,650	489	178,494	85
CT23	Hwy 101 / Higuera	NB off	U.S. 101 on- and off-ramps	Highway Ramp	0.17	5,600	942	343,764	162
CT24	Hwy 101 / Higuera	SB on	U.S. 101 on- and off-ramps	Highway Ramp	0.23	5,400	1,255	458,034	216
CT25	Hwy 101 / Higuera	SB off	U.S. 101 on- and off-ramps	Highway Ramp	0.22	3,200	690	251,961	119
CT26	Hwy 101 / Broad	NB on	U.S. 101 on- and off-ramps	Highway Ramp	0.08	1,350	110	40,036	19
CT27	Hwy 101 / Broad	NB off	U.S. 101 on- and off-ramps	Highway Ramp	0.05	1,850	88	32,100	15
CT28	Hwy 101 / Broad	SB on	U.S. 101 on- and off-ramps	Highway Ramp	0.06	2,700	168	61,220	29
CT29	Hwy 101 / Broad	SB off	U.S. 101 on- and off-ramps	Highway Ramp	0.06	1,500	95	34,530	16
CT30	Hwy 101 / Osos	NB on	U.S. 101 on- and off-ramps	Highway Ramp	0.08	2,200	170	62,050	29
CT31	Hwy 101 / Osos	NB off	U.S. 101 on- and off-ramps	Highway Ramp	0.06	2,800	170	61,939	29
CT32	Hwy 101 / Osos	SB on	U.S. 101 on- and off-ramps	Highway Ramp	--	8,900	--	--	0
CT33	Hwy 101 / Osos	SB off	U.S. 101 on- and off-ramps	Highway Ramp	0.07	950	68	24,824	12
CT34	Hwy 101 / Olive	SB on	U.S. 101 on- and off-ramps	Highway Ramp	0.21	2,200	466	170,029	80
CT35	Hwy 101 / Toro	NB on	U.S. 101 on- and off-ramps	Highway Ramp	0.11	1,200	128	46,786	22
CT36	Hwy 101 / Toro	NB off	U.S. 101 on- and off-ramps	Highway Ramp	0.06	8,800	557	203,183	96
CT37	Hwy 101 / California	NB on	U.S. 101 on- and off-ramps	Highway Ramp	0.11	2,075	238	86,926	41
CT38	Hwy 101 / California	NB off	U.S. 101 on- and off-ramps	Highway Ramp	0.11	4,600	501	182,846	86
CT39	Hwy 101 / California	SB on	U.S. 101 on- and off-ramps	Highway Ramp	0.06	2,775	168	61,195	29
CT40	Hwy 101 / California	SB off	U.S. 101 on- and off-ramps	Highway Ramp	0.08	3,700	310	113,053	54
CT41	Hwy 101 / Grand	NB off	U.S. 101 on- and off-ramps	Highway Ramp	0.13	3,450	438	159,791	76
CT42	Hwy 101 / Grand	SB on	U.S. 101 on- and off-ramps	Highway Ramp	0.12	4,775	596	217,529	103
CT43	Hwy 101 / Monterey	NB on	U.S. 101 on- and off-ramps	Highway Ramp	0.09				0
CT44	Hwy 101 / Monterey	NB off	U.S. 101 on- and off-ramps	Highway Ramp	0.09	900	78	28,370	13
CT45	Hwy 101 / Monterey	SB on	U.S. 101 on- and off-ramps	Highway Ramp	--	2,150	--	--	47
CT46	Hwy 101 / Monterey	SB off	U.S. 101 on- and off-ramps	Highway Ramp	0.08	3,600	272	99,297	0
Totals					49.86	12,713	768,239	280,407,300	132,137

Source: City of San Luis Obispo, Public Works Department, Transportation Division (City-wide Traffic Counts Program, 2005-06)

Table A.8 provides a summary of the results from the traffic counts program in terms of daily and annual VMT and the carbon dioxide equivalent of each VMT sub-area. The Downtown/Uptown and Madonna/LOVR sub-areas each generated over 16,000 $MTCO_2e$, although the emissions occurred over five roadway miles in the Madonna/LOVR sub-area as opposed to over nearly thirteen miles of roadway miles in the Downtown/Uptown sub-area. Three of the sub-areas (Tank Farm/Broad, Santa Rosa/Foothill, and South Higuera) each generated between 11,000 and 14,000 $MTCO_2e$, all over a similar distance of roadway mileage.

Table A.8: Transportation Sector – Summary of VMT & Emissions by sub-area (2005-2006)

VMT Sub-area	Road miles	Daily VMT	Annual VMT (in millions)	Equivalent CO_2 (metric tons)	Energy (MMBtu)
Broad/South	2.68	49,531	18.1	8,534	118,829
Cal Poly area (e/o Santa Rosa)	1.46	18,212	6.6	3,140	43,713
Downtown/Uptown	12.78	95,653	34.9	16,365	227,898
Johnson/Orcutt	3.48	39,803	14.5	6,768	94,241
Madonna/LOVR area	5.02	94,046	34.3	16,213	225,757
Santa Rosa/Foothill	5.37	72,684	26.5	12,533	174,531
South Higuera corridor	5.36	77,706	28.4	13,394	186,511
Tank Farm/Broad	5.66	67,743	24.7	11,678	162,605
U.S. 101 (LOVR to Monterey)[(b)]	4.12	236,057	86.2	40,616	565,542
U.S. 101 on- and off-ramps	3.89	16,806	6.1	2,896	40,344
Total (all sub-areas)	49.82	768,241	280.4	132,137	1,839,971

Source: City of San Luis Obispo, Public Works Department, Transportation Division (City-wide Traffic Counts Program, 2005-06)

[(a)] All vehicle mileage is counted along U.S. 101 from Los Osos Valley Road to Monterey Street exits

Table A.9 provides greater insight into the different levels of vehicle miles of travel in the eight subareas (and U.S. 101-related vehicle miles of travel), by showing daily and annual vehicle miles of travel per lane-mile in each sub-area, as well as vehicle emissions per lane-mile[34]. It is readily apparent that the highest level of daily and annual VMT per lane-mile occurs along U.S. 101 (12,257 daily vehicle miles of travel per lane-mile; 4.47 million annual vehicle miles of travel per lane-mile). Additionally, the highest level of carbon dioxide equivalent emissions per lane-mile occurs on U.S. 101 (2,109 $MTCO_2e$ per lane-mile, which is more than double the amount in the Broad/South sub-area). Among the local roadways in the community, the highest levels of daily and annual VMT per lane-mile occur in Broad/South, Madonna/LOVR, and Santa Rosa/Foothill subareas. Local traffic in each of these subareas generates more than 900 $MTCO_2e$ per lane-mile. It is important to point out that the local traffic in the Downtown/Uptown sub-area generates only 556 $MTCO_2e$ per lane-mile, whereas the average of all the subareas, including the traffic accounted for on U.S. 101, is 952 $MTCO_2e$ per lane-mile.

