Greenhouse Gas Emissions Inventory for Sacramento County

Unincorporated Sacramento County and Cities of Citrus Heights, Elk Grove, Folsom, Galt, Isleton, Rancho Cordova, and Sacramento

Prepared for:

Sacramento
County Department of
Environmental Review and
Assessment
827 7th Street, Room 220
Sacramento, CA 95814
Contact: Antonia Barry

Prepared by:

ICF Jones & Stokes
630 K Street, Suite 400
Sacramento, CA 95814
Contact: Shannon Hatcher
916/737-3000

June 2009

GHG Emissions Inventory for Incorporated and Unincorporated Sacramento County

Prepared for:

Sacramento County Department of
Environmental Review and Assessment
827 7th Street, Room 220
Sacramento, CA 95814
Contact: Antonia Barry

Prepared by:

ICF Jones & Stokes
630 K Street, Suite 400
Sacramento, CA 95814
Contact: Shannon Hatcher
916/737-3000

June 2009

ICF Jones & Stokes. 2009. GHG Emissions Inventory for Incorporated and Unincorporated Sacramento County. June. (ICF J&S 00310.08.) Sacramento, CA. Prepared for: Sacramento County Department of Environmental Review and Assessment.

Contents

Tables

Figures

Page

Acronyms and Abbreviations

AB 32	Global Warming Solutions Act of 2006
ARB	California Air Resources Board
Btus	British thermal units
CACP	Clean Air and Climate Protection
Caltrans	California Department of Transportation
CCAR	California Climate Action Registry
CFCs	chlorofluorocarbons
Ch_4	methane
CIWMB	California Integrated Waste Management Board
CO_2	carbon dioxide
CO_2e	CO_2 equivalents
CNG	compressed natural gas
DERA	Department of Environmental Review and Assessment
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FMMP	California Division of Land Resource Protection Farmland Mapping and Monitoring Program
FOD	first order decay
GHG	greenhouse gas
GWP	global warming potential

HFCs	hydroflourocarbons
HPMS	Highway Performance Monitoring System
IC	internal combustion
ICLEI	International Council for Local Environmental Initiatives
IPCC	Intergovernmental Panel on Climate Change
lbs/MWh	pounds per megawatt hours
LGOP	Local Governments Operations Protocol
LMOP	Landfill Methane Outreach Program
LPG	liquefied petroleum gas
MSA	Municipal Services Agency
N_2O	nitrous oxide
NAICS	North American Industry Classification System
PFC	perfluorocarbons
PG&E	Pacific Gas and Electric Company
SACOG	Sacramento Area Council of Governments
SASD	Sacramento Area Sewer District
SCRSD	Sacramento Regional County Sanitation District
SF_6	sulfur hexafluoride
SMAQMD	Sacramento Metropolitan Air Quality Management District
SMUD	Sacramento Municipal Utilities District
STAPPA/ALAPCO	State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials
VMT	vehicle miles traveled

Executive Summary

Introduction

The Sacramento County Department of Environmental Review and Assessment (DERA), with the assistance of ICF Jones and Stokes, developed 2005 greenhouse gas (GHG) inventories for the unincorporated areas of Sacramento County, for the incorporated cities within the County (Sacramento, Rancho Cordova, Citrus Heights, Elk Grove, Folsom, Isleton, and Galt), as well as for the entire County (including the cities listed above)[1]. The inventory defines a baseline emissions level from which Sacramento County and each of the Cities can begin to quantify emissions reduction efforts in order to comply with Assembly Bill 32 (AB 32) goals. These inventories also identify the largest contributing sectors to GHG emissions, and as such can be used to make informed decisions about potential, effective GHG controls.

Sacramento County, one of the original 27 counties of the State of California, covers about 994 square miles (2,570 km^2) of the Central Valley. Sacramento County extends from the low delta lands between the Sacramento and San Joaquin Rivers north to about 10 miles beyond the State Capitol and east to the foothills of the Sierra Nevada mountain range. The average annual rainfall in the County is 19.6 inches. Sacramento County is a major center for travel and transport, containing Sacramento International Airport, 3 mainline railroad tracks, 36.87 miles of light rail tracks, and the Port of Sacramento. The primary agricultural crops include: rice, milk, wine grapes, Bartlett pears, field corn, and tomatoes. The population of Sacramento County was 1,387,257 on January 1, 2006 and 1,424,415 on January 1, 2008 (California Department of Finance 2008). Sacramento County has the advantage of being the home to the state government and the California Air Resources Board (ARB), who are enacting progressive environmental legislation to address climate change within California (County of Sacramento 2007).

This report describes the data sources and methodology used to calculate GHG emissions for each source sector. Except where noted, the GHG methodology for each source sector is the same for each inventory. This report also describes the results for each inventory. For each inventory, the government sources are described in a separate inventory to demonstrate those sources under direct government control. All results are presented in units of metric tons of carbon dioxide equivalent (MT CO_2e).

[1] GHG emissions related to the government operations of Citrus Heights and Rancho Cordova were scaled back from 2007 emissions (see chapter 1).

Sacramento County is a member of the International Council for Local Environmental Initiatives (ICLEI) Local Governments for Sustainability. ICLEI's Clean Air and Climate Protection (CACP) software was used to generate GHG emissions estimates (State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials [STAPPA/ALAPCO], the International Council for Local Environmental Initiatives, and Torrie Smith Associates 2003). When available, area-specific values were substituted for CACP default values.

The County and city inventories presented in this report were developed using a geographic boundary (i.e., jurisdictional/city limits) for the emissions reporting. These inventories are referred to as *city-wide* inventories. In contrast, the government inventories were developed for the areas of each government's operational control. Emissions for a particular source were included in this inventory if the government entity either wholly owns an operation, facility or source, or has full authority to introduce and implement operating policies at the operation. This typically includes government-owned facilities, vehicles, and operations.

Some of the sources used for the inventory aggregate data from government and non-government activities. The government inventories include only those emissions specifically attributed to government operations. In some specific cases the emissions data used to generate this inventory differs from that used to generate the County and city inventories. Describing the government and city inventories as separate and non-duplicative will result in double-counting of some sectors (i.e., building energy use, transportation, etc.) if the two inventories are added together. This report identifies the government inventories as subsets of the city inventories to eliminate any double-counting.

Chapters 1–10 present the inventories. Appendix A provides all CACP software outputs. Appendix B provides the complete City GHG emissions methodology and Appendix C provides the complete Government GHG emissions methodology.

Global Climate Change

Global climate change is a problem caused by anthropogenic emissions of GHGs into the atmosphere through combustion of fossil fuels and other greenhouse gas producing activities such as deforestation and certain land use.

GHGs play a critical role in the Earth's radiation budget by trapping infrared radiation emitted from the Earth's surface, which could have otherwise escaped to space. Prominent GHGs contributing to this process include water vapor, carbon dioxide (CO_2), nitrous oxide (N_2O) methane (CH_4), ozone, and certain hydro- and fluorocarbons. This phenomenon, known as the *greenhouse effect*, keeps the Earth's atmosphere near the surface warmer than it would be otherwise and allows for successful habitation by humans and other forms of life. The combustion of fossil fuels releases carbon that has been stored underground into the active carbon cycle, thus increasing concentrations of greenhouse gases in the atmosphere. Emissions of GHGs in excess of natural ambient concentrations are thought to be responsible for the enhancement of the greenhouse effect and to contribute to what is termed "global warming," a trend of unnatural warming of the Earth's natural climate. Increases in these gases lead to more absorption of radiation and warm the lower atmosphere further, thereby increasing evaporation rates and temperatures near the surface. Climate change is a global problem, and GHGs are global pollutants, unlike criteria air pollutants (such as ozone precursors) and toxic air contaminants (TACs), which are pollutants of regional and local concern.

The Intergovernmental Panel on Climate Change (IPCC) has been established by the World Meteorological Organization and United Nations Environment Programme to assess scientific, technical and socio- economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation. The IPCC predicts substantial increases in temperatures globally of between 1.1 to 6.4 degrees Celsius (depending on scenario) (Intergovernmental Panel on Climate Change 2007).

Climate change could impact the natural environment in California in the following ways, among others.

- Rising sea levels along the California coastline, particularly in San Francisco and the San Joaquin Delta due to ocean expansion.
- Extreme-heat conditions, such as heat waves and very high temperatures, which could last longer and become more frequent.
- An increase in heat-related human deaths, infectious diseases and a higher risk of respiratory problems caused by deteriorating air quality.
- Reduced snow pack and stream flow in the Sierra Nevada mountains, affecting winter recreation and water supplies.
- Potential increase in the severity of winter storms, affecting peak stream flows and flooding.
- Changes in growing season conditions that could affect California agriculture, causing variations in crop quality and yield.
- Changes in distribution of plant and wildlife species due to changes in temperature, competition from colonizing species, changes in hydrologic cycles, changes in sea levels, and other climate-related effects.

These changes in California's climate and ecosystems are occurring at a time when California's population is expected to increase from 34 million to 59 million by the year 2040 (California Energy Commission 2005).

Consequently, for a "business as usual" scenario, increases are expected in the amount of anthropogenic GHG emissions and the number of people potentially affected by climate change. Similar changes as those noted above for California would also occur in other parts of the world with regional variations in resources affected and vulnerability to adverse effects.

Worldwide, California is the 12th to 16th largest emitter of CO_2 (California Energy Commission [CEC] 2006), and is responsible for approximately 2% of the world's CO_2 emissions (California Energy Commission 2006).

Transportation is responsible for 41% of the California's GHG emissions, followed by the industrial sector (23%), electricity generation (20%), agriculture and forestry (8%) and other sources (8%) (California Energy Commission 2006). Emissions of CO_2 and N_2O are byproducts of fossil fuel combustion, among other sources. Methane, a highly potent GHG, results from off-gassing associated with agricultural practices and landfills, among other sources. Sinks[2] of carbon dioxide include uptake by vegetation and dissolution into the ocean. California GHG emissions in 2002 totaled approximately 491 million metric tons of CO_2 equivalent (CO_2e) (California Energy Commission 2006).

Results Summary

The following sections present emissions from each inventory. The Sacramento County-wide emissions inventory results are presented in Tables ES-1 to ES-3 and Figures ES-1 to ES-5. Government emissions are presented in Table ES-4 and Figures ES-6 to ES-9.

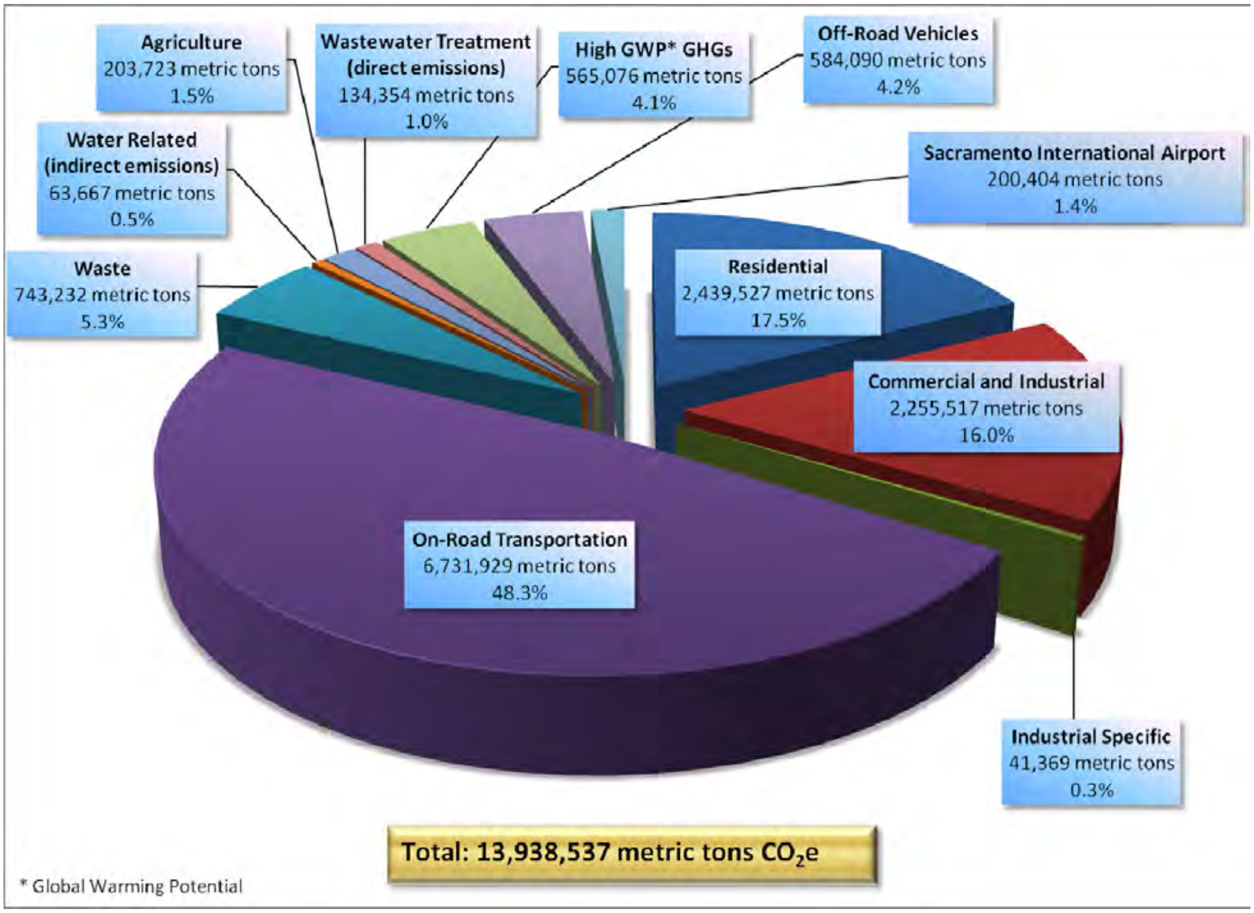
County-Wide Emissions by Sector, Jurisdiction, and Source

Tables ES-1 to ES-3 and Figures ES-1 to ES-4 show the 2005 GHG emissions by sector, jurisdiction, and source, respectively, for all incorporated and unincorporated areas in the County. Table ES-4 shows the 2005 population for each city. County-wide emissions inventory results are presented in Figure ES-1 and Table ES-1. Emissions are presented by sector. These results demonstrate that on-road transportation emissions are the largest source of GHG emissions in Sacramento County. Residential, commercial, and industrial building energy use is the next largest source of GHG emissions in the County. These results are consistent with each city's inventory, although the percentages vary slightly by city. Figure ES-2 and Table ES-2 show County-wide emissions by jurisdiction. Total emissions presented in Table ES-2 are 0.3% less than total emissions presented in Table ES-1. This is due to two major factors: 1) additional industrial fuel use for the County of Sacramento provided by the Sacramento Metropolitan Air Quality Management District (SMAQMD) not separated by city; 2) aggregated waste data from the California Integrated Waste Management Board

[2] A carbon sink is a resource that absorbs carbon dioxide from the atmosphere and stores it for an indefinite period. The classic example of a sink is a forest in which vegetation absorbs carbon dioxide and produces oxygen through photosynthesis.

(CIWMB)[3].The City of Sacramento and Unincorporated Sacramento County have the largest jurisdiction-wide emissions.

Figure ES-1. Sacramento County GHG Emissions for 2005 by Sector (metric tons CO_2e)



[3] See Appendix B for further discussion.