[34] Table A.9 provides roadway figures in terms of total road-miles, without taking into account that some roadways in the community are four-lane facilities (i.e., Los Osos Valley Road or most of Broad Street), while many roadways are two-lane facilities (i.e., Osos Street, Monterey Street).

Table A.9: Transportation Sector – Emissions per lane-mile by sub-area (2005-2006)

VMT Sub-area	Lane-miles	Daily VMT	Annual VMT (in millions)	Equivalent CO_2 (metric tons)	Daily VMT per lane-mile	Annual VMT per lane-mile (in millions)	Equivalent CO_2 per lane-mile (metric tons)
Broad/South	8.64	49,531	18.1	8,534	5,734	2.09	988
Cal Poly area (e/o Santa Rosa)	4.01	18,212	6.6	3,140	4,544	1.66	784
Downtown/Uptown	29.42	95,653	34.9	16,365	3,251	1.19	556
Johnson/Orcutt	10.35	39,803	14.5	6,768	3,847	1.40	654
Madonna/LOVR area	17.66	94,046	34.3	16,213	5,326	1.94	918
Santa Rosa/Foothill	13.93	72,684	26.5	12,533	5,220	1.91	900
South Higuera corridor	15.41	77,706	28.4	13,394	5,042	1.84	869
Tank Farm/Broad area	16.16	67,743	24.7	11,678	4,191	1.53	723
U.S. 101 (LOVR to Monterey)[a]	19.26	236,057	86.2	40,616	12,257	4.47	2,109
U.S. 101 on- and off-ramps	3.89	16,806	6.1	2,896	4,318	1.58	744
Total (all sub-areas)	138.73	768,241	280.3	132,137			
Average					5,538	2.02	952

Source: City of San Luis Obispo, Public Works Department, Transportation Division (City-wide Traffic Counts Program, 2005-06)

[a] All vehicle mileage is counted along U.S. 101 from Los Osos Valley Road to Monterey Street exits

Appendix B – Electricity and Natural Gas Coefficients

Electricity and natural gas coefficients are defaulted to national averages in the CACP software. To make the inventory more accurate and representative of the city's real impact on climate change, specific coefficient sets for California were obtained. The author of this report collaborated with the authors of the County of San Luis Obispo's "Community-Wide and County Government Operations Baseline Greenhouse Gas Emissions Inventory" to identify the appropriate coefficient set for use in this emissions inventor y for Year 2005. Sources and coefficient values are summarized in the tables below.

Average Grid Electricity Set	Unit	CO_2	N_2O	CH_4
PG&E California, 2005	lbs / MWh	489.16	0.011	0.029

Source: California Air Resources Board et al., *Local Government Operations Protocol*, [Table G.5: Utility-Specific Verified Electricity CO_2 Emission Factors (2000-2006)].

Marginal Grid Electricity Set
13 – Western Systems Coordinating Council/CNV

Source: Coefficient set provided by CACP

Average CHP Heat Set
USA total

Source: Coefficient set provided by CACP

RCI Average Set	Sector	Units	N_2O	CH_4
California Coefficients for Natural Gas				
Natural Gas	Commercial	kg/MMBtu	0.0001	0.0059
Natural Gas	Industrial	kg/MMBtu	0.0001	0.0059
Natural Gas	Residential	kg/MMBtu	0.0001	0.0059

Source: The "California Coefficients for Natural Gas" coefficient set is based on a PG&E eCO_2 emissions factor of 53.05 kg/MMBtu of delivered natural gas, certified by the California Climate Action Registry and the CEC, and was reported to ICLEI in December 2007 by Jasmin Ansar. The weighted U.S. Average CO_2 emission factor for natural gas combustion is 53.06 kg/MMBtu, as noted in the California Air Resources Board et al., *Local Government Operations Protocol*, [Table G.1: Default Factors for Calculating CO_2 Emission Factors from Fossil Fuel Combustion].

Appendix C – Municipal Analysis Emission Quantification Methodology

C.1 Electricity Use

Many of the City's facilities use purchased electricity, which is a Scope 2 emission, an indirect emission. The generation of electricity through the combustion of fossil fuels typically yields CO_2, and to a smaller extent, N_2O and CH_4. Under the *Local Government Operations Protocol* (*Protocol*), this inventory will report Scope 2 emissions occurring in the following sectors:

- Streetlights and traffic signals;
- Water delivery facilities;
- Wastewater facilities; and
- All other buildings and facilities not included in the sectors above.

Reporting these sectors separately facilitates a more useful comparison of a local government's emissions over time.

Under the *Protocol*, the recommended approach to calculating Scope 2 emissions from electricity use includes the following three steps:

1) Determine annual electricity use from each facility;
2) Select the appropriate emission factors that apply to the electricity used; and
3) Determine your total annual emissions in metric tons of carbon dioxide equivalent.

Step 1: Determine annual electricity consumption.

Monthly electricity bills provide the number of kilowatt hours of electricity consumed for each facility. Monthly bills were aggregated to determine the annual electricity use for each facility.

Step 2: Select the appropriate emission factors.

An electricity emission factor represents the amount of greenhouse gases emitted per unit of electricity consumed. It is usually reported in units of pounds of GHG per kWh or MWh. The *Protocol* stipulates that if your electricity provider is a member of the California Climate Action Registry and has "verified an electricity deliveries metric under CCAR's Power/Utility Protocol" this factor can be used to determine CO_2 emissions from purchased electricity (CARB *et al.*, 2008: 38). The utility-specific verified electricity CO_2 emission factor for Pacific Gas & Electric is 489.16 lbs of CO_2 per MWh of electricity consumed in 2005.

Under the *Protocol*, local governments in California are to use the CH_4 and N_2O default emission factors (California Grid Average Electricity Emission Factors) used by the Air Resources Board in the *Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004* (California Energy

Commission 2007). The emission factor for CH_4 is 0.029 pounds of CH_4 per MWh of electricity consumed. The emission factor for N_2O is 0.011 pounds of N_2O per MWh of electricity consumed. The most recent year for which emission factors are available is 2004, and is to be used for inventories using more recent years as a baseline year. The Marginal Grid Electricity Set used was "13 – Western Systems Coordinating Council/CNV" in the CACP Software.

Step 3: Determine total annual emissions and convert to metric tons of carbon dioxide equivalent.