Figure ES-2. Total Jurisdiction GHG Emissions for 2005 (metric tons CO_2e)

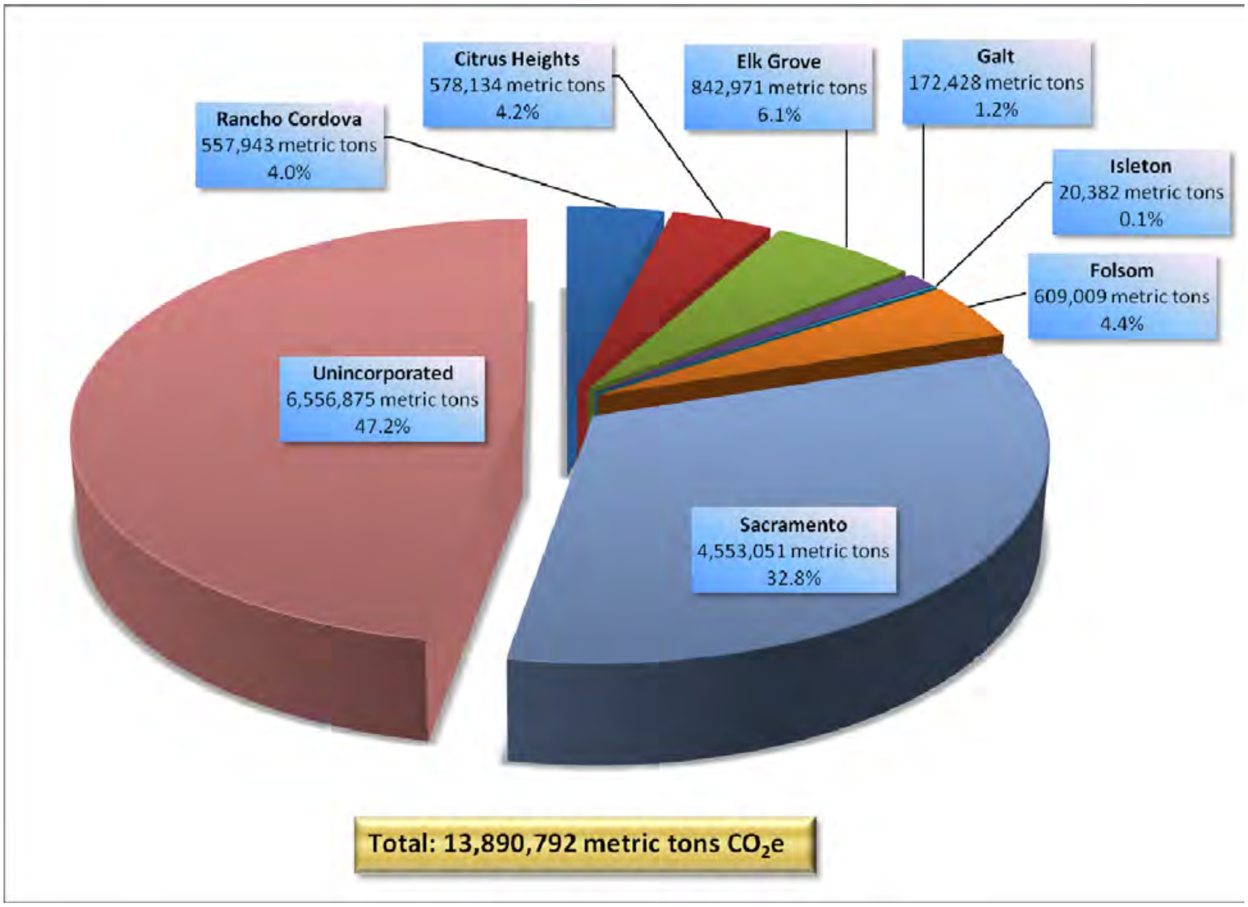


Table ES-1. 2005 GHG Emissions for the County of Sacramento by Sector[1]

Sector	CO_2e (metric tons)	Percent of Total
Residential	2,439,527	17.5
Commercial and Industrial	2,231,168	16.0
Industrial Specific	41,369	0.3
On-road Transportation	6,731,929	48.3
Off-road Vehicle Use	584,090	4.2
Waste	743,232	5.3
Wastewater Treatment	134,354	1.0
Water-Related	63,667	0.5
Agriculture	203,723	1.5
High Global Warming Potential (GWP) GHGs	565,076	4.1
Sacramento International Airport	200,404	1.4
Total Emissions in Sacramento County	**13,938,537**	**100.0**

[1] Calculated using CACP software (Appendix A). The total may not be the exact sum of emissions due to rounding.

Table ES-2. 2005 GHG Emissions for the County of Sacramento by Jurisdiction[1]

Jurisdiction	CO_2e (metric tons)	Percent
Citrus Heights	578,134	4.2
Elk Grove	842,971	6.1
Folsom	609,009	4.4
Galt	172,428	1.2
Isleton	20,382	0.1
Rancho Cordova	557,943	4.0
Sacramento	4,553,051	32.8
Unincorporated Sacramento County	6,556,875	47.2
Sacramento County	**13,890,792**[2]	**100.0**

[1] Calculated using CACP software (Appendix A).
[2] Total emissions for the County represent the sum of the jurisdictions listed here. The total may not be the exact sum of emissions due to rounding.

Figure ES-3 presents a breakdown of the County-wide emissions by source[4]. Figure ES-4 presents a breakdown of the County-wide emissions by source for “other” emissions. Figure ES-3 and Table ES-3 show that gasoline for on-road transportation and electricity consumption are the largest sources of GHG emissions in the County.

[4] Emissions of high GWP GHGs are primarily in the form of hydrofluorocarbons (HFCs).

Figure ES-3. Sacramento County GHG Emissions for 2005 by Source (metric tons CO_2e)

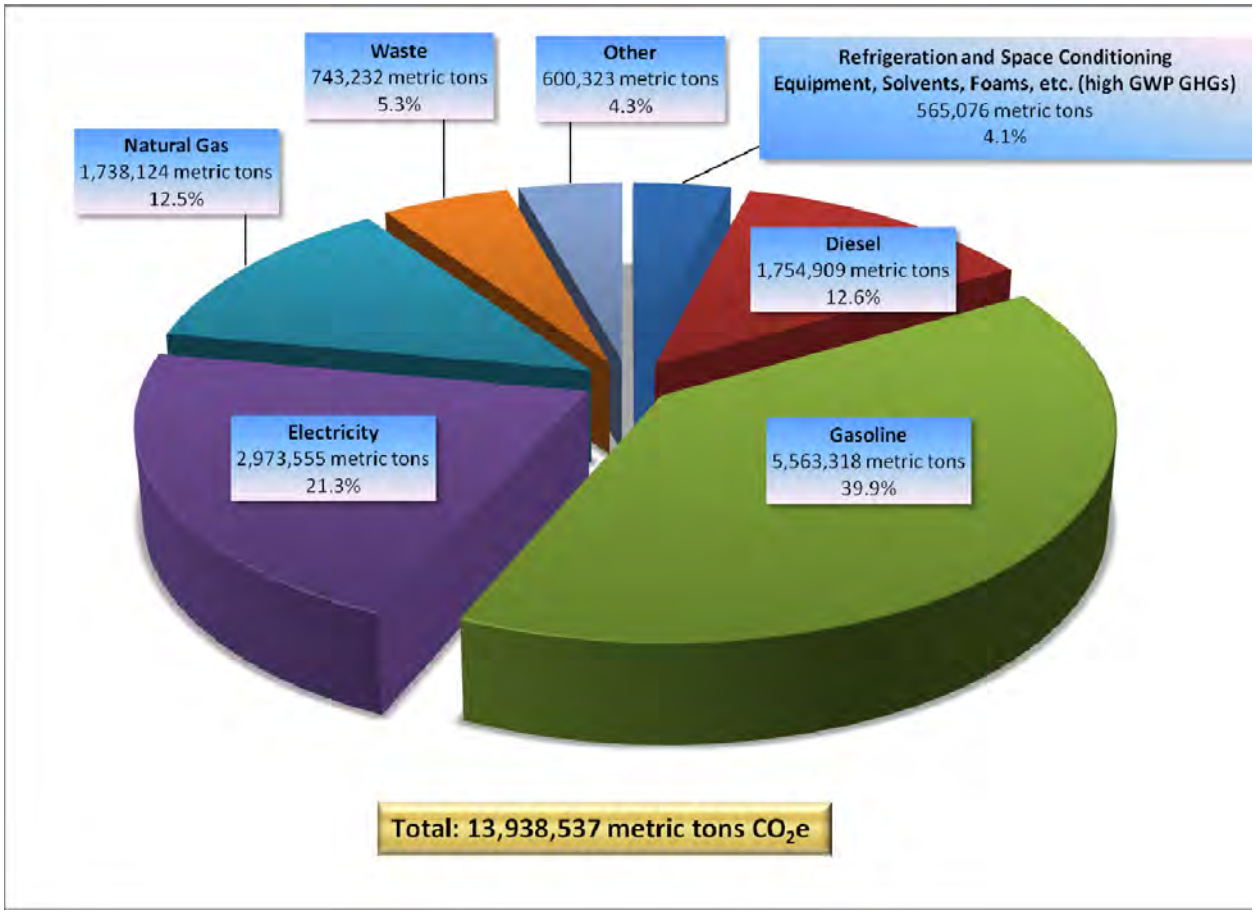


Figure ES-4. Sacramento County GHG Emissions for 2005 by Source for "Other" Emissions (metric tons CO_2e)

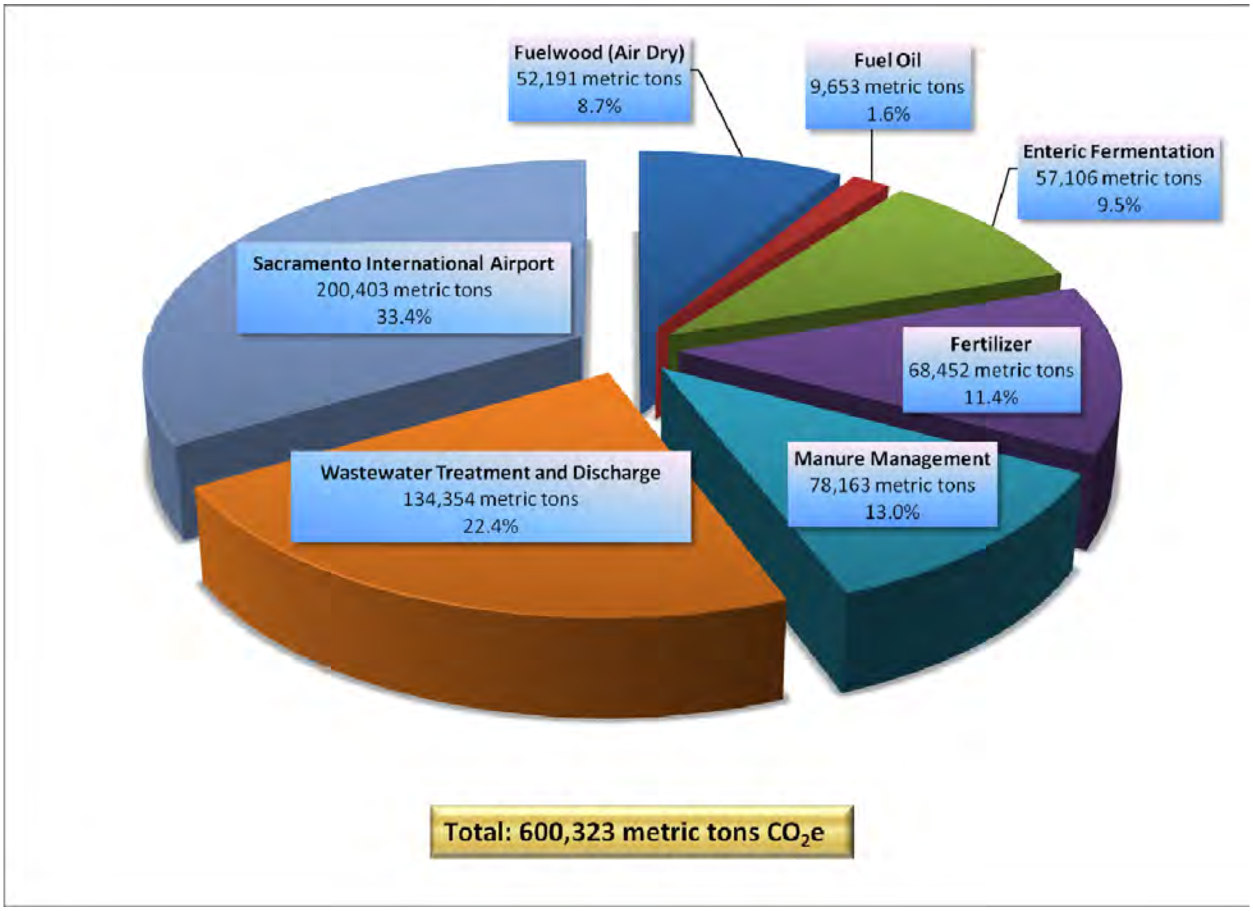


Table ES-3. 2005 GHG Emissions for the County of Sacramento by Source[1]

Sector	CO_2e (metric tons)	Percent
Refrigeration and Space Conditioning Equipment, Solvents, Foams, etc. (high GWP GHGs)	565,076	4.1
Diesel	1,754,909	12.6
Gasoline	5,563,318	39.9
Electricity	2,973,555	21.4
Natural Gas	1,738,124	12.5
Waste	743,232	5.3
Other	600,323	4.3
Fuelwood (Air Dry)	52,191	0.4
Fuel Oil	9,653	0.1
Enteric Fermentation	57,106	0.4
Manure Management	78,163	0.6
Fertilizer	68,452	0.5
Wastewater Treatment and Discharge	134,354	1.0
Sacramento International Airport	200,404	1.4
Total	**13,938,537**	**100.0**

[1] Calculated using CACP software (Appendix A).

Table ES-4. 2005 Population for Each Jurisdiction in Sacramento County

City/Jurisdiction	Population	Percent
Citrus Heights	86,988	6.27
Elk Grove	131,033	9.45
Folsom	69,521	5.01
Galt	23,007	1.66
Isleton	814	0.06
Rancho Cordova	56,432	4.07
Sacramento	457,837	33.00
Unincorporated Sacramento County	561,625	40.48
Sacramento County Total	**1,387,257**	**100.00**

Source: California Department of Finance 2008.

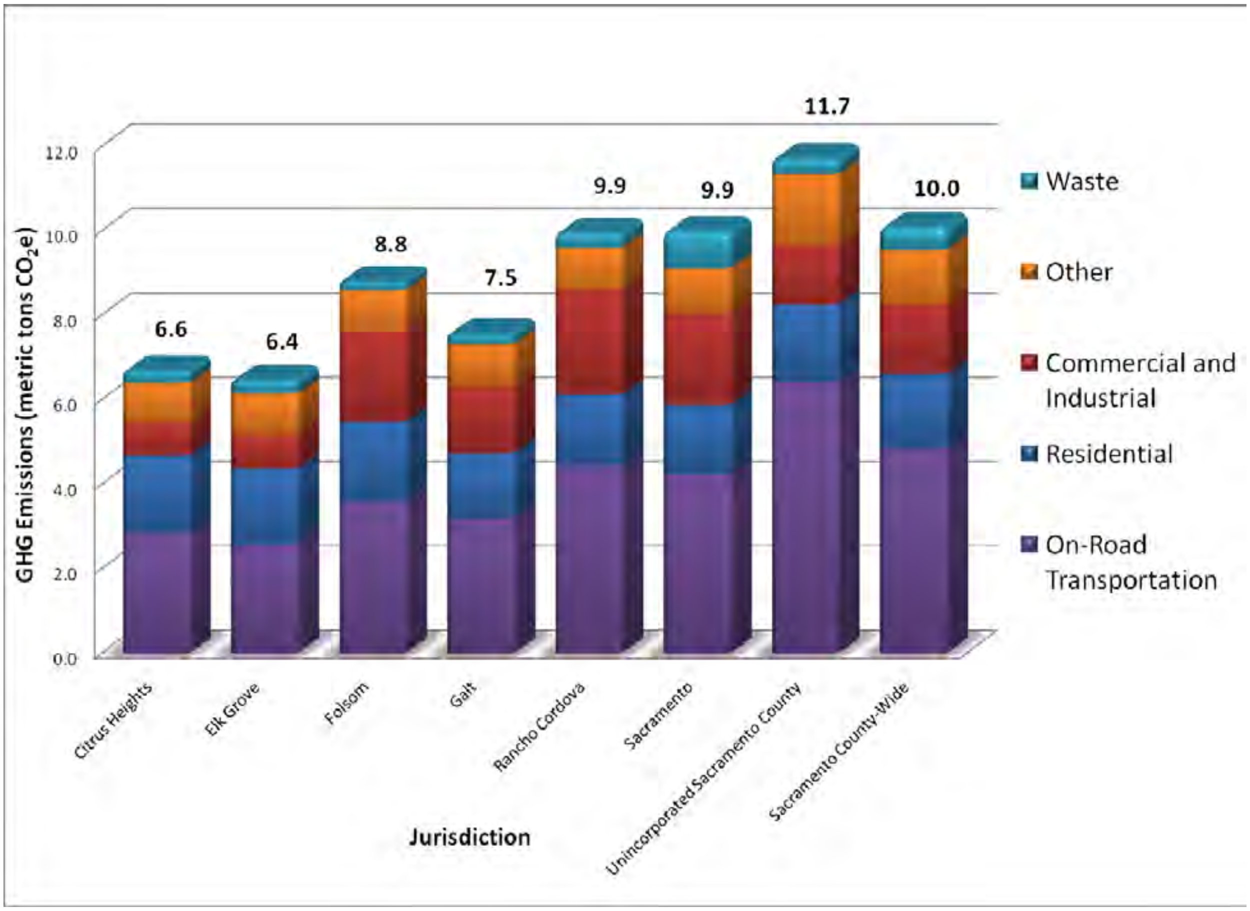
Per-Capita Emissions

Figures ES-5 and ES-6 present per capita emissions by sector for each city in Sacramento County based on estimated emissions and population data for 2005 (California Department of Finance 2008). These per capita estimates include all emissions associated with each city, regardless of jurisdictional control. Per capita emissions range from 6.4 (Elk Grove) to 11.7 (Unincorporated Sacramento County) metric tons of CO_2e[5]. Overall, County-wide per capita emissions are 10.0 metric tons of CO_2e. This is much lower than the average per capita emissions of 24.5 metric tons of CO_2e for the United States and a whole, as shown in Figure ES-7. County-wide per capita emissions approach AB 32's goal of approximately 9.7 metric tons of CO_2e necessary to achieve 1990 levels by 2020 for the state of California.