To determine annual emissions, multiply annual electricity use (in MWh) from Step 1 by the emission factors for CO_2, CH_4, and N_2O (in pounds per MWh) from Step 2. The resulting product is then converted into metric tons by dividing by the total by 2,204.62 lbs/metric ton (See Equation C.1).

Equation C.1. Calculating Indirect Emissions From Electricity Use
CO_2 Emissions (metric tons) = Electricity Use x Emission Factor / 2,204.62 (MWh) (lbs CO_2/MWh) (lbs/metric ton)
CH_4 Emissions (metric tons) = Electricity Use x Emission Factor / 2,204.62 (MWh) (lbs CH_4/MWh) (lbs/metric ton)
N_2O Emissions (metric tons) = Electricity Use x Emission Factor / 2,204.62 (MWh) (lbs N_2O/MWh) (lbs/metric ton)

Source: California Air Resources Board et al., *Local Government Operations Protocol*

To convert CH_4 and N_2O into units of carbon dioxide equivalent, multiply total emissions of each gas (in metric tons) by its IPCC global warming potential (GWP) factor provided in Equation C.2. Then sum the emissions of each of the three gases in units of CO_2 to obtain greenhouse gas emissions.

Equation C.2. Converting to CO_2-Equivalent and Determining Total Emissions
CO_2 Emissions = CO_2 Emissions x 1 (metric tons CO_2e) (metric tons) (GWP)
CH_4 Emissions = CH_4 Emissions x 21 (metric tons CO_2e) (metric tons) (GWP)
N_2O Emissions = N_2O Emissions x 310 (metric tons CO_2e) (metric tons) (GWP)
Total Emissions = CO_2 + CH_4 + N_2O (metric tons CO_2e) (metric tons CO_2e)

Source: California Air Resources Board et al., *Local Government Operations Protocol*

C.2 Natural Gas Use

Several of the City's facilities consume natural gas, a form of stationary combustion, which is a Scope 1 emission. The combustion of natural gas, a fossil fuel, yields CO_2, and to a smaller extent, N_2O and CH_4. Under the *Local Government Operations Protocol*, this inventory will report Scope 1 emissions from stationary combustion in the following sectors:

- Buildings and facilities using natural gas; and the
- Wastewater facilities (water reclamation facility only).

Reporting these sectors separately facilitates a more useful comparison of a local government's emissions over time.

Under the *Protocol*, the recommended approach to calculating emissions from stationary combustion of natural gas involves the following steps:

1) Determine annual consumption of natural gas combusted at city facilities;
2) Determine the appropriate CO_2 emission factors for natural gas;
3) Determine the appropriate CH_4 and N_2O emission factors for natural gas;
4) Calculate CO_2 emissions from the combustion of natural gas;
5) Calculate CH_4 and N_2O emissions from the combustion of natural gas;
6) Convert CH_4 and N_2O emissions to CO_2 equivalent and determine total emissions.

Step 1: Determine annual consumption of natural gas at city facilities.

Monthly natural gas bills determine the amount of natural gas used by each facility. Monthly bills were aggregated to determine the annual electricity use for each facility. Fuel use is measured in therms.

Step 2: Select the appropriate CO_2 emission factor for natural gas.

The *Protocol* provides default emission factors for a wide variety of fuels in Table G.1 (in Appendix G of that document). Emission factors are provided in units of CO_2 per unit energy and CO_2 per unit mass or volume. The Weighted U.S. Average emission factor for natural gas is 53.06 kg CO_2 per MMBtu (one-million Btu) and is used in calculations for natural gas usage in this inventory.

Step 3: Determine the appropriate CH_4 and N_2O emission factors for natural gas.

The *Protocol* provides default emission factors in Table G.3 (in Appendix G of that document). Emission factors are provided in units of CH_4 or N_2O per unit energy. The *Protocol* suggests that local governments use the "commercial/institutional" sector emission factors. The emission factor for CH_4 is 5.9g per MMBtu (0.0059kg/MMBtu). The emission factor for N_2O is 0.1g per MMBtu (0.0001kg/MMBtu). These are the "California Coefficients for Natural Gas".

Step 4: Calculate CO_2 emissions from the combustion of natural gas.

To determine CO_2 emissions from stationary combustion, natural gas use figures must first be converted from therms to MMBtu (1 therm equals 100,000 Btu or 0.1 MMBtu). Natural gas use (in MMBtu) is then multiplied by the CO_2 emission factor, and then divided by 1,000 to convert from kilograms to metric tons (see Equation C.3).

Equation C.3. Calculating CO_2 Emissions From Stationary Combustion (fuel use in MMBtu)
Fuel A CO_2 Emissions (metric tons) = Fuel Consumed x Emission Factor / 1,000 (MMBtu) (lbs CO_2/MMBtu) (kg/metric ton)

Source: California Air Resources Board et al., *Local Government Operations Protocol*

Step 5: Calculate CH_4 and N_2O emissions and convert to metric tons.

To determine CH_4 emissions from stationary combustion, multiply fuel use from Step 1 by the CH_4 emission factor from Step 3, and then convert kilograms to metric tons (see Equation C.4). The same procedure is followed to calculate total emissions of N_2O at a particular city facility, using Equation C.5.

Equation C.4. Calculating CH_4 Emissions From Stationary Combustion
CH_4 Emissions (metric tons) = Fuel Use x Emission Factor / 1,000 (MMBtu) (kg CH_4/MMBtu) (kg/metric ton)

Source: California Air Resources Board et al., *Local Government Operations Protocol*

Equation C.5. Calculating N_2O Emissions From Stationary Combustion
Fuel A N_2O Emissions (metric tons) = Fuel Use x Emission Factor / 1,000 (MMBtu) (kg N_2O/MMBtu) (kg/metric ton)

Source: California Air Resources Board et al., *Local Government Operations Protocol*

Step 6: Convert CH_4 and N_2O emissions to units of CO_2 equivalent and determine total emissions from stationary combustion.

The global warming potential (GWP) factors established by the Intergovernmental Panel on Climate Change's *Second Assessment Report* are used to convert CH_4 and N_2O emissions to units of CO_2 equivalent. The sum of emissions from the three gases will determine the total greenhouse gas emissions from stationary combustion at city facilities (see Equation C.6).

Equation C.6. Converting to CO_2-Equivalent and Determining Total Emissions
CO_2 Emissions = CO_2 Emissions x 1 (metric tons CO_2e) (metric tons) (GWP)
CH_4 Emissions = CH_4 Emissions x 21 (metric tons CO_2e) (metric tons) (GWP)
N_2O Emissions = N_2O Emissions x 310 (metric tons CO_2e) (metric tons) (GWP)
Total Emissions = CO_2 + CH_4 + N_2O (metric tons CO_2e) (metric tons CO_2e)

Source: California Air Resources Board et al., *Local Government Operations Protocol*

C.3 Mobile combustion

Under the City's operation, mobile combustion sources include both on-road and off-road vehicle such as automobiles, trucks, buses, and construction equipment. The combustion of fossil fuels in mobile sources emits CO_2, CH_4 and N_2O.