These per capita results may be underestimates for several of the cities, particularly Sacramento, because two major emissions sources were not broken out by city. Specifically, industrial energy use data is aggregated into the "commercial" category by the utilities and fuel consumption data is aggregated from each jurisdiction such that these sources are not counted as emissions associated with particular cities.

[5] High per capita GHG emissions do not necessarily correlate with high city-wide emissions

Figure ES-5[6]. Per Capita GHG Emissions for the Cities and County (metric tons CO_2e)



[6] Isleton was not included in this figure due to the difficulty in estimating per capita emissions. See chapter 6.

Figure ES-6[7]. Per Capita GHG Emissions for the Cities and County for "Other" Emissions (metric tons CO_2e)

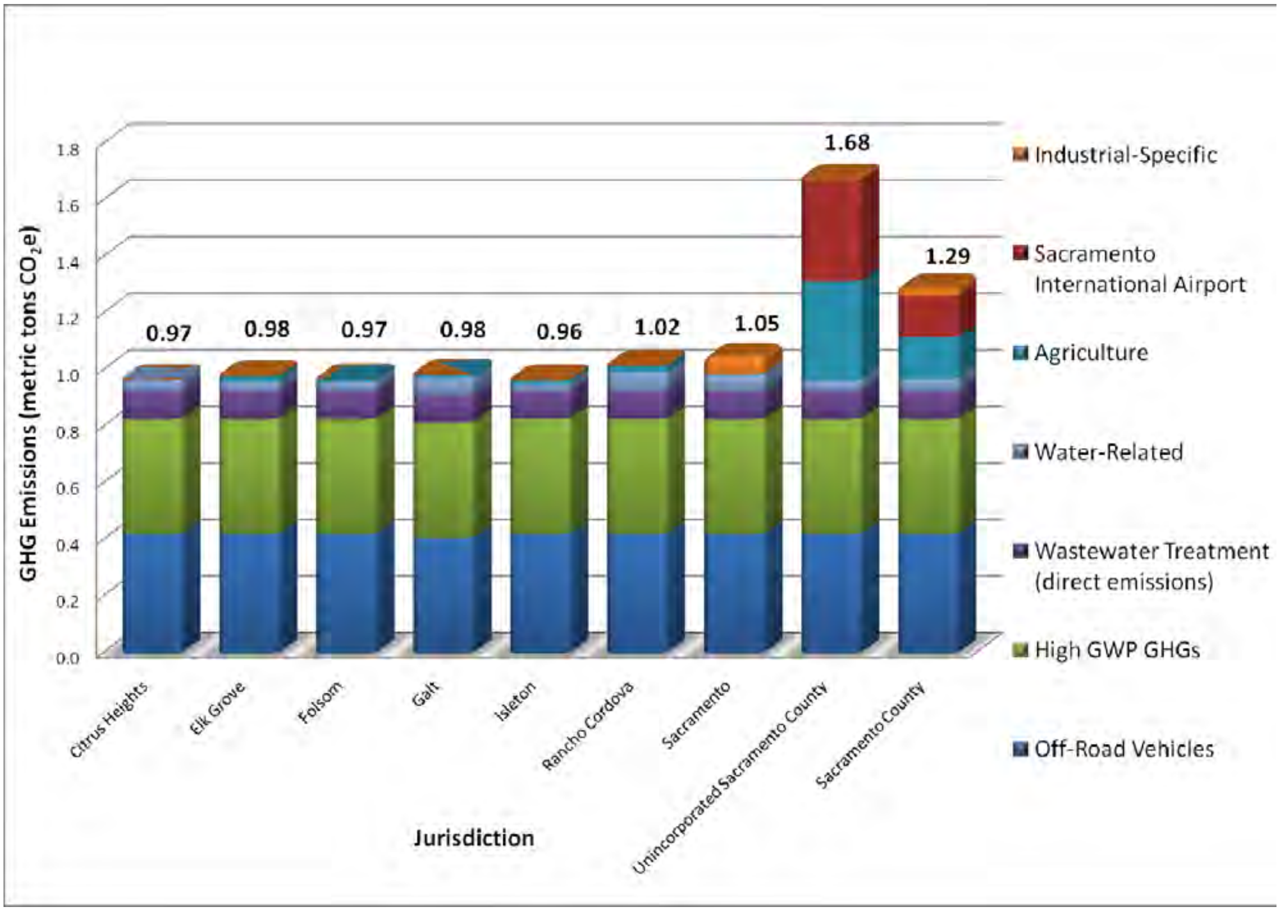
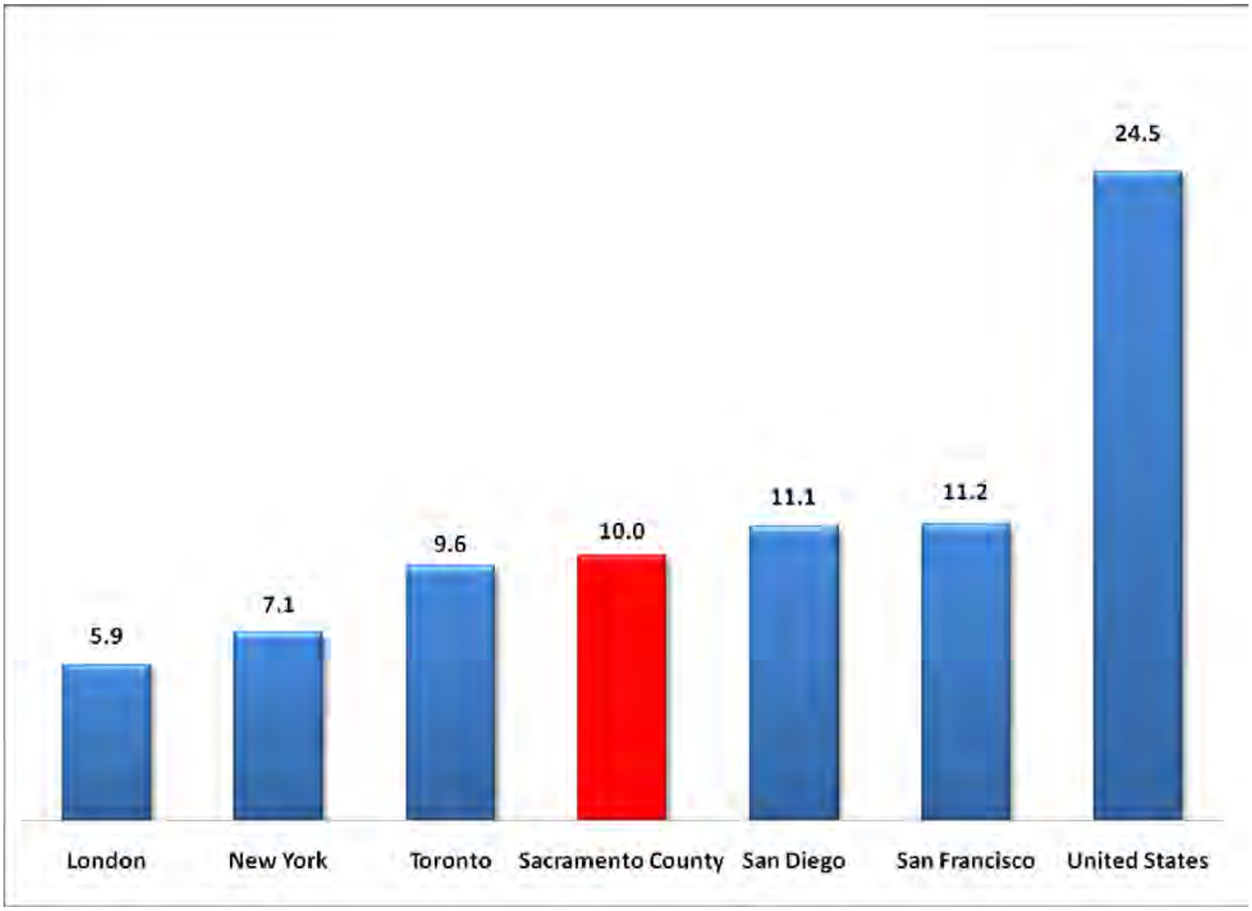
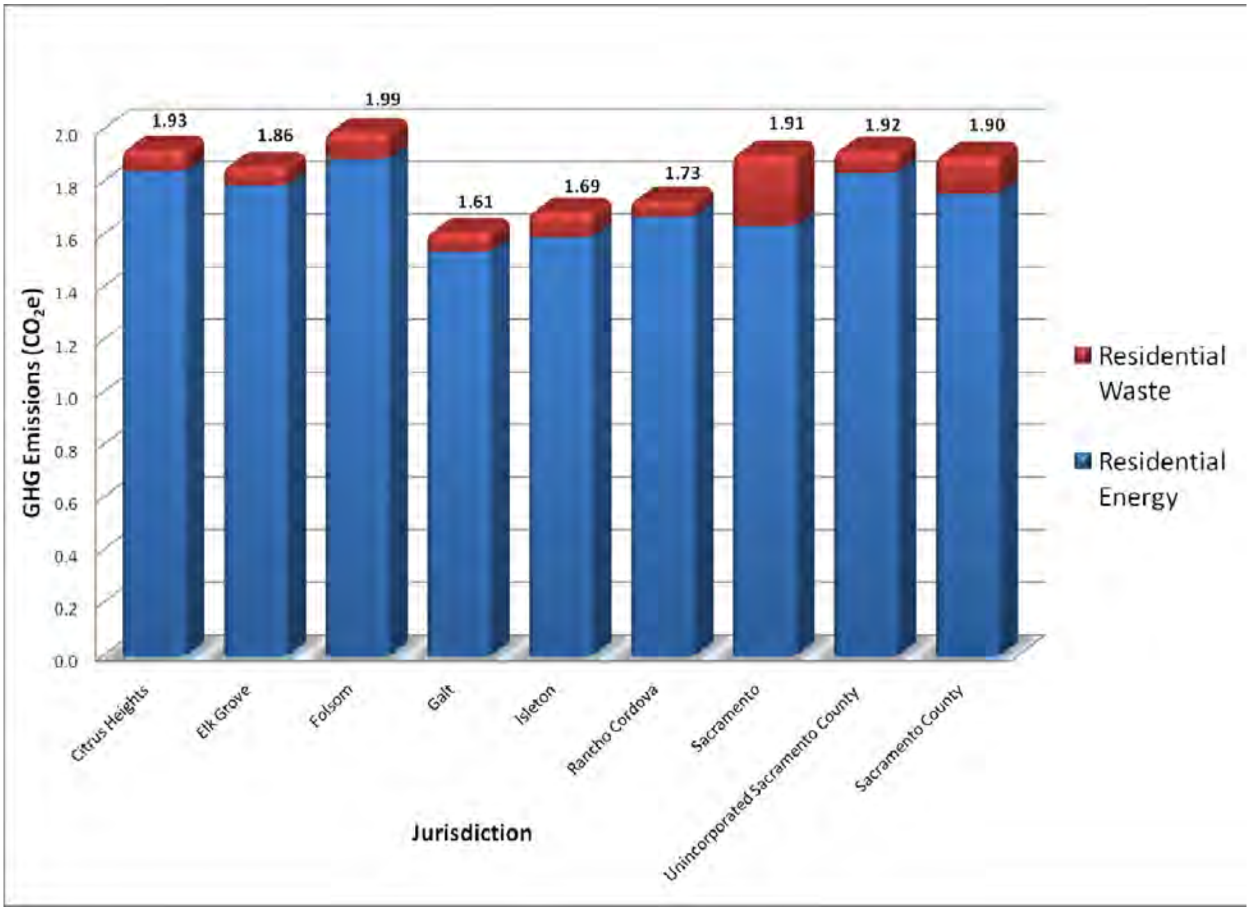


Figure ES-7. Per Capita GHG Emissions of Cities and the U.S. (metric tons CO_2e)



Source: Inventory of New York City Greenhouse Gas Emissions 2007

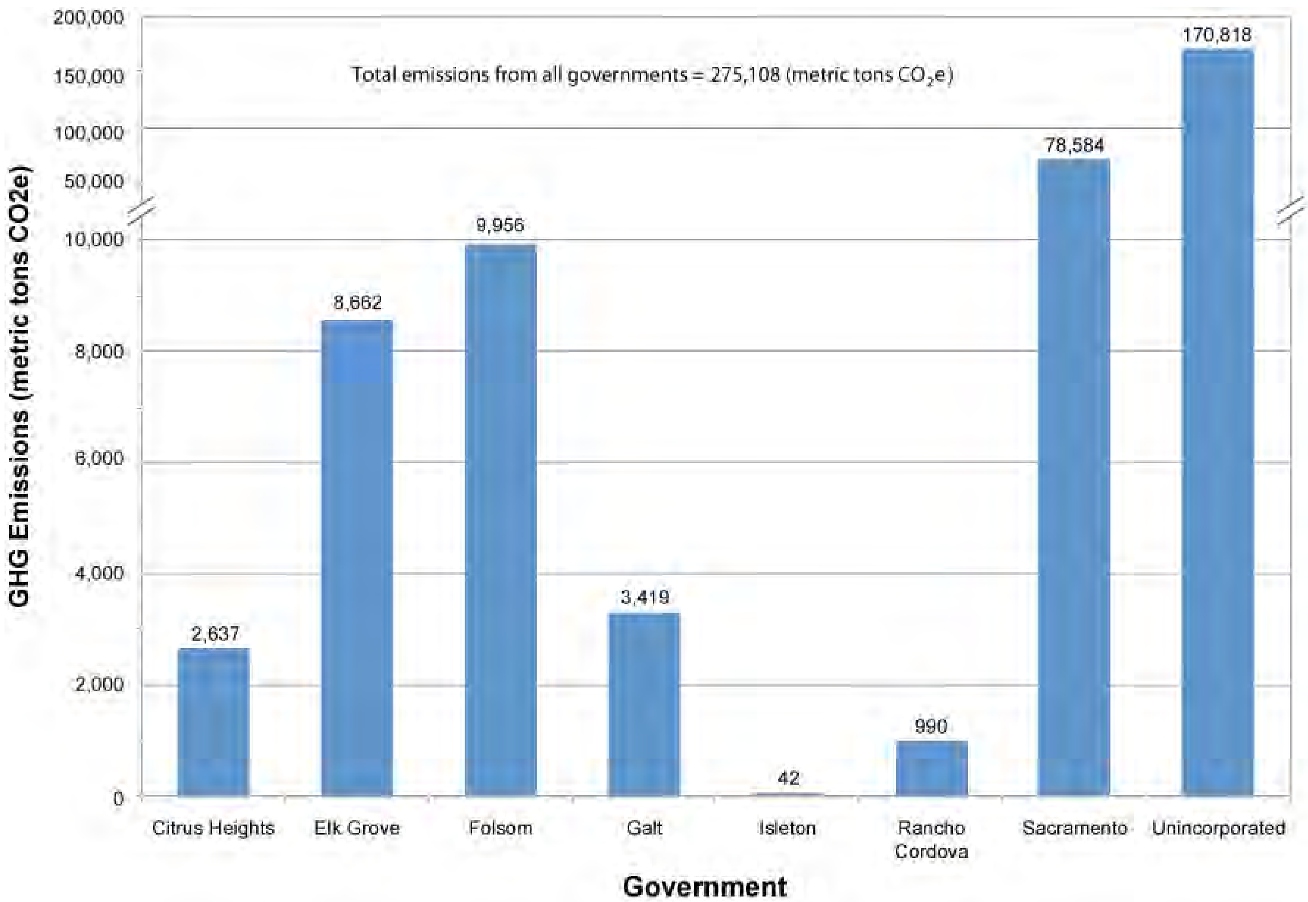
Figure ES-8. Per Capita Residential-Related GHG Emissions for the Cities and County (metric tons CO_2e)



Government Emissions

Government emissions for the County and city operations shown in Figure ES-9 and Table ES-5 are generally a small portion of the city inventory (<2%), and are typically dominated by building energy use. For the County Government inventory, the Sacramento International Airport operations are also a large source of GHG emissions. Emissions from aircraft and airport ground support equipment were not included in the County Government inventory, however, because of the County's limited control over these airport sources.

Figure ES-9. Government GHG Emissions for 2005 (metric tons CO_2e)



Figures ES-10 and ES-11 present a comparison between all the incorporated city and government emissions respectively. Figure ES-12 presents total government emissions for County and city operations by sector.

Figure ES-10. Total Incorporated City Emissions for 2005 (metric tons CO_2e)

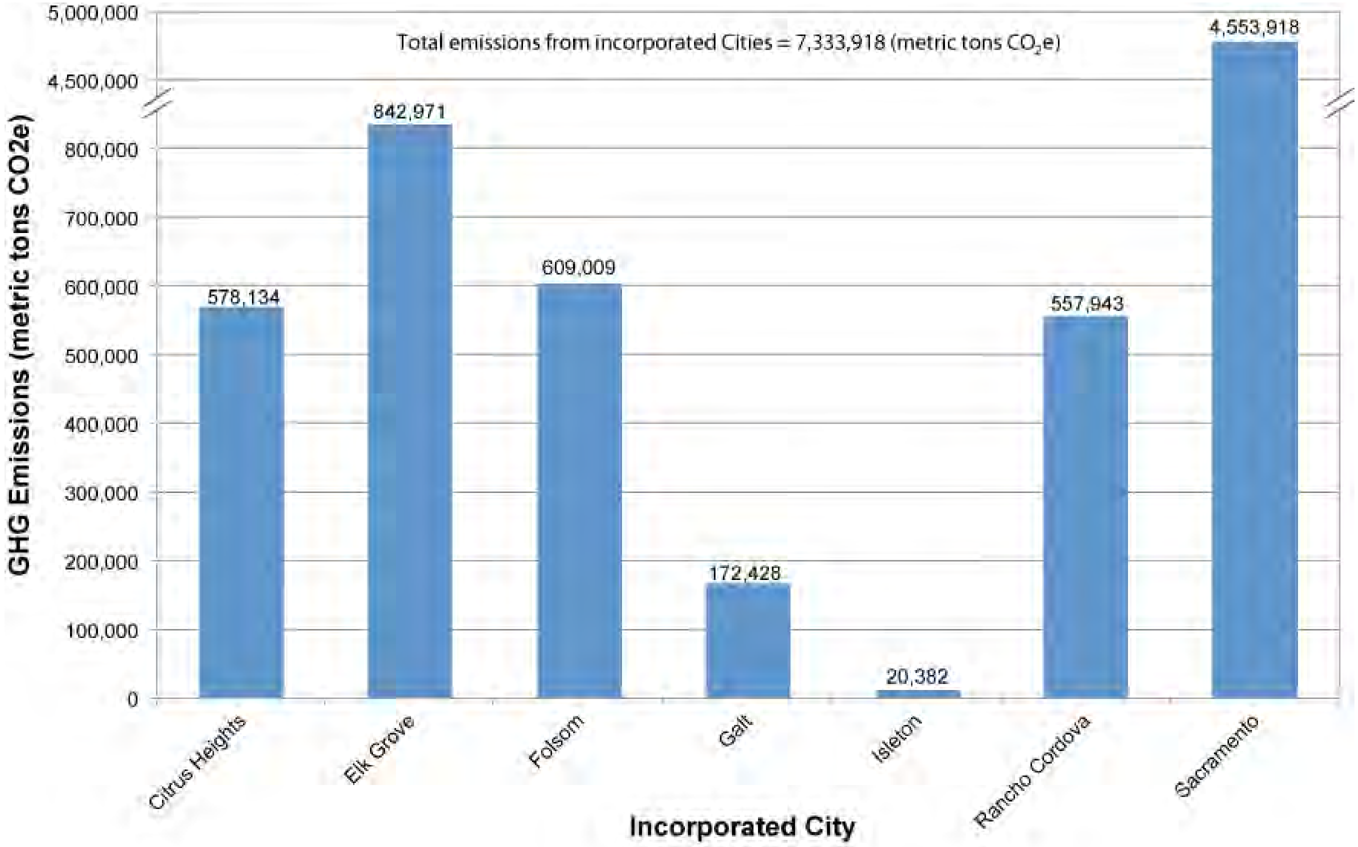


Figure ES-11. Total Incorporated Government Emissions for 2005 (metric tons CO_2e)

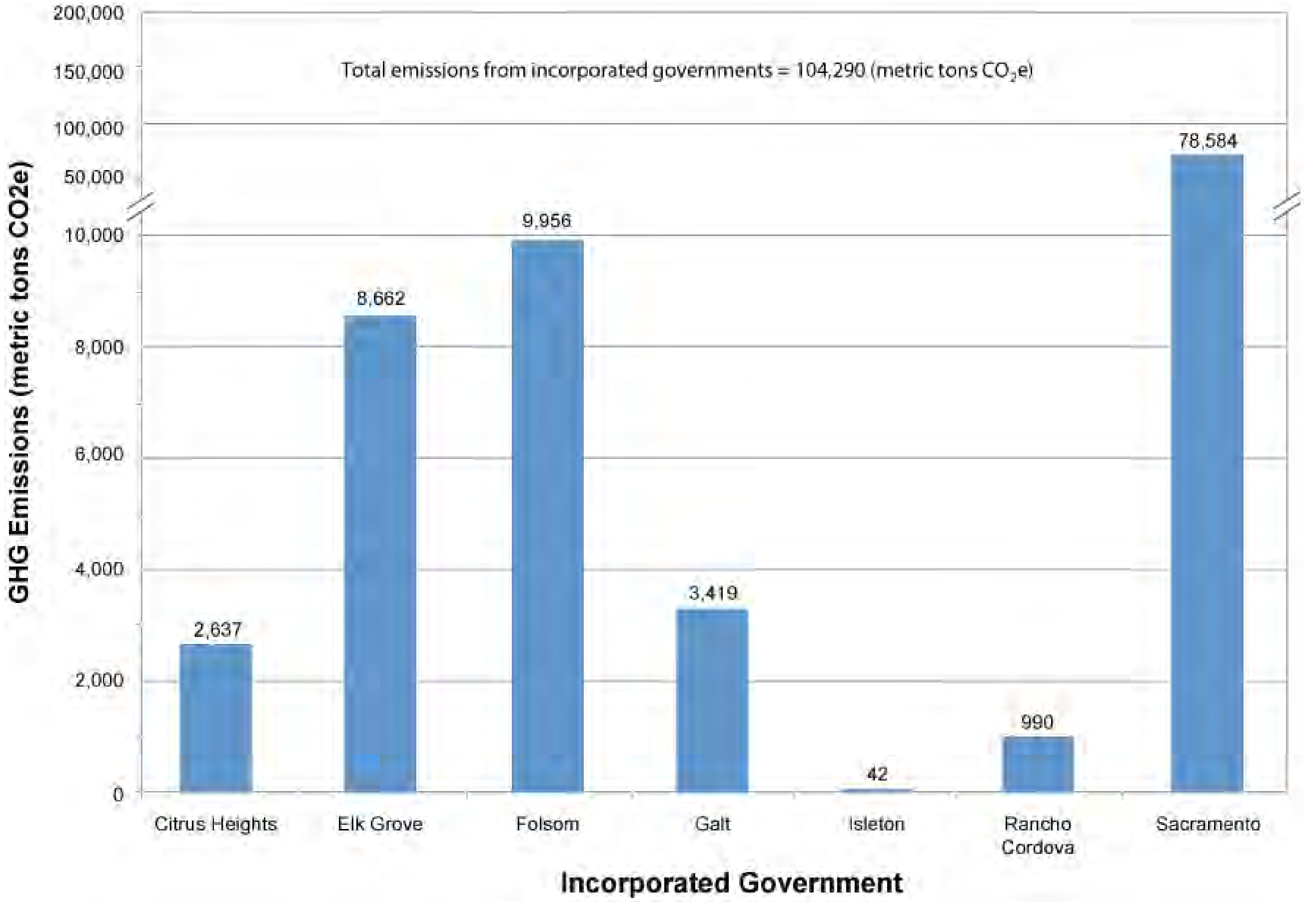


Figure ES-12. Sacramento County Government GHG Emissions for 2005 by Sector (metric tons CO_2e)

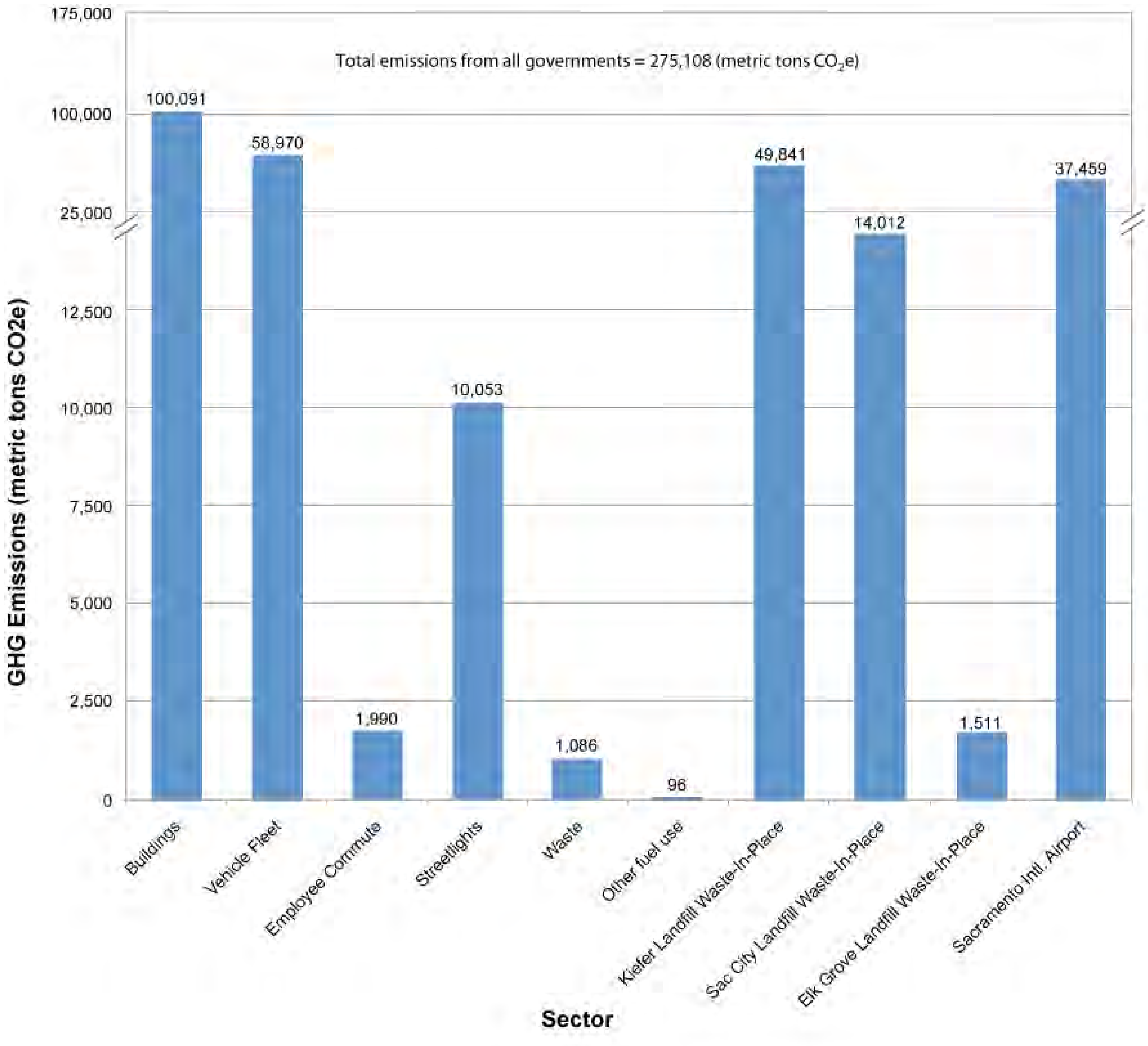


Table ES-5. 2005 GHG Emissions for the County of Sacramento by Government Operations[1]

Municipal Government	CO_2e (metric tons)	Percent
Citrus Heights	2,637	1.0
Elk Grove	8,662	3.1
Folsom	9,956	3.6
Galt	3,419	1.2
Isleton	42	0.0
Rancho Cordova	990	0.4
Sacramento	78,584	28.6
Unincorporated Sacramento County	170,818	62.1
Sacramento County	**275,108**	**100.0**

[1] Calculated using CACP software (Appendix A).

Data Limitations and Recommendations

The 2005 Sacramento County GHG emissions inventories identify significant GHG emissions contributions from both community activities and government operations. These inventories serve as a baseline for emissions reduction measures and as a starting point for future GHG emissions inventories. Future updates to the GHG emissions inventories presented in this report should be conducted on a biennial (rather than annual) basis to minimize resources while ensuring that the inventory remains accurate and that data gaps are resolved in a timely manner. This would also enable efficient tracking of the effectiveness of any GHG reduction measures put in place to address these emission sources. The CACP software used to develop these inventories is a straightforward tool that can be used to identify generic reduction opportunities for each source sector, though for some source sectors a custom methodology may be required to more accurately identify GHG reduction opportunities.

Although all efforts were made to obtain data from 2005, in some cases this data was unavailable and data from another year was substituted. For example, in the county government emissions inventory, almost all available data used was from 2006, because this data had previously been collected.

As previously indicated, not all GHG emissions were captured in the city-wide inventories, such that the per capita emissions estimate found in this report may be slightly higher than calculated. Efforts were made to account for all significant emissions sources so that informative decisions regarding effective control measures could be made by each jurisdiction. Emissions not accounted for include residential, commercial, and industrial sources from non-utility-based fuels (such as propane, stationary diesel, fuel oil, etc.) and emissions resulting directly from industrial processes. These data gaps may be addressed through community surveys, cooperation with the SMAQMD, and through dialogue with local industrial and commercial facilities. However, because of the resource-intensive nature of collecting non-utility-based fuel consumption data, efforts should be made to characterize the relative magnitude of these emissions sources before undertaking these data collection efforts.