Emissions from mobile combustion can be estimated based on vehicle fuel use and miles traveled data. CO_2 emissions, which account for the majority of emissions from mobile sources, are directly related to the quantity of fuel combusted and can be calculated using fuel consumption data. CH_4 and N_2O emissions depend more on the emission control technology employed in the vehicle and distance traveled. Calculating CH_4 and N_2O emissions requires data on vehicle characteristics (which takes into account emission control technologies) and vehicle miles traveled.

Calculating Scope 1 CO_2 emissions from mobile combustion involves three steps:

- Identify total annual fuel consumption by fuel type;
- Determine the appropriate emission factor; and
- Calculate total CO_2 emissions.

Step 1: Identify total annual fuel consumption by fuel type.

Methods for determining total annual fuel consumption include direct measurements of fuel use (official logs of vehicle fuel gauges or storage tanks); collected fuel receipts; and purchase records for bulk storage fuel purchases (in cases where fuel is stored at a facility). Total annual fuel purchases should include both fuel purchased for the bulk fueling facility and fuel purchased for vehicles at other fueling locations. In the case of the City of San Luis Obispo, purchase records for bulk storage fuel purchases were used to determine annual fuel consumption. In the baseline year of 2005, only gasoline and diesel were used to fuel the City's vehicle fleet. Equation C.7 below may be used to determine total fuel that was actually consumed.

Equation C.7. Accounting for Changes in Fuel Stocks From Bulk Purchases
Total Annual Consumption = Total Annual Fuel Purchases + Amount Stored at Beginning of Year – Amount Stored at End of Year

Source: California Air Resources Board et al., *Local Government Operations Protocol*

At the time of the data collection process for this inventory, only total annual fuel purchases was determined; the amount stored at the beginning of the year and at the end of the year was not determined. Additionally, fuel purchased for vehicles at other fueling locations was not determined.

Step 2: Determine the appropriate CO_2 emission factor for each fuel.

As it is not yet standard practice for states or regions to develop state- or region-specific greenhouse gas emission factors for their fuel blends, the *Protocol* recommends the use of widely-accepted national averages as the emission factor for use in calculating emissions from mobile combustion. The *Protocol* provides default emission factors for transport fuels in Table G.9 (in Appendix G of that document). The CO_2 emission factor for Motor Gasoline is 8.81 kg CO_2 per gallon; the CO_2 emission factor for Diesel Fuel No. 1 and 2 is 10.15 kg CO_2 per gallon.

Step 3: Calculate total CO_2 emissions and convert to metric tons.

To determine CO_2 emissions from mobile combustion, fuel use from Step 1 is multiplied by the CO_2 emission factor from Step 2; the resulting product is converted from kilograms to metric tons (see Equation C.8). This is repeated for both fuel types used by the city's vehicle fleet – Gasoline and Diesel.

Equation C.8. Calculating CO_2 Emissions From Mobile Combustion
Fuel A CO_2 Emissions (metric tons) = Fuel Consumed x Emission Factor / 1,000 (gallons) (kg CO_2/gallon) (kg/metric ton)
Fuel B CO_2 Emissions (metric tons) = Fuel Consumed x Emission Factor / 1,000 (gallons) (kg CO_2/gallon) (kg/metric ton)
Total CO_2 Emissions (metric tons) = CO_2 from Fuel A + CO_2 from Fuel B (metric tons) (metric tons)

Source: California Air Resources Board et al., *Local Government Operations Protocol*

Calculating Scope 1 CH_4 and N_2O emissions from mobile combustion involves five steps:

1) Identify the vehicle type, fuel type, and model year of each vehicle owned and operated by the City;
2) Identify the annual mileage by vehicle type;

3) Select the appropriate emission factor for each vehicle type;
4) Calculate CH_4 and N_2O emissions for each vehicle type and sum to obtain total CH_4 and N_2O emissions; and
5) Convert CH_4 and N_2O emissions to units of CO_2 equivalent and sum to determine total emissions.

Step 1: Identify the vehicle type, fuel type, and technology type or model year of all the vehicles owned and operated by the City.

An inventory of the City's entire vehicle fleet is necessary to complete this step, including identifying the vehicle type (categorized as passenger car, light truck/SUV/pickup, and heavy-duty truck), fuel type (such as gasoline or diesel), and model year.

Step 2: Identify the annual mileage by vehicle type.

CH_4 and N_2O emissions depend more on distance traveled than volume of fuel consumed. Therefore, the recommended approach is to use vehicle miles traveled data by vehicle type. At this time, the City has recently begun the process of developing a fleet management system that will be able to track annual vehicle mileage for each vehicle in its fleet. The vehicle mileage for the fleet for the baseline year of 2005 is considered by City staff to be incomplete and inconsistently collected and tracked. Instead, an estimate of vehicle mileage data is generally available by vehicle type, but data is not available in such a way that it would allow accurate calculation of CH_4 and N_2O emissions per the *Protocol*. Therefore, CH_4 and N_2O emissions from mobile combustion from the City's vehicle fleet will not be explicitly accurate at this time.

However, the methodology outlined in this report will allow city staff to complete this section of the emissions inventory when sufficient data (such as one years' worth of vehicle fleet data) is tracked and available for use in accurately calculating CH_4 and N_2O emissions.

Step 3: Select the appropriate emission factor for each vehicle type.

Emission factors for vehicles are available in Table G.10 (in Appendix G) of the *Protocol*, and are in units of grams of CH_4 (or N_2O) per mile.

Step 4: Calculate CH_4 and N_2O emissions by vehicle type and sum to obtain total CH_4 and N_2O emissions.

Use Equation C.9 to calculate CH_4 emissions by vehicle type, convert to metric tons, and obtain total CH_4 emissions. This calculation is repeated using Equation C.10 to obtain total N_2O emissions.