Chapter 1
Methodology

Introduction

This chapter summarizes the methodology used to inventory greenhouse gas (GHG) emissions within the County of Sacramento for the year 2005. This inventory included an evaluation of the cities within Sacramento County (Citrus Heights, Galt, Elk Grove, Folsom, Isleton, Rancho Cordova, and Sacramento), as well as Unincorporated Sacramento County. The GHG inventory evaluated total GHG emissions for each of the individual jurisdictions, and included an evaluation of emissions from residential , commercial and industrial , industrial-specific, transportation, the Sacramento International Airport, agricultural, waste, high global warming potential (GWP) GHG emission sources, water-related, and domestic wastewater treatment and discharge sources. An evaluation of emissions from government sources was also included as a subset of each of the jurisdictional inventories. The government inventories evaluated emissions from building, streetlight and traffic signal, vehicle fleet, employee commute, waste, landfill (both waste generation and waste-in-place), and the Sacramento International Airport.

The baseline year of 2005 was chosen based on the availability of information because this year represented the latest year that the most complete data was available. In cases where 2005 data was unavailable, 2006 or other recent-year data was substituted. In addition to the 2005 baseline year, a 2007 baseline year was also used for the Citrus Height and Rancho Cordova government inventories, as it was determined that growth in operations for these two jurisdictions made the 2005 baseline year an unrealistic representation of actual governmental activities. To avoid any confusion regarding the specific year each data set represents, the year is provided for all data sources included in the inventory.

ICLEI Clean Air and Climate Protection Software

Sacramento County is a member of the ICLEI association of Local Governments for Sustainability. ICLEI’s Clean Air and Climate Protection (CACP) software version 1.1 was used to generate GHG emissions estimates (State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials [STAPPA/ALAPCO], the International Council for Local Environmental Initiatives, and Torrie Smith Associates 2003). The CACP software inventories city GHG emissions for all operations within the selected boundary of the local government and also enables GHG emissions of local government operations to be calculated separately. The county and city inventories presented in this report were developed using a geographic boundary (i.e., jurisdictional/city limits) for the emissions reporting. All GHG emissions occurring within each city's geographical boundary are reported in that city's inventory, including emissions attributed to the city's government operations.

In contrast, the government inventories presented in this report were developed with organizational boundaries representing the government's operational control. Emissions for a particular source were included in this inventory if the government entity either wholly owns an operation, facility, or source, or has full authority to introduce and implement operating policies at the operation. Sources typically include government-owned facilities, vehicles, and operations.

The ICLEI Local Governments Operations Protocol (LGOP) employs the convention of categorizing local government emission sources as Scope1, 2, or 3. GHG emission scopes are defined as follows.

- **Scope 1:** All direct GHG emissions (with the exception of direct CO_2 emissions from biogenic sources).
- **Scope 2:** Indirect GHG emissions associated with the consumption of purchased or acquired electricity, steam, heating or cooling.
- **Scope 3:** All other indirect emissions not covered in Scope 2, such as the emissions resulting from the extraction and production of purchased materials and fuels, transport related activities in vehicles not owned or controlled by the reporting entity (e.g., employee commuting or business travel), outsourced activities, waste disposal, etc.

Our approach, per the LGOP guidance, was to include emissions for each jurisdiction that were fully under its operational control (for government inventories) and/or within its geographic boundaries (for city-wide inventories), irrespective of scope classification. Please refer to the individual jurisdiction chapters for detailed descriptions of the emission sources included for each jurisdiction.

GHG emissions are quantified in terms using CO_2 equivalents (CO_2e). Each GHG has a different GWP that represents its power as a GHG relative to a standard. CO_2 is used as the standard for GHG emissions because it is the most abundant in the atmosphere and has the lowest GWP. Emissions of GHGs quantified in this inventory are reported in metric tons of CO_2e based on the GWP of the gas.

The majority of GHG emissions are produced through the burning of fossil fuels. The inventories of both city and government emissions includes GHG emissions from both direct and indirect sources. A direct emission source is defined as an on-site source of emissions, such as the combustion of fossil fuel in a vehicle engine. An indirect emissions source is defined as an emissions source generated off the site as a result of city or government operations, such as electricity consumption.

When available, area-specific values were substituted for CACP default values. The CACP fuel CO_2 emissions factors were updated to reflect the most recent and accurate research to date, as presented in The Climate Action Registry General Reporting Protocol Version 1.1 (The Climate Action Registry 2009a). The Climate Action Registry is a non-profit organization that cooperates with the ARB and the California Climate Action Registry (CCAR) to facilitate voluntary reporting and certification of GHG emissions.

To assess both city and government GHG emissions, city-wide and government energy use data was obtained for the Sacramento Municipal Utility District (SMUD) and the Pacific Gas and Electric Company (PG&E). SMUD provides electricity to all of Sacramento County, while PG&E provides electricity to portions of Sacramento County and natural gas to all of Sacramento County. Both SMUD and PG&E are members of CCAR, and reported area-specific year 2005 CO_2 emission factors for electricity based on all electricity sold in Sacramento County (California Climate Action Registry 2007a, 2007b). In 2005, SMUD's and PG&E's CO_2 emission factors for electricity were 616.07 and 489.2 pounds per megawatt hours (lbs/MWh) respectively. These emission factors are based on established emissions reporting protocols and a database system for registering entity-wide emission inventories (California Climate Action Registry 2009b).

An updated CO_2 natural gas emission factor for PG&E (0.054 lbs CO_2/ft^3) was substituted for the default CACP software emission factor. This updated emission factor was verified and certified by CCAR (California Climate Action Registry 2009a). Additional CACP fuel CO_2 emission factors[1] were also updated to reflect the most recent and accurate research to date. See Appendix B for a discussion of revised emission factors (California Climate Action Registry 2009a). As a result, these emissions factors were input into the CACP model as a replacement for the default statewide emissions factors to generate more accurate GHG emissions estimates for Sacramento County.

Appendix A provides all the ICLEI CACP software outputs. Appendix B provides the complete city GHG emissions methodology and Appendix C provides the complete government GHG emissions methodology.

[1] Emission factors were updated for the following fuels: natural gas, propane, diesel, stationary diesel, motor gasoline, stationary gasoline, compressed natural gas (CNG), liquefied petroleum gas (LPG), digester gas, and landfill gas.

City-Wide GHG Emissions Methodology

Inventories were performed for the cities of Citrus Heights, Elk Grove, Folsom, Galt, Isleton, Rancho Cordova, and Sacramento to quantify GHG emissions associated with each jurisdiction. Additional inventories were performed for Unincorporated Sacramento County and Sacramento County in its entirety (including all incorporated and unincorporated areas). The city-wide analysis apportions GHG emissions into residential, commercial, industrial, transportation, agricultural, waste, high GWP GHG emissions and domestic wastewater treatment and discharge sources for each of the cities within Sacramento County.

Some of the sectors evaluated in the city-wide analysis are based on population data provided by the California Department of Finance for the year 2005 (California Department of Finance 2008). Examples of these sectors include residential wood-burning, high GWP GHGs, and off-road emissions. Only county-wide or per capita emissions data were available for these sectors. Table 1-1 presents necessary data inputs and data sources for each sector of the city-wide inventories. The following methodology describes the emission sources evaluated in the city-wide inventories.

Table 1-1. City-Wide Data Input Needs and Data Sources

Sector	Data Input Needs	Source of Data
Residential	▪ Electricity consumption (kWh) ▪ Natural gas consumption (therms) ▪ Number of fireplaces/wood/pellet stoves and fuel consumption (cords of wood, lbs of wood pellets)	▪ Electricity records from Sacramento Municipal Utilities District (SMUD) ▪ Gas and electricity records from The Pacific Gas and Electric Company (PG&E) ▪ SMAQMD reports
Commercial (Note: most commercial and industrial emissions were combined due to utility aggregation of records.)	▪ Electricity consumption (kWh) ▪ Natural gas consumption (therms)	▪ Electricity records from SMUD ▪ Gas and electricity records from PG&E
Industrial	▪ Electricity consumption (kWh) ▪ Natural gas consumption (therms) ▪ Other fuel consumption by type (natural gas, digester gas, LPG, fuel oil, landfill gas and diesel)	▪ Electricity records from SMUD ▪ Gas and electricity records from PG&E ▪ SMAQMD reports
Transportation (on-road and off-road emissions)	▪ Vehicle miles traveled (VMT) ▪ Vehicle types and percent mix (Full, mid or compact size cars; heavy duty or light trucks; vans motorcycles) ▪ Fuel type (gasoline, diesel) ▪ Fuel use (gallons or vehicle miles) ▪ Fuel efficiency (by vehicle type) ▪ Off road equipment and associated fuel combustion.	▪ CACP default vehicle mix, fuel efficiency, and fuel type. ▪ Caltrans Highway Performance Monitoring System (HPMS) reports ▪ California Air Resources Board (ARB) OFFROAD emissions model
Agricultural Emissions	▪ Number of livestock ▪ Agricultural land distribution ▪ Fertilizer application	▪ California Division of Land Resource Protection Farmland Mapping and Monitoring Program ▪ Sacramento County 2005 Crop & Livestock Report
Waste	▪ Amount of waste generated and landfilled ▪ Type of disposal (landfill, incineration, compost) ▪ Landfill information: name, location, date opened, tons of waste in place, closing date, methane capture capability and efficiency ▪ Waste composition and percent mix (paper, food , plant, wood, textiles)	▪ California Integrated Waste Management Board (CIWMB) ▪ Sacramento County Environmental Department ▪ The Environmental Protection Agency (EPA) Landfill Methane Outreach Program (LMOP) database.
High Global Warming Potential	▪ Sources and emissions rates of	▪ ARB California GHG inventory

Sector	Data Input Needs	Source of Data
(GWP) GHGs	HFCs, CFCs or SF_6 emissions include refrigerants and electric utility transmission and distribution equipment	
Domestic Wastewater Treatment and Discharge (direct emissions)	▪ CH_4 and N_2O emissions from the treatment of wastewater from domestic sources (municipal sewage).	▪ ARB California GHG inventory
Water-Related Emissions (indirect emissions for water supply and irrigation infrastructure and wastewater collection and treatment facilities)	▪ Electricity consumption (kWh) ▪ Natural gas consumption (therms)	▪ Electricity records from SMUD ▪ Gas and electricity records from PG&E ▪ Gas and electricity records from the Sacramento Municipal Services Agency

Residential Emissions

Residential emissions are primarily emissions associated with electricity and natural gas usage and other alternative means of heating (i.e., wood stoves, fireplaces, etc.). Residential electricity and natural gas consumption data for each city, as well as Unincorporated Sacramento County, was provided by SMUD and PG&E. CH_4 and N_2O emissions from the burning of wood and wood pellets was calculated using the Sacramento Metropolitan Air Quality Management District (SMAQMD) final Staff report on Rule 421: Management Episodic Curtailment of Wood and Other Solid Fuel Burning (Sacramento Metropolitan Air Quality Management District 2007). Based on this report, wood consumption was converted into total annual British thermal units (Btus) of heat for the entire county and apportioned to each city according to population. The consumption of electricity, natural gas, and wood pellets/wood and the associated GHG emissions was calculated for the residential sector for each city.

Commercial and Industrial Emissions

The primary sources of emissions associated with commercial and industrial land uses include the consumption of electricity and natural gas to power and heat commercial buildings and processes. It should be noted that emissions associated with individual processes were not calculated for most commercial and industrial sources, as facility-specific information was not available and is often considered a confidential trade secret. However, processes for which data is available were quantified, as described in the "Industrial Specific Emissions" section, below.

The commercial and industrial sectors are combined because both SMUD and PG&E aggregate energy use data for these two sectors into their "commercial" sector. SMUD does not have an industrial category and PG&E's 15/15 rule protects customer confidentiality by aggregating industrial and commercial energy usage into a single category. In addition, light rail electricity use is included in this sector.

Industrial Specific Emissions

2005 electricity and natural gas consumption data for some industrial sectors was provided by SMUD and PG&E. The SMAQMD also supplied additional industrial fuel use data for the County of Sacramento; this data represents fuel use for large stationary point-sources, such as boilers, incinerators, and internal combustion (IC) engines. Fuels included in the data set include natural gas, liquefied petroleum gas (LPG), digester gas, and diesel fuel (Bay Area Air Quality Management District, 2006). According to the SMUD and PG&E, the natural gas combustion data from the SMAQMD was included in PG&E's commercial category. Fuel combustion related to SMUD and PG&E power plants is accounted for in the electricity emission factors used to evaluated electricity emissions for each sector of this inventory (Ave pers. comm., Bartholomy pers. comm.).

Transportation Emissions

Transportation emissions include on-road and off-road sources within the County of Sacramento. On-road GHG emissions were calculated using the CACP software Transportation Assistant. The CACP software breaks out total aggregate vehicle-miles traveled (VMT) into default VMT percentages by vehicle type and determines emissions based on default vehicle population characteristics and emission factors, as well as state averages of fuel economy for the base-year inventory. VMT by city and for state highways in the county was provided by the California Department of Transportation (Caltrans) Highway Performance Monitoring System (HPMS) 2005 public road data. VMT from state highways were apportioned by the number of highway miles located within each city's jurisdictional boundaries.

The ARB OFFROAD 2007 air quality model was used to calculate off-road GHG emissions for 2005. This model considers $CO_{2,}$, CH_4 and N_2O emissions from off-road equipment, including recreational boats and vehicles, industrial equipment, construction equipment, lawn and garden, airport ground support, military, agriculture, rail operation, and more (California Air Resources Board 2006). The OFFROAD 2007 model was run to calculate overall $CO_{2,}$, CH_4 and N_2O emissions for Sacramento County, and these emissions were then apportioned by population to obtain emissions by city.

SMUD was unable to separate electricity consumption and emissions related to light rail operations by city or jurisdiction (and so it is included in the commercial and industrial sector), but was able to provide the electricity consumption for Regional Transit and its associated GHG emissions.

Sacramento International Airport Emissions

The Sacramento International Airport is located in Unincorporated Sacramento County and is owned by the county government, and is therefore included in the government GHG inventory for Unincorporated Sacramento County[2]. The Sacramento Department of Environmental Review and Assessment (DERA) Final Impact Report on the Sacramento International Airport Master Plan (County of Sacramento Department of Environmental Review and Assessment 2007) quantified GHG emissions from aircraft, ground support equipment, on-site roadways, parking facilities, and off-airport roadways, and this data was used in this inventory.

Agricultural Emissions

There are five general sources of agricultural emissions evaluated in this inventory: cattle and swine enteric fermentation, cattle and swine manure management, dairy cow enteric fermentation, dairy cow manure management, and N_2O emissions from the application of fertilizer. All agriculture emissions were calculated separately from the CACP software using ARB and Intergovernmental Panel on Climate Change (IPCC) methodology and entered into the CACP software as “Other” emissions (Intergovernmental Panel on Climate Change 2006a; California Air Resources Board 2008a, 2008b, 2008c). Farmland and livestock data was gathered from the Sacramento County 2005 Crop & Livestock Report and the California Division of Land Resource Protection Farmland Mapping and Monitoring Program (FMMP) (County of Sacramento 2006; California Division of Land Resource Protection 2007).

Waste Emissions

There are two sources of waste emissions included in the inventory: 1) emissions from waste generated and landfilled in 2005, and 2) “waste-in-place” emissions for all waste currently located in landfills within the county. The CACP software was used to calculate GHG emissions from all waste generated and landfilled in 2005 for the entire county and for each jurisdiction within the county. Waste-in-place emissions are based on the accumulated waste in the landfill over the landfill’s lifetime, and take into account the methane control technology at each landfill. Weighted CH_4 capture efficiencies were calculated for each city based

[2] Sacramento County owns and maintains control over the Sacramento International Airport but does not have control over the activity or operations of the airlines and their aircraft. Consequently, the county government inventory includes GHG emissions from on-site roadways, parking facilities, and off-airport roadways associated with the Sacramento International Airport (Barry pers. comm.). See Appendix C.

on landfill gas controls at landfills accepting waste from Sacramento County. Emissions from the current year's waste generation were included in the inventory as Scope 3 emissions, per the guidelines in the LGOP; even though these emissions take into account the future methane emissions commitment of the waste. Waste generation data was compiled from the California Integrated Waste Management Board's web site. GHG sequestration at the landfills was set to zero, based on guidance in the Local Government Operations Protocol.[3]

Waste-in-place emissions were calculated for landfills located within county borders that had available waste-in-place and CH_4 capture data. Methane emissions from waste-in-place were calculated using the ARB's Excel tool based on the IPCC's first order decay (FOD) model, according to the guidelines of the Local Government Operations Protocol.[4] It was assumed that the total amount of waste in each landfill was deposited evenly over the landfills' lifetime. These landfills include Kiefer (Unincorporated Sacramento County), L&D (Sacramento), Sacramento City Landfill (Sacramento), Elk Grove Landfill (Elk Grove), and Dixon Pit Landfill (Elk Grove) (Environmental Protection Agency 2007; County of Sacramento 2009a).

High GWP GHG Emissions

High GWP GHG emissions in Sacramento County are predominantly associated with refrigerants and transmission lines and consist of hydrofluorocarbons (HFCs), chlorofluorocarbons (CFCs), and sulfur hexafluoride (SF_6). The statewide emissions trends of high GWP GHGs used as replacements for ozone-depleting substances were mapped from 1990 to 2004, and the resulting trend line was used to estimate State-wide emissions in 2005 at 15.1 million metric tons of CO_2e (California Air Resources Board 2007). The 2005 population in Sacramento County was then used to determine per capita emissions of high GWP GHGs based on this figure, and the population for each city in 2005 was then used to scale emissions of high GWP GHGs to estimate emissions for each.

Domestic Wastewater Treatment and Discharge Emissions

All sources of electricity and natural gas usage in the commercial and industrial sectors (including those associated with both domestic and industrial water and wastewater facilities not accounted for in the section below) are accounted for in the commercial sector of this inventory (Ave pers. comm; Bruso pers. comm.).

[3] ICLEI recommends eliminating the effect of landfill sequestration for both government operations inventories and community inventories, to be consistent with the principle that local government operations and community inventories should not account for emissions sinks (ICLEI 2009).
[4] ICLEI recommends using landfill gas measurement data whenever possible. This data was not available for these landfills. Consequently, ARB's landfill tool (based on the IPCC FOD model) was used instead (ICLEI 2008).

Indirect emissions from energy consumption are discussed in the following section.

Treatment of wastewater from both domestic (municipal sewage) and industrial sources produce direct, fugitive emissions of CH_4 and N_2O, but due to the lack of available data on industrial wastewater treatment, only GHG emissions from domestic wastewater were analyzed. Wastewater from domestic sources is treated to remove soluble organic matter, suspended solids, pathogenic organisms, and chemical contaminants. CH_4 is generated when microorganisms biodegrade soluble organic material in wastewater under anaerobic conditions. N_2O is generated during both nitrification and de-nitrification of the nitrogen present in wastewater, usually in the form of urea, ammonia, and proteins (U.S. Environmental Protection Agency 2007). Fugitive emissions of CH_4 and N_2O from domestic wastewater treatment and discharge were calculated using the ARB's 2004 state-wide per capita CH_4 and N_2O emission rates. These statewide emission rates were applied to the population of each city and the County of Sacramento in 2005 to estimate overall city and county emissions.

Water-Related Emissions

Water-related emissions include indirect emissions from electricity consumption and direct emissions from fuel combustion for water supply and irrigation infrastructure and wastewater collection and treatment facilities. The Sacramento Regional County Sanitation District (SCRSD) and the Sacramento Area Sewer District (SASD) provide most wastewater collection and treatment services for Citrus Heights, Elk Grove, Folsom, Rancho Cordova, the City of Sacramento, and Unincorporated Sacramento County. Energy consumption for these services was provided by the Sacramento Municipal Services Agency (MSA) (Fry pers. comm.). Because SCRSD and SASD do not provide wastewater services to the entire county, energy consumption for wastewater treatment for Galt, Isleton, and portions of Folsom and the City of Sacramento was provided by SMUD and PG&E (Ave pers. comm., Cheeseman pers. comm). SMUD and PG&E also provided energy consumption for water supply and irrigation for each city. This data was based on the North American Industry Classification System (NAICS) codes 221311 (water supply), 221312 (irrigation), and 221320 (sewage treatment).

According to SMUD, water-related electricity and natural gas consumption is included in the Commercial and Industrial sector. To avoid double-counting, water-related electricity and natural gas consumption was subtracted from the Commercial and Industrial sector and placed in a separate category.

Government GHG Emissions Methodology

The government analysis divides emissions among government buildings, streetlight and traffic signals, vehicle fleet, employee commute, and CH_4 emissions from waste generated by government operations and placed in landfills. Inventory calculations for the government inventories were performed using the CACP software following the guidelines in the Local Government Operations Protocol.

While most cities provided emissions from government operations for 2005, the City of Citrus Heights and the City of Rancho Cordova provided data regarding their government operations for the year 2007. Both cities have grown substantially between 2005 and 2007 and believe that a baseline GHG inventory for the year 2005 would inaccurately reflect the scale of their operations. Consequently, this analysis presents activity data and associated emissions for the baseline year 2007 for these two cities, in addition to a baseline year of 2005. GHG emissions related to the government operations of Citrus Heights and Rancho Cordova for the year 2005 were scaled from 2007 data.

Based on guidance provided by the two cities, Citrus Heights' emissions for 2007 in each sector were scaled back based on the change in governmental budget during the interim, and Rancho Cordova's emissions for 2007 in each sector were scaled back based on the change in the city's population from 2005 to 2007. Citrus Heights believes that their total operating expenses are a reasonable proxy for GHG emissions. Rancho Cordova's service levels (and consequent government-related emissions) did not change substantially between 2005 and 2007. A transfer of services from other service providers (such as the county) to the Rancho Cordova (or from facility rental to facility ownership) occurred during these years. The city believes that growth in population (8% from 2005 to 2007) more accurately reflects the scale of governmental services provided to the people of Rancho Cordova.

Data provided by certified CCAR GHG inventories for Sacramento County (2007a) and the City of Sacramento (2007b) government operations were used for their respective government inventories. The CCAR reports represent verified and audited emissions reporting based on the strict operational control of each government (Mendonsa pers. comm.).

Table 1-2 presents necessary data inputs and data sources for each sector of the government inventories. The following methodology describes the emission sources evaluated in the government inventories.

Table 1-2. Government Data Input Needs and Data Sources

Sector	Data Input Needs	Source of Data
Buildings	▪ Name, location and department (fire, police, parks) ▪ Electricity consumption (kWh) ▪ Natural gas consumption (Therms) ▪ Other fuel consumption by type (gallons of propane, diesel, etc.)	▪ City Administration records ▪ Electricity records from SMUD ▪ Gas and electricity records from PG&E ▪ CCAR reports
Streetlights and Traffic Signs	▪ Electricity consumption (kWh)	▪ Electricity records from SMUD and PG&E ▪ CCAR Reports
Vehicle Fleet	▪ Number and types of vehicle (Full, mid or compact size cars; heavy duty or light trucks; vans motorcycles) ▪ Fuel type (gasoline, diesel) ▪ Vehicle miles traveled	▪ Public Works ▪ City/County Administration ▪ CCAR Reports
Employee Commute	▪ Number and types of vehicle (full, mid or compact size cars; heavy duty or light trucks; vans motorcycles) ▪ Fuel type (gasoline, diesel) ▪ Vehicle miles traveled	▪ City/County Administration ▪ Employee survey
Waste	▪ Amount of waste generated and landfilled ▪ Type of disposal (landfill, incineration, compost) ▪ Waste composition and percent mix (paper, food , plant, wood, textiles) ▪ Diverted waste and percent mix (recycling, compost, green waste)	▪ City/County Administration ▪ CIWMB ▪ EPA Landfill Methane Outreach Program database
Sacramento International Airport	▪ GHG emissions from aircraft, ground support equipment, onsite roadways, parking facilities, and off-airport roadways associated with the Sacramento International Airport	▪ County of Sacramento Department of Environmental Review and Assessment
High Global Warming Potential (GWP) GHGs	▪ Not included in government operations	▪ NA
Water Supply and Waste Water Treatment	▪ Not included in government operations	▪ NA

Buildings

Electricity and natural gas consumption was primarily supplied by SMUD and PG&E, although some energy and fuel use data was supplied by the individual cities or from certified CCAR reports when more accurate information was available. Citrus Heights and Rancho Cordova building data were provided for the year 2007. Scaling factors based budget and population were used to estimate building emissions for 2005 from this 2007 data.

Streetlights and Traffic Signals

Electricity consumption for streetlights and traffic signals was primarily supplied by SMUD although some electricity use data was supplied by the individual cities when more accurate information was available. Citrus Heights and Rancho Cordova streetlight and traffic signal data were provided for the year 2007. Scaling factors based on budget and population were used to estimate streetlight and traffic signal emissions for 2005 from this 2007 data. Each government GHG inventory evaluates accounts owned directly by the jurisdiction and does not include district-owned accounts (i.e., SMUD-owned streetlights); these accounts are included in the city-wide inventories in the commercial and industrial sector.

Vehicle Fleet

Vehicle fleet data was supplied by each of the cities except Isleton and entered into the CACP software. This sector includes vehicles owned by city/county governments, which can include sheriff vehicles, garbage trucks, police and fire. Some cities contract these fleets and consequently do not fall under the operational control boundaries for municipal governments as described above. Citrus Heights and Rancho Cordova vehicle fleet data were provided for the year 2007. Scaling factors based on budget and population were used to estimate vehicle fleet emissions for 2005 from this 2007 data. Cities provided vehicle fleet information in multiple forms, including net VMT, VMT by vehicle class, and fuel consumption by fuel type. Additional data on off-road equipment was provided by some cities. In some cases fuel consumption was unavailable for a vehicle type and was left out of the inventory; however, this lack of data represents a relatively small gap (less than 5%) of emissions data.

Employee Commute

Employee commute data was provided by Citrus Heights (for 2007), Elk Grove, Galt, and Rancho Cordova (for 2007). Employee commute data based on VMT supplied by these cities were entered into the CACP software.

Waste Emissions

GHG emissions from landfills due to waste generated and landfilled by the government operations from each jurisdiction came from two sources: 1) emissions from waste generated and landfilled in 2005, and 2) waste-in-place emissions for all waste currently located in landfills owned and operated by the municipal governments.

Landfill Emissions from Waste Generation in 2005

Waste generation data was provided by Citrus Heights (for 2007), Elk Grove, Folsom, and Galt. Waste generation data was not provided by Isleton, Rancho Cordova, Sacramento, and Unincorporated Sacramento County. For city-landfilled waste, the waste stream profile is the community business waste profile for each city reported by the CIWMB[5]. Emissions associated with recycling, compost, and green waste were not estimated because the CACP software does not have the option to report tonnage recycled. In addition, the Local Government Operations Protocol recommends that local inventories not account for emissions sinks such as carbon sequestration at landfills (ICLEI 2008). This assumption may result in an overestimate of methane emissions from landfill because composting can be an emissions sink (Intergovernmental Panel on Climate Change 2006b). GHG sequestration at the landfills was set to zero, based on guidance in the Local Government Operations Protocol.[6]

Landfill Emissions from Waste-In-Place in 2005

Waste-in-place emissions are based on the accumulated waste in the landfill over the landfill's lifetime, as opposed to the current year's generation of waste. Waste-in-place emissions were calculated for landfills owned and operated by municipal governments, with available waste-in-place and CH_4 capture data including Kiefer (County), Sacramento City Landfill (Sacramento), and Elk Grove Landfill (Sacramento). Data was collected from the Environmental Protection Agency's (EPA's) Landfill Methane Outreach Program (LMOP) and County staff (Environmental Protection Agency 2007; County of Sacramento 2009a). Methane emissions from waste-in-place were calculated using the ARB's Excel-based tool based on the IPCC's first order decay (FOD) model, according to the guidelines of the Local Government Operations Protocol.

[5] Waste stream profile data specific to government operations is unavailable.
[6] ICLEI recommends eliminating the effect of landfill sequestration for both government operations inventories and community inventories, to be consistent with the principle that local government operations and community inventories should not account for emissions sinks (ICLEI 2009).

Sacramento International Airport Emissions

The Sacramento International Airport is located in Unincorporated Sacramento County and is owned by the county government, and is therefore included in the government GHG inventory for Unincorporated Sacramento County (Barry pers. comm.). However, because the county does not have control over aircraft technology (aircraft are regulated by the Federal Aviation Administration [FAA]) nor over the activity or operations of the airlines, GHG emissions from aircraft and ground support equipment were not included in the government GHG inventory. GHG emissions from airport on-site roadways, parking facilities, and off-airport roadways associated with the Sacramento International Airport were included in the Sacramento County Government emissions inventory (County of Sacramento Department of Environmental Review and Assessment 2007).

High GWP GHG Emissions

The Local Government Operations Protocol recommends that government operations inventories include fugitive emissions of HFCs from refrigerants and fire suppression equipment from buildings and facilities as well as vehicles. Because the city and county governments do not track use of refrigerants, fire suppression substances, and other substances that result in high GWP GHG emissions, high GWP GHG emissions from these and other uses in Sacramento County are included in the county-wide and city-wide inventories and estimated based on per-capita averages provided by the ARB as discussed in the methodology.

Water Supply and Wastewater Treatment

Energy consumption related to water distribution or processing infrastructure owned or operated by the governments (i.e. water pumps, lift stations, sprinkler systems, etc.) is included in the buildings sector for each Government inventory because this data could not easily be disaggregated. However, energy consumption related to water supply, distribution, and wastewater treatment and collection was included in the county-wide and city-wide inventories in the water sector. The county and cities involved in the development of these inventories determined that these emissions are not under direct jurisdiction of the governments. Jurisdiction is split between private companies and local governments, and more than 20 water purveyors serve Sacramento County. Energy use data for each of these specific purveyors was not readily available.

Chapter 2
Greenhouse Gas Emissions Inventory for the City of Citrus Heights

Introduction

In recognition of the rising concern over the threat of climate change the City of Citrus Heights, along with all incorporated cities within Sacramento County, opted to join the International Council for Local Environmental Initiatives (ICLEI) program. The City of Citrus Heights committed to conduct an inventory of emissions within its jurisdiction as part of a county-wide effort to account for GHG emissions generated within Sacramento County. The inventory described in detail in this chapter is the first step to reduce GHG emissions. These efforts to reduce emissions are consistent with State policy and current regulation from AB 32 directing the State of California to reduce GHG emissions to 1990 levels by 2020. The City of Citrus Heights lies within Sacramento County covers approximately 14.2 square miles, and has a population of 87,584 (County of Sacramento 2009b). Citrus Heights is known to be a regionally important retail destination, home to the Sunrise Mall and Birdcage Walk shopping centers. Citrus Heights maintains a tradition of hospitality.

The City of Citrus Heights incorporated in 1997 and operates on the Manager–City Council type of governance (County of Sacramento 2009b: City of Citrus Heights 2009)

The majority of GHG emissions are produced through the burning of fossil fuels. The City of Citrus Heights City-Wide GHG Inventory includes GHG emissions from direct and indirect sources. A direct emission source is defined as an on-site source of emissions such as the combustion of fossil fuel in a vehicle engine. An indirect emission source is defined as an emissions source generated offsite as a result of county operation, such as electricity consumption.

GHG emissions were inventoried for all operations within the City of Citrus Heights' geographical boundaries (i.e. city limits). The City of Citrus Heights City-Wide GHG Inventory includes GHG emissions from residential, commercial, industrial, transportation, and waste sectors. The government GHG inventory is described separately, and is a subset of the City of Citrus Heights City-Wide GHG Inventory. The government analysis divides emissions among buildings, vehicle fleet, employee commute, streetlights, water/sewage, and waste sectors.

Government GHG emissions for the City of Citrus Heights were inventoried for the year 2007 rather than 2005. Between 2005 and 2007, Citrus Heights underwent large growth of government operations and felt that a baseline GHG inventory for the year 2005 would inaccurately reflect the scale of their operations. Consequently, this analysis presents activity data and associated emissions for the year 2007.