Equation C.9. Calculating CH_4 Emissions From Mobile Combustion
Vehicle Type A CH_4 Emissions (metric tons) = Annual Distance x Emission Factor / 1,000,000 (miles) (g CH_4/mile) (g/metric ton)
Vehicle Type B CH_4 Emissions (metric tons) = Annual Distance x Emission Factor / 1,000,000 (miles) (g CH_4/mile) (g/metric ton)
Total CH_4 Emissions = CH_4 from Type A + CH_4 from Type B + … (metric tons) (metric tons) (metric tons)

Source: California Air Resources Board et al., *Local Government Operations Protocol*

Equation C.10. Calculating N_2O Emissions From Mobile Combustion
Vehicle Type A N_2O Emissions (metric tons) = Annual Distance x Emission Factor / 1,000,000 (miles) (g CH_4/mile) (g/metric ton)
Vehicle Type B N_2O Emissions (metric tons) = Annual Distance x Emission Factor / 1,000,000 (miles) (g CH_4/mile) (g/metric ton)
Total N_2O Emissions = N_2O from Type A + N_2O from Type B + … (metric tons) (metric tons) (metric tons)

Source: California Air Resources Board et al., *Local Government Operations Protocol*

Step 5: Convert CH_4 and N_2O emissions to units of CO_2 equivalent and determine total emissions from mobile combustion.

Using the IPCC Global Warming Potential factors in Equation C.6, CH_4 and N_2O emissions can be converted to units of CO_2 equivalent. Emissions of all three gases are then summed to determine the total greenhouse gas emissions from mobile combustion (see Equation C.6 above).

Appendix D – Detailed Data Collection Methodology

D.1 Community Analysis Data Collection Methodology

D.1.1 Residential Sector

This sector calculates energy use and associated emissions for residential buildings within San Luis Obispo. Electricity and natural gas are the two primary energy sources utilized by the vast majority of households in San Luis Obispo, and for which data is available.

A representative from PG&E provided electricity figures for all residential users within San Luis Obispo. This included the number of residential customers and the community-wide electricity usage figures (in kilowatt-hours). Figures were available for 2003, 2004, and 2005.

A representative from Southern California Gas Company provided natural gas figures for all residential users within San Luis Obispo. This included the aggregated natural gas usage figures (in decatherms). Figures were available for 2005, 2006, and 2007.

D.1.2 Commercial & Industrial Sector

This sector calculates energy use and associated emissions for commercial businesses within the city. Electricity and natural gas are the two primary energy sources utilized by the vast majority of commercial businesses in San Luis Obispo, and for which data is available.

A representative from PG&E provided electricity figures for all commercial users within San Luis Obispo. This included the number of commercial customers and the community-wide electricity usage figures (in kilowatt-hours). Commercial electricity usage figures included industrial businesses due to the "15/15 Rule", an industry confidentiality ruling established by the California Public Utilities Commission. Figures were available for 2003, 2004, and 2005.

A representative from Southern California Gas Company provided natural gas figures for all commercial users within San Luis Obispo. This included the aggregated natural gas usage figures (in decatherms). Natural gas figures for industrial businesses were available, but were aggregated with commercial natural gas figures for consistency purposes. Figures were available for 2005, 2006, and 2007.

D.1.4 Transportation Sector

This sector calculates total vehicle miles of travel within the city limits on city-maintained roadways by commercial and private vehicles. As there are three highways maintained by the Department of Transportation (Caltrans) traversing the city (U.S. 101, SR-1 and SR-227), a determination must be made as to what mileage should be counted toward the total vehicle miles of travel (VMT) figure for the community.

The primary source of data is the City of San Luis Obispo's traffic counts program. At the time of the inventory, the most recent complete counts were the 2005-2006 traffic counts. The traffic counts program includes data for all of the follow roadway types in the city:

- Major Arterials
- Minor Arterials
- Collectors
- County Highways
- Highways
- Highway Ramps

Among other information, the traffic counts program provides peak Average Daily Trips (traffic volume) figures for 176 local roadway segments (non-highway). For instance, Broad Street includes 17 segments along its entire length, as it transitions from a local collector at the north end of the city (near Foothill), travels through downtown, and becomes a major arterial/state highway at the south end of the city to the southern city limits (near Aero). Because this roadway facility serves in these varying capacities, there are vastly different traffic volumes at the south end of the roadway (exceeding 25,000 ADT) from the north end of the roadway (around 5,000 ADT). Additionally, each of the 17 segments has varying lengths.

Vehicle miles of travel figures are commonly calculated, if sufficient traffic volume data is available, by using the following formula:

(i) *Segment Length* (in miles) X *Average Daily Traffic = Daily Vehicle Miles of Travel*
(ii) *Daily Vehicle Miles of Travel* X *365 days = Annual Vehicle Miles of Travel*

Segment lengths were calculated by using the City's geographic information systems (GIS) roadway network shape files to determine the segment length in miles. Shape files were created to reflect the 176 local roadway segments included in the traffic counts program, as well as the 46 highway segments and highway ramps.

Several county highways are not within the city limits, but are major roadway facilities that connect directly into the city-maintained roadway system; and therefore were included in the evaluation. For example, Highland (from city limits to Mt. Bishop) connects east of Santa Rosa/SR-1 toward the California Polytechnic State University (Cal Poly) campus. Also, southern portions of the city are connected by a section of Tank Farm Road (between South Higuera and Broad Street/SR-227), which is a county-maintained roadway.

It was determined to be necessary to count VMT on this section of roadway, as the city recently annexed property north and south of Tank Farm to accommodate future residential and commercial development in these areas (*see the Airport Area Specific Plan and Margarita Area Specific Plan*). It is necessary to include VMT occurring on this roadway segment in the process of establishing the baseline VMT figures, in order to track changes in VMT on this particular roadway. For the same reason, traffic volumes on Orcutt Road (between Johnson and Tank Farm) were included in the baseline VMT figures, as future residential and commercial development is planned between Orcutt Road, Tank Farm and the Union Pacific Railroad (*reference the Orcutt Area Specific Plan*).

U.S. 101 is a limited-access freeway facility through the San Luis Obispo, and there are many on- and off-ramps to allow access to the city roadway network. The highway enters the city from the north at Monterey Street and exits the city after the Los Osos Valley Road interchange in the south end of the city. According to California Department of Transportation (Caltrans) figures, two-way traffic volumes north of Monterey Street are approximately 40,000 Annual Average Daily Trips (AADT), while two-way volumes south of Los Osos Valley Road are 62,000 AADT. A majority of this traffic volume can be assumed to be pass-through traffic or traffic connecting to or from points north or south of the city. Although U.S. 101 is operated and maintained by Caltrans, there are segments of the highway in the middle of the city (i.e., between Madonna and Marsh), where volumes exceed 62,000 ADT. The spike in vehicular volume along this stretch of freeway may indicate that to some extent, there is some use of U.S. 101 as a local roadway, in order to bypass downtown traffic or to connect from the north end of town to the Madonna area (or vice versa), as a matter of convenience. At this time no standard emission reporting protocol exists that provides definitive direction as to how to quantify vehicle mileage that occurs in a given community. For that reason, all vehicle mileage from the Los Osos Valley Road exit to the Monterey Street exit was counted in the community-wide emissions inventory.

Within the city limits, SR-1 (Santa Rosa) and SR-227 (Madonna/South/Broad) are primarily utilized as major arterials, and are classified as such by the City's Circulation Element. Although operated and maintained by Caltrans, for all intents and purposes, the segments of these roadways within the city limits serve local traffic.

U.S. 101 highway on- and off-ramps are included in the community-wide VMT figures. Although these facilities are operated and maintained by Caltrans, the use of the on- and off-ramps indicates that a vehicle is about to enter or exit the local roadway network.

For the purposes of analysis of vehicle miles of travel resulting from the traffic count data, the city was split into eight subareas. The numerous traffic count segments were aggregated into these subareas by using the traffic analysis zones utilized in the city-maintained traffic demand model. A map showing the location of the VMT subareas and denoting the roadways for which traffic counts are collected is included in section 3.4 of this document.

D.1.5 Solid Waste Sector

This sector calculates emissions for the decomposition of waste under a specified disposal method (in this case, managed landfill). Due to a lack of information on the criteria air pollutants emitted from the waste sector, the software only reports on the greenhouse gases being released by waste disposal. There are two methods for calculating greenhouse gas emissions in the waste sector -- Methane Commitment method and the Waste-In-Place method. The Methane Commitment Method, which was used in this inventory, quantifies the net lifetime greenhouse gas emissions from waste disposed of in the active year. This method attributes all future emissions to the year in which the waste was produced.

The San Luis Garbage Company provides solid waste disposal services for residents and businesses in San Luis Obispo. The San Luis Garbage service area extends beyond city limits to include residential properties and commercial businesses adjacent to the city.

San Luis Garbage indicated approximately 92% of their residential customers lived within the city limits. The company provided totals of solid waste volumes for both residential and commercial customers (without specifying whether waste was generated by a city or county customer). Therefore, it was assumed that 92% of both residentially- and commercially-generated garbage was from customers located within the City. The waste figures provided are for years 2005, 2006 and 2007.

The software uses a waste composition (waste stream) of the following categories: paper products, food waste, plant debris, wood/textiles, and all other waste. Available data did not precisely fall into each one of the above categories. However, the Utilities Department maintains data tracking solid waste tonnage attributable to residences and businesses in San Luis Obispo. This data is disaggregated into many categories of solid waste, including commercial haulers, cardboard, white goods (appliances), and green waste, among others. With the assistance of Utilities Department staff, the categories of solid waste were assigned into the aforementioned four categories, as well as "all other waste". This was done in order to reasonably represent waste composition generated by the community before entering data into the software to calculate estimated emissions.

D.1.6 Air Travel

The San Luis Obispo County Regional Airport (McChesney Field) is a commercial service airport located adjacent to the southeast limits of the city; with three airlines providing commercial air service at the airport. The airport is operated by San Luis Obispo County, which precludes the City of San Luis Obispo from having any operational control of the airport for purposes of this greenhouse gas emissions inventory at the municipal operations level.

However, it is understood that residents and businesses of San Luis Obispo rely on the airport for commercial air service. According to Caltrans' Office of Aviation Planning, in 1995 there were 267,335 total passengers at McChesney Field. In 2006 there were 354,998 total passengers, a 33 percent increase in passenger service. It is not known what percentage of those passengers are San Luis Obispo residents.

The San Luis Obispo Air Pollution Control District has completed a detailed study of take-offs and landings at the airport by type of airplane. Greenhouse gas emissions from air travel are calculated in a way similar to vehicle miles of travel. A primary determinant of the level of emissions is the transport fuel used in the vehicle or airplane. The *Local Government Operations Protocol* lists two emission factors for use in the calculation of greenhouse gas emissions, in Table G.9 (Appendix G):

- Aviation Gasoline, with an emission factor of 8.32 kg CO_2 per gallon
- Jet Fuel (Jet A or A-1), with an emission factor of 9.57 kg CO_2 per gallon

However, the *Protocol* does not have a standard practice that allows for the calculation of emissions generated by air travel to be attributed to an individual community. Emissions from community air travel are more difficult to calculate and reasonably attribute to an individual community than other mobile sources (i.e., vehicles), for obvious reasons, as airplanes spend a very limited amount of time in a given community, let alone an air basin. A study of aircraft source emissions was completed by the San Luis Obispo County Air Pollution Control District in August 2008, which considered all aircraft exhaust emissions at the three commercial and general aviation airports in the county – San Luis Obispo County Regional Airport, Oceano County Airport, and Paso Robles Municipal Airport. It was determined that there were 59,033 landings and takeoffs (a total of 118,066 operations) at the San Luis Obispo County Regional Airport during the year 2007.

A significant amount of energy is required for take-offs and landings. Due to the shorter commercial flights available at McChesney Field, a greater percentage of energy necessary for a single flight (and resulting emissions) occur at the airport itself, when compared to commercial airports offering cross-country or international flights, such as Los Angeles International Airport (LAX) or San Francisco International Airport (SFO).

As no standard protocol exists to calculate emissions from community and regional airports, specific emissions figures are not included in this report. Additionally, an important goal of this emissions inventory is to produce an inventory that is consistent with the methodologies of other inventories across the state.

D.1.7 Freight and Passenger Train Travel

The Union Pacific Railroad owns the railroad tracks traveling through the community, and more than a dozen freight trains pass through every day. Additionally, Amtrak provides passenger rail service on both the Coast Starlight (with daily service to Klamath Falls, Oregon) and the Pacific Surfliner (with twice-daily service to Los Angeles) lines. California jurisdictions that have completed emissions inventories to date have not included rail travel, so in order to maintain consistency with other inventories throughout the state, emissions generated from freight and passenger rail travel will not be quantified in this report. The California Department of Transportation (Caltrans) is working to incorporate freight and passenger train travel in its current climate action planning efforts. As no standard protocol exists to calculate emissions from passenger and freight rail traffic due to the nature of interregional train travel, specific emissions figures are not included in this report.