In an effort to determine GHG emissions related to the government operations of Citrus Heights for the year 2005, emissions for 2007 in each sector were scaled back based on the change in governmental budget from fiscal year 2004–2005 to 2006–2007. Citrus Heights' total expenses increased 10.6% during this time period. It was assumed that total operating expenses would be a reasonable proxy for determining GHG emissions, so 2007 emissions were multiplied by 90.4% to represent the budgetary growth (1/1.106)[7]. Data for 2005 in some sectors were available from SMUD and PG&E, including electricity and natural gas consumption for buildings and streetlights, but not used because it is likely that the data do not reflect actual energy use by Citrus Heights in 2005, including all contracted services.

Results

City-Wide Inventory

The City of Citrus Heights City-Wide GHG Inventory encompasses emissions from commercial, industrial, and residential activities within the city limits.

Table 2-1 quantifies the contributions of each sector to total 2005 city-wide emissions for the City of Citrus Heights. Figure 2-1 illustrates each sector's contribution to total city-wide emissions. On-road transportation accounted for 42.8% of overall emissions and is the largest contributing sector to overall emissions.

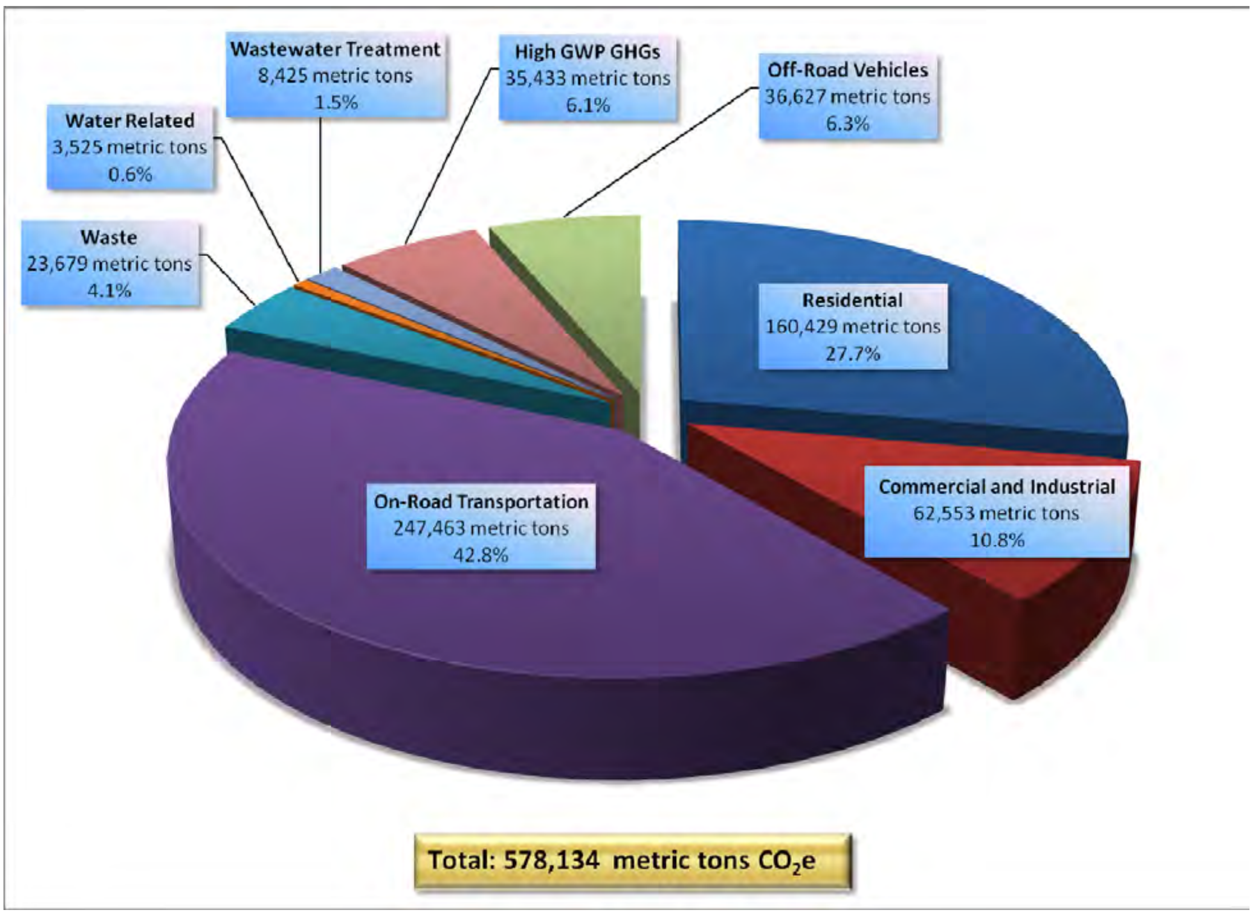
[7] See Appendix C for a detailed discussion of scaling methodology.

Table 2-1. 2005 GHG Emissions for the City of Citrus Heights[1]

Sector	CO_2e (metric tons)	Percent
Residential	160,429	27.7
Commercial and Industrial	62,553	10.8
Industrial Specific	0	0.0
On-Road Transportation	247,463	42.8
Off-Road Vehicle Use	36,627	6.3
Waste	23,679	4.1
Wastewater Treatment	8,425	1.5
Water-Related	3,525	0.6
Agriculture	0	0.0
High GWP GHGs	35,433	6.1
Total	**578,134**	**100.0**

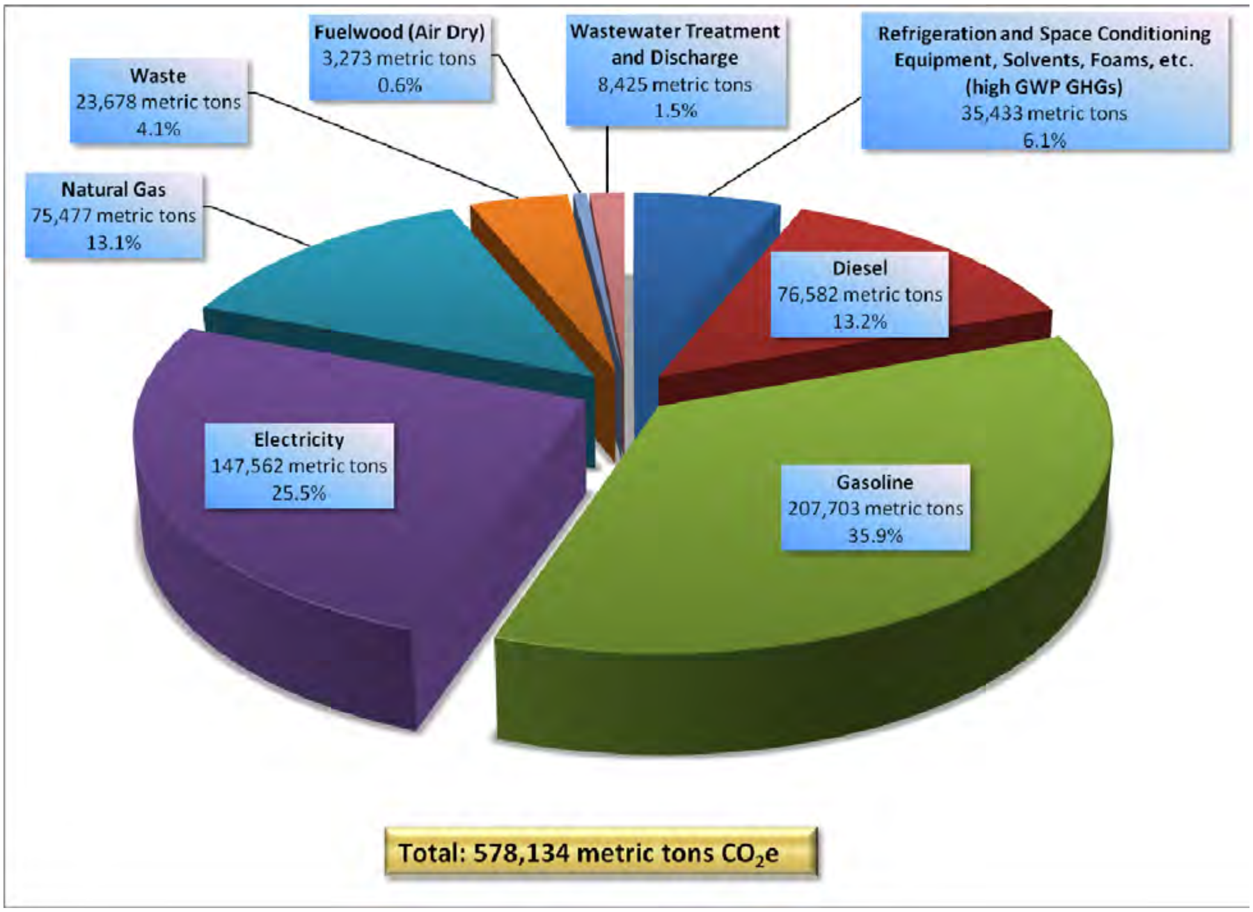
[1] Calculated using CACP software (Appendix A).

Figure 2-1. City of Citrus Heights GHG Emissions for 2005 (metric tons CO_2e)



Total GHG emissions in 2005 for the City of Citrus Heights amounted to 578,134 metric tons of CO_2e, the fourth-largest incorporated city contributor to emissions. Figure 2-2 shows the contribution of each fuel type and emissions source to overall GHG emissions. Electricity, natural gas, gasoline, and diesel are the largest overall contributors to GHG emissions in the City of Citrus Heights.

Figure 2-2. City of Citrus Heights GHG Emissions for 2005 by Source (metric tons CO_2e)



Emissions from the City of Citrus Heights in 2005 accounted for 4.2% of overall GHG emissions for Sacramento County in 2005. Citrus Heights 2005 per capita GHG emissions are 6.6 metric tons of CO_2e compared to county-wide per capita emissions of 10.0 metric tons and ARB target 2020 goal of 9.7 metric tons. Figure ES-5 compares 2005 per capita emissions for the cities, Sacramento County, and Unincorporated Sacramento County. City-wide emissions range from 20,382 (Isleton) to 6,556,875 (Unincorporated Sacramento County) metric tons of CO_2e, and per capita emissions range from 6.4 (Elk Grove) to 11.7 (Unincorporated Sacramento County) metric tons of CO_2e.

A discussion of City of Citrus Heights GHG emissions for each major sector is presented below. For detailed analysis of emissions inventory methodologies, see Appendix B.

Residential Emissions

As shown in Table 2-1, residential GHG emissions for the City of Citrus Heights in 2005 amounted to 160,429 metric tons of CO_2e, which represents 27.7% of total city-wide emissions in Citrus Heights.

Residential-sector GHG emissions mainly result from household use of electricity and natural gas. Residential emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E. Residential GHG emissions also include CH_4 and N_2O emissions from residential wood burning in Citrus Heights residences. GHG emissions from residential wood burning were quantified using a staff report from the SMAQMD (SMAQMD 2007).

Emissions were quantified using CACP emission factors. Emissions were apportioned by population data for the City of Citrus Heights in 2005, available through the California Department of Finance (California Department of Finance 2008). Wood-burning contributions to GHG emissions were included because the SMAQMD introduced a wood stove change-out incentive program in Sacramento County that may reduce GHG emissions from wood burning (SMAQMD 2007).

Residential use of self-generated energy through the consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified due to lack of available data. It is expected that the GHG emissions from these sources are negligible. High GWP gases partially originate from the residential sector but are included in a separate category below. See Appendix B for a detailed description of calculations and methodology.

Commercial and Industrial Emissions

The commercial and industrial sector are combined because both SMUD and PG&E aggregate energy use data from these two sectors into their “commercial” sector. As shown in Table 2-1, commercial and industrial GHG emissions for the City of Citrus Heights in 2005 amounted to 62,553 metric tons of CO_2e, which represents 10.8% of total emissions from Citrus Heights in 2005.

Commercial- and industrial-sector GHG emissions mainly result from consumption of electricity and natural gas by commercial and industrial buildings. Commercial and industrial GHG emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E.

Energy generated through the commercial and industrial consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified due to lack of available data. Appendix B describes in detail the methodology used to quantify these emissions.

Industrial Specific Emissions

Industrial-sector GHG emissions mainly result from consumption of electricity and natural gas by industrial buildings. There were no GHG emissions for the City of Citrus Heights in 2005 estimated for the industrial sector's use of electricity and natural gas (Ave pers. comm., Bruso pers. comm.). Companies that fall within the industrial sector may, by law, choose not to disclose energy use. In that case, energy consumed by the industrial sector may be included in the commercial sector to maintain confidentiality. See Appendix B for a detailed description of commercial and industrial emissions.

On-Road Transportation Emissions

GHG emissions from on-road transportation for the City of Citrus Heights in 2005 amounted to 73,801 metric tons of CO_2e, which represents 42.8% of total Citrus Heights emissions. Emissions from on-road vehicle use, including heavy-duty trucks and buses, were quantified using average annual VMT for the City of Citrus Heights in 2005. VMT data for 2005 was obtained from the Caltrans HPMS 2005 Public Road Data (Caltrans 2006). A significant portion of highway VMT may be attributed to employee commute trips within the county. Therefore, the county-wide highway VMT was apportioned by highway miles located in the City of Citrus Heights. Approximately 1% of highway miles are located within the City of Citrus Heights. Approximately 15.4% of VMT and associated GHG emissions in Citrus Heights are due to travel on highways located in Citrus Heights.

See Appendix B for a detailed description of calculations and methodology.

Off-Road Vehicle Emissions

Exhaust emissions from off-road vehicle use for the City of Citrus Heights in 2005 amounted to 36,627 metric tons of CO2e, which represents 6.3% of overall emissions. Emissions were calculated using the California Air Resources Board OFFROAD 2007 air quality model. OFFROAD 2007 considers emissions from off-road equipment including recreational boats, recreational vehicles, industrial equipment, construction equipment, and lawn and garden equipment, as well as equipment dealing with airport ground support, military, agriculture, rail operation, and more (California Air Resources Board 2006). County-wide emissions were apportioned by population in the City of Citrus Heights using

California Department of Finance data for 2005 (California Department of Finance 2008).

See Appendix B for a detailed description of calculations and methodology.

Waste Emissions

Approximately 94,600 tons of waste was landfilled by the City of Citrus Heights in 2005; 30% of landfilled waste is due to household (residential) disposal, and 70% of landfilled waste is due to business (commercial/industrial) disposal. The CIWMB estimates that only 41% of all generated waste was landfilled in 2005, because Citrus Heights achieved a diversion rate of 59% for that year (California Integrated Waste Management Board 2008b). CH_4 emissions are released to the atmosphere as waste decomposes in the anaerobic environment created by a landfill. Approximately 23,679 metric tons of CO_2e were emitted as a result of landfilling of waste in 2005. Waste emissions were calculated using waste stream profile information from the CIWMB, CH_4 control efficiencies for each landfill accepting waste from the city, and waste-in-place information from the EPA (California Integrated Waste Management Board 2008c, Israel pers. comm., Environmental Protection Agency 1998).

Appendix B describes in detail the methodology used to quantify these emissions.

Wastewater Treatment Emissions

GHG emissions from domestic wastewater treatment required for the City of Citrus Heights in 2005 amounted to 8,425 metric tons of CO_2e, which represents 1.5% of overall emissions. Emissions from this source are included as per capita emissions of CH_4 and N_2O as calculated for the State of California (California Air Resources Board 2008a, 2008b).

Appendix B describes in detail the methodology used to quantify these emissions.

Water-Related Emissions

GHG emissions from electricity and natural gas consumption for water supply and irrigation infrastructure and wastewater collection and treatment facilities required for the City of Citrus Heights in 2005 amounted to 3,525 metric tons of CO_2e, which represents 0.6% of overall emissions.

Appendix B describes in detail the methodology used to quantify these emissions.

Agricultural Emissions

Total agricultural emissions for the City of Citrus Heights in 2005 were 0 metric tons of CO_2e. GHG emissions from enteric fermentation and manure management for cattle and swine, use of fertilizers, and emissions from dairy operations were considered. In 2005, the City of Citrus Heights had no agricultural activities. See Appendix B for a detailed description of methodology.

High GWP GHG Emissions

Emissions from high GWP GHGs, including chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs) used as substitutes for ozone-depleting substances, for the City of Citrus Heights in 2005 amounted to 35,433 metric tons of CO_2e. Emissions were calculated based on the California Air Resources Board per capita estimate for California (California Air Resources Board 2007). Appendix B describes in detail the methodology used to quantify these emissions.

Government Inventory

The government GHG inventory encompasses emissions from sources under the City of Citrus Heights's jurisdiction, including government buildings, vehicle fleet, and employee commute as well as streetlights and water/wastewater treatment and supply within the boundaries of the City of Citrus Heights. Although in some cases different data sources were used to develop the government GHG inventory, this inventory is a subset of the City of Citrus Heights City-Wide GHG Inventory. The Citrus Heights government GHG inventory represents 0.5% of the total City of Citrus Heights City-Wide GHG Inventory. Total government GHG emissions by sector for 2007 are summarized in Table 2-2.

Government-related emissions from the City of Citrus Heights in 2005 accounted for 1.0% of overall GHG emissions for Sacramento County governments in 2005. Government emissions range from 42 (Isleton) to 170,818 (Unincorporated Sacramento County) metric tons of CO_2e.

As discussed previously, government GHG emissions for the City of Citrus Heights were inventoried for the year 2007 rather than 2005 due to recent growth of government operations. Consequently, this analysis presents activity data and associated emissions for the year 2007. Emissions for 2007 in each sector were scaled back to 2005 based on the change in governmental budget from fiscal year 2006–2007 to 2004–2005.

The City of Citrus Heights' total expenses increased 10.6% during this time period. It was assumed that total operating expenses would be a reasonable proxy for determining GHG emissions, so 2007 emissions for each city were scaled back by 90.4% (1/1.106). Data for 2005 in some sectors was available from

SMUD and PG&E, including electricity and natural gas consumption for buildings and streetlights. This data was not used because it likely does not reflect actual energy use by Citrus Heights in 2005, including all contracted services. Total government GHG emissions by sector for 2005 are summarized in Table 2-3.

The budget for almost all areas of governmental services increased from fiscal year 2004–2005 to 2006–2007, including city council, finance, police, fleet management, and facilities management, to name a few. According to Paul Junker, Planning Director for the City of Rancho Cordova, increases in budget do not necessarily represent a similar increase in actual services or GHG-generating activities. In some cases, it merely represents rising costs and economic shifts (Junker pers. comm.). This reasoning also applies to the City of Citrus Heights.

An alternate method of backcasting emissions is by net change in energy use between 2005 and 2007 and resulting GHG emissions. Because electricity and natural gas data for both years was available from the utilities, a scaling factor representing the change could be used to estimate emissions from vehicle fleet, employee commute, and any additional fuel usage. GHG emissions from Citrus Heights' energy use grew by 206% during this time period. A scaling factor of 33% could be used to backcast emissions based on this growth. However, energy use for 2005 likely does not reflect actual energy use by Citrus Heights, including all contracted services. For this reason, this method of backcasting was not used. City population increased 0.4% from 2005 to 2007. Using population as a metric to backcast emissions would therefore underestimate the growth in Citrus Heights' governmental operations.

Table 2-2. 2007 Government GHG Emissions for the City of Citrus Heights[1]

Sector	CO_2e (metric tons)	Percent
Buildings	666	22.8
Vehicle Fleet	158	5.4
Employee Commute	1,044	35.8
Streetlights and Traffic Signals	1,004	34.4
Waste	28	1.0
Other Fuel Use	15	0.5
Total	**2,915**	**100.0**

[1] Calculated using CACP software. See Appendix C for a detailed discussion of scaling methodology.

Figure 2-3 illustrates the contribution of each sector to the total government emissions for the City of Citrus Heights in 2007. Figure 2-4 illustrates the contribution of each sector to the total government emissions for the City of Citrus Heights in 2005. For detailed analysis of emissions methodologies for the government sector, see Appendix C.

Table 2-3. 2005 Government GHG Emissions for the City of Citrus Heights[1]

Sector	CO_2e (metric tons)	Percent
Buildings	603	22.8
Vehicle Fleet	143	5.4
Employee Commute	945	35.8
Streetlights and Traffic Signals	908	34.4
Waste	25	1.0
Other Fuel Use	14	0.5
Total	**2,637**	**100.0**

[1] Calculated using CACP software and scaling back based on budget. See Appendix C for a detailed discussion of scaling methodology.

Figure 2-3. City of Citrus Heights Government GHG Emissions for 2007 (metric tons CO_2e)

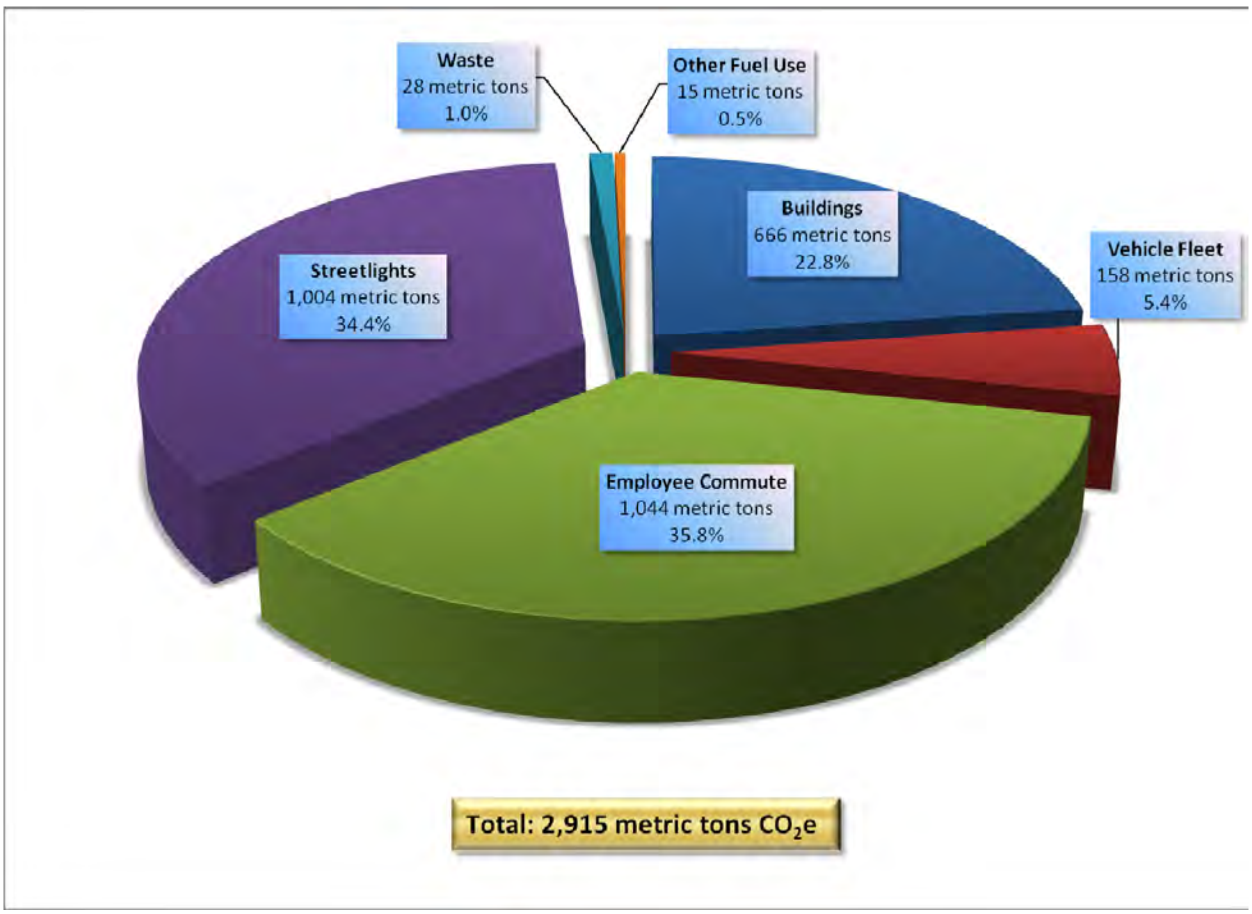
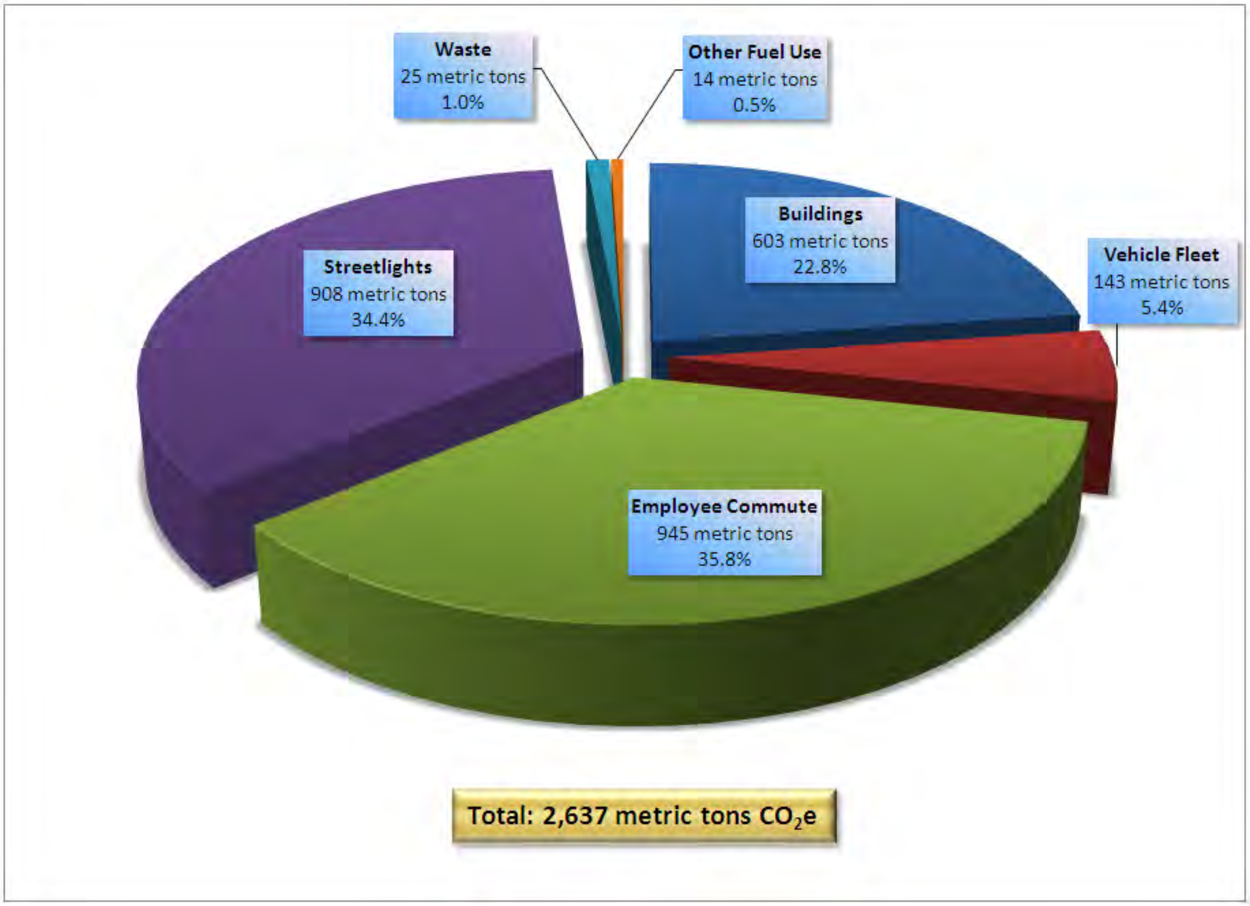


Figure 2-4. City of Citrus Heights Government GHG Emissions for 2005 (metric tons CO_2e)



Buildings

As shown in Table 2-2, GHG emissions from building energy consumption in 2007 amounted to 666 metric tons of CO_2e and 603 metric tons of CO_2e in 2005, which represents 22.8% of total government emissions for Citrus Heights. Electricity, natural gas, and other fuel consumption for government facilities were obtained from SMUD, PG&E, and city staff (Ave pers. comm., Bruso pers. comm., Kempenaar pers. comm.). The City of Citrus Heights had 133 employees and six government buildings in operation, covering 57,520 square feet of floor space in 2007 (Kempenaar pers. comm.). Appendix C describes in detail the methodology used to quantify these emissions.

Vehicle Fleet

The third largest source of emissions from government operations resulted from use of the vehicle fleet. Vehicle fleet emissions amounted to 158 metric tons of CO_2e in 2007, which represents 5.4% of total government emissions, and 143 metric tons of CO_2e in 2005 based on budgetary backcasting. Vehicle fleet emissions include government fleet vehicles ranging from motorcycles to heavy trucks. See Appendix C for a detailed description of calculations and methodology.

Employee Commute

As shown in Table 2-2, GHG emissions from Citrus Heights employee commuting amounted to 1,044 metric tons of CO_2e in 2007, which represents 35.8% of overall government emissions, and 945 metric tons of CO_2e in 2005 based on budgetary backcasting. GHG emissions resulting from employee commutes were calculated based on a commute survey provided by city staff (Kempenaar pers. comm.). Appendix C describes in detail the methodology used to quantify these emissions.

Streetlights and Traffic Signals

As Table 2-2 illustrates, electricity consumption of Citrus Heights–owned streetlights and traffic signals amounted to 1,004 metric tons of CO_2e and 908 metric tons of CO_2e in 2005, representing 34.4% of overall government emissions. Electricity use data for City of Citrus Heights streetlights and traffic signals for 2007 was provided by SMUD (Ave pers. comm.). See Appendix C for a detailed description of calculations and methodology.

Waste

As shown in Table 2-2, GHG emissions from waste generation specific to City of Citrus Heights government facilities amounted to 28 metric tons of CO_2e in 2007, which represents 1% of overall government emissions, and 25 metric tons of CO_2e in 2005 based on budgetary backcasting. Citrus Heights generated 106 tons of trash in 2007, and diverted 7.3 tons to recycling and 20 tons to composting. All waste landfilled by the City of Citrus Heights, including government waste generation, was included in the City of Elk Grove City-Wide GHG Inventory. Appendix C describes in detail the methodology used to quantify emissions from waste generation.

Other Fuel Use

Use of fuels such as kerosene, propane, and heavy fuel oil in city government operation were considered. Use of these fuels resulted in emissions of 15 metric tons of CO_2e in 2007, and 14 metric tons of CO_2e in 2005 based on budgetary backcasting. Citrus Heights operates a 400 kW generator one hour per week, and it was estimated that 1,487 gallons of diesel fuel were combusted in 2007

(Kempenaar pers. comm.). See Appendix C for a detailed description of calculations and methodology.

Summary

GHG emissions for the City of Citrus Heights in 2005 amounted to 578,134 metric tons of CO_2e, including government emissions. Per capita emissions were 6.6 metric tons of CO_2e, compared to county-wide per capita emissions of 10 metric tons and ARB target 2020 goal of 9.7 metric tons. The main sources of GHG emissions in the City of Citrus Heights were transportation (284,090 metric tons CO_2e from fuel combustion) and buildings (222,982 metric tons CO_2e from electricity and natural gas consumption), representing 49% and 39% of net city-wide emissions, respectively.

Government GHG emissions for City of Citrus Heights amounted to 2,915 metric tons of CO_2e in 2007, and 2,637 metric tons of CO_2e in 2005. The main sources of GHG emissions for government operations for 2007 were employee commute (1,044 metric tons CO_2e from fuel combustion) and streetlights and traffic signals (1,004 metric tons CO_2e from electricity consumption), representing 36% and 34% of net government emissions, respectively. The main sources of GHG emissions in 2005 were employee commute (945 metric tons CO_2e from fuel combustion) and streetlights and traffic signals (908 metric tons CO_2e from electricity consumption), representing 36% and 34 % of net government emissions, respectively.

Chapter 3
Greenhouse Gas Emissions Inventory for the City of Elk Grove

Introduction

In recognition of the rising concern over the threat of climate change the City of Elk Grove, along with all incorporated cities within Sacramento County, opted to join the International Council for Local Environmental Initiatives (ICLEI) program. Elk Grove committed to conduct an inventory