D.2 Municipal Analysis Data Collection Methodology

D.2.1 Building/Facility Sector

This sector calculates energy use (electricity and natural gas) and emissions associated with government-owned and operated buildings. This includes leased office space or buildings. The steps used to determine emissions include:

(a) Obtain electricity and natural gas billing records for necessary years (in this case, 2004 through 2007 were available). Records were available in the form of monthly billing records in extensive spreadsheets.
(b) Extensive data compilation was performed to rearrange and aggregate monthly electricity usage figures so as to present data as annual electricity usage figures for each building, park, or other facility. Unit of measurement used in monthly bills is kilowatt-hours (kWh).
(c) City facilities were categorized, for purposes of the software, as either "Buildings", "Streetlights", or "Water & Sewage" facilities. Facilities such as City Hall, Ludwick Community Center, the four fire stations, parks, and the Corporation Yard were classified as "Buildings".
(d) Natural gas usage figures were available for the following facilities:

- City Hall, 990 Palm Street
- Corporation Yard, 25 Prado Road
- San Luis Obispo County Historical Museum, 696 Monterey Street
- Fire Station #1, 2160 Santa Barbara Street
- Fire Station #3, 1284 Laurel Lane
- Jack House, 535 Marsh Street
- Ludwick Community Center, 864 Santa Rosa Street
- SLO Little Theatre/Old City Library, 888 Morro Street
- Parks and Recreation Office, 1341 Nipomo Street
- Police Department, 1042 Walnut Street
- Public Works/Community Development/Parking Garage, 919 Palm Street
- Senior Citizen Center, 1445 Santa Rosa Street
- Sinsheimer Pool/Swim Center, 900 Southwood
- Water Reclamation Facility, 35 Prado Road[35]
- Utilities Administration, 879 Morro Street

D.2.2 Vehicle Fleet Sector

This sector calculates fuel usage and emissions associated with government-owned vehicle fleet(s). The vehicle fleet information system has the ability to produce reports that, for a given time period, identify vehicle mileage for individual vehicles. Fuel usage figures were collected separately, by

[35] The Water Reclamation Facility is classified as "Water & Sewage", whereas all other facilities are classified as "Buildings".

reviewing records of all bulk fuel purchases for city vehicles. These records indicate gasoline and diesel purchases split between two separate accounts – Fire Department and General Vehicle Fleet. However, there is no apparent way to link the quantity of fuel purchased with individual vehicles or by vehicle fleet, except for the Fire Department vehicles as a fleet. The vehicle fleet information system does provide vehicle miles of travel for the following vehicle types and data is entered into the software using these categories:

- Passenger Vehicles
- On-Road Diesel Vehicles
- Construction Vehicles
- Police Vehicles

Transit vehicle fleet information is collected separately. First Transit, the transit operator for the SLO Transit system, provides a monthly report to the city's Transit Manager that includes transit vehicle mileage by vehicle. Vehicle mileage and fuel usage total were recorded by month and annual totals were calculated. There are 16 transit vehicles. Of these sixteen vehicles, fourteen are transit buses that operate on diesel, while two are trolley vehicles. One trolley operates on diesel, the other operates on gasoline.

D.2.3 Employee Commute Sector

This sector calculates fuel usage and emissions associated with travel to and from work by employees of the government entity. A brief web-based survey using Survey Monkey was distributed via email, requesting the following information:

(a) Typical weekly work schedule (5 days/week, "9/80" work week, or 3 days/week or less)
(b) Distance traveled to work (one-way)
(c) Primary mode of travel (drive alone, carpool, transit, motorcycle, bike, walk, other)
(d) Secondary mode of travel (if >20% of all work trips are made using this second mode)

Out of 370 employees[36], approximately 250 responses were received, a high response rate (68%).

The assumptions utilized in the calculation of vehicle-miles of travel for employee commutes are as follows:

- The work year was assumed to be 50 weeks per year.
- Respondents who selected "5 days/week" work 250 days/year.
- Respondents who selected "9/80" work 225 days/year.
- Respondents who selected "3 days/week or less" work 150 days/year.
- Respondents who selected "Drive alone" were assigned all vehicle mileage traveled by those trips.

[36] This information was provided by April Craft in the Finance Department, and reflects total number of regular full-time city employees.

- Respondents who selected "Carpool" were assumed to be traveling with one other person; thus assigned half the vehicle mileage traveled by those trips.
- Respondents who selected Motorcycle were assigned all motorcycle trips for those trips; mileage would be recorded under motorcycle in the software as opposed to vehicle mileage.
- Respondents who selected Public Transit, Bicycle, or Walk were not assigned vehicle mileage for those trips.
- Secondary mode of travel was assumed to be utilized 20 percent of the time.

The methodology for calculating total vehicle mileage for each individual respondent was as follows:

(i) Mileage from the primary mode of travel was calculated first, using the following formula:

Number of days worked in a year X *One-way distance to work* X *Assigned percentage from Primary mode of travel*

(ii) If a secondary mode of travel was reported, the result of equation (i) was multiplied by 0.80.

(iii) If a secondary mode of travel was reported, mileage from the secondary mode of travel was calculated second, using the following formula:

Number of days worked in a year X *One-way distance to work* X *Assigned % from Secondary mode of travel*

(iv) As the secondary mode of travel was assumed to be utilized 20 percent of the time, the result of equation (iii) was multiplied by 0.20.

(v) To determine annual total of one-way vehicle mileage from primary and secondary modes of travel, add (i) and (iii).

(vi) To determine annual total of two-way vehicle mileage, multiply (v) by 2.

(vii) To determine total vehicle mileage from employee commute for a given year, sum all respondents annual total of two-way vehicle mileage [sum results for all respondents of (vi)].

(viii) Identify all mileage from motorcycle travel separately from vehicle mileage to differentiate data when entering into software.

Recommendation for subsequent employee commute surveys: For purposes of the allowing data entry to be more accurate, add the following questions to the survey:
(a) "What type of car do you drive?" (Light truck, SUV, compact, sedan, hybrid, other)
(b) "What type of fuel do you use?" (Gasoline, Diesel, Electric, other (specify))

D.2.4 Streetlight and Traffic Signal Sector

This sector calculates energy consumption and emissions associated with government-operated streetlights and traffic signals operated by the City. The steps used to determine emissions include:
(a) Obtain electricity billing records for necessary years (in this case, 2004 through 2007 were available). Records were available in the form of monthly billing records in a spreadsheet format.
(b) Extensive data compilation was performed to rearrange and aggregate monthly electricity usage figures so as to present data as annual electricity usage figures for each facility. The unit of measurement used in monthly bills is kilowatt-hours (kWh).
(c) City facilities were categorized, for purposes of the software, as either "Buildings", "Streetlights", or "Water & Sewage" facilities. The city's 55 traffic signals and several records for city-owned streetlights were classified under "Streetlights".

D.2.5 Water Delivery Sector

This sector calculates energy consumption and emissions associated with government-operated water delivery and wastewater delivery systems operated by the City. The steps used to determine emissions include:
(a) Obtain electricity billing records for necessary years (in this case, 2004 through 2007 were available). Records were available in the form of monthly billing records in extensive spreadsheets.
(b) Extensive data compilation was performed to rearrange and aggregate monthly electricity usage figures so as to present data as annual electricity usage figures for each facility. The unit of measurement used in monthly bills is kilowatt-hours (kWh).
(c) City facilities were categorized, for purposes of the software, as either "Buildings", "Streetlights", or "Water & Sewage" facilities. Facilities included in the "Water & Sewage" sector include the following:

- Water treatment plant
- 7 water pump stations
- 2 Whale Rock pump stations
- Several water tanks and wells associated with the water delivery system

(d) The results from the software were disaggregated to present the information in terms of water delivery and wastewater treatment systems separately.

D.2.6 Wastewater Sector

This sector calculates energy consumption and emissions associated with government-operated water delivery and wastewater delivery systems operated by the City. The steps used to determine emissions include:
(a) Obtain electricity and natural gas billing records for necessary years (in this case, 2004 through 2007 were available). Records were available in the form of monthly billing records in extensive spreadsheets.
(b) Extensive data compilation was performed to rearrange and aggregate monthly electricity usage figures so as to present data as annual electricity usage figures for each facility. The unit of measurement used in monthly bills is kilowatt-hours (kWh).

(c) City facilities were categorized, for purposes of the software, as either "Buildings", "Streetlights", or "Water & Sewage" facilities. Facilities included in the "Water & Sewage" sector include the following:

- Water reclamation facility
- Effluent structure (northeast of Los Osos Valley Road and U.S. 101 interchange)
- 8 sewer lift stations
- Several ancillary facilities associated with wastewater treatment system

(d) The results from the software were disaggregated to present the information in terms of water delivery and wastewater treatment systems separately.

D.2.7 Solid Waste Sector

This sector calculates solid waste volumes and emissions associated with solid waste contributed by local government operations and facilities. Emissions are based on the quantity of waste hauled to a landfill from local government operations and the composition of the waste stream. The Methane Commitment method is used to calculate all future emissions for annual waste generation, which is then applied to the active year. In this case, the active year is 2005. The software uses a waste composition (waste stream) default categories of the following: paper products, food waste, plant debris, wood/textiles, and all other waste.

The Utilities Department maintains records of the estimated tonnage of solid waste that is generated by city operations by city facility. San Luis Garbage provides service to the city facilities, as it does to city residents and businesses. As is available to residents and businesses, three separate bins are available – trash/refuse bins, recycle bins, and green waste bins. Therefore, the records maintained by the city disaggregate overall figures for solid waste into three categories – trash, commingled recycle, and green waste. City staff provided direction as to the general composition of refuse by the city facility in order to approximately match the above five categories of waste the CACP software uses for the overall waste composition.

For the purposes of the inventory, recyclables (or "commingled recyclables") were classified as "all other waste". Additionally, green waste was classified as "plant debris". About thirty city facilities generate some level of solid waste. Depending on the nature of the city facility, it will vary in the type of solid waste service it requires. For example, most of the city offices (including fire stations and community centers) have all three collection bins – refuse, green waste, and recycling; while most of the parks facilities will only have two collection bins – refuse and recycling. Due to data availability, 2007 will be used as a proxy year for this particular sector.

D.2.8 Employee Business Travel Sector

This sector calculates emissions associated with government employees traveling on behalf of the city in vehicles that are not owned or maintained by the city. These emissions are considered Scope 3 emissions. This includes emissions associated with personal and rented vehicles, mass transit, and air travel. Employee business travel records, or travel reimbursement records, were available for the year 2005 for four departments, while another department had records available for 2008. This was used as a proxy year for 2005. Although not all of the department records explicitly stated whether or not a personal vehicle or city vehicle was used to travel to employment-related events, it was determined that approximately twenty percent of employee business travel was in personal or rented vehicles. This percentage was then applied to the departments that did not have this data (vehicle driven) available. Employee business travel records that indicated a city vehicle was used for the trip were not included in this sector as the mileage would have already been accounted for in the Vehicle Fleet sector.

All vehicle travel mileage was assumed to originate in San Luis Obispo unless otherwise stated. Vehicle distance traveled was calculated using Google Maps. All air travel was assumed to originate at the San Luis Obispo County Regional Airport. Air travel distance was calculated using an online air travel trip-planning website (www.expedia.com) to determine an approximate itinerary (i.e., determine all intermediate stops and associated distances) that may have been used to reach the specified destination.

Appendix E – U.S. Mayors Climate Protection Agreement

(As endorsed by the 73rd Annual U.S. Conference of Mayors meeting, Chicago, 2005)

A. We urge the federal government and state governments to enact policies and programs to meet or beat the target of reducing global warming pollution levels to 7 percent below 1990 levels by 2012, including efforts to: reduce the United States' dependence on fossil fuels and accelerate the development of clean, economical energy resources and fuel-efficient technologies such as conservation, methane recovery for energy generation, waste to energy, wind and solar energy, fuel cells, efficient motor vehicles, and biofuels;

B. We urge the U.S. Congress to pass bipartisan greenhouse gas reduction legislation that 1) includes clear timetables and emissions limits and 2) a flexible, market-based system of tradeable allowances among emitting industries; and

C. We will strive to meet or exceed Kyoto Protocol targets for reducing global warming pollution by taking actions in our own operations and communities such as:
   a. Inventory global warming emissions in City operations and in the community, set reduction targets and create an action plan.
   b. Adopt and enforce land-use policies that reduce sprawl, preserve open space, and create compact, walkable urban communities;
   c. Promote transportation options such as bicycle trails, commute trip reduction programs, incentives for car pooling and public transit;
   d. Increase the use of clean, alternative energy by, for example, investing in "green tags", advocating for the development of renewable energy resources, recovering landfill methane for energy production, and supporting the use of waste to energy technology;
   e. Make energy efficiency a priority through building code improvements, retrofitting city facilities with energy efficient lighting and urging employees to conserve energy and save money;
   f. Purchase only Energy Star equipment and appliances for City use;
   g. Practice and promote sustainable building practices using the U.S. Green Building Council's LEED program or a similar system;
   h. Increase the average fuel efficiency of municipal fleet vehicles; reduce the number of vehicles; launch an employee education program including anti-idling messages; convert diesel vehicles to bio-diesel;
   i. Evaluate opportunities to increase pump efficiency in water and wastewater systems; recover wastewater treatment methane for energy production;
   j. Increase recycling rates in City operations and in the community;
   k. Maintain healthy urban forests; promote tree planting to increase shading and to absorb CO_2; and
   l. Help educate the public, schools, other jurisdictions, professional associations, business and industry about reducing global warming pollution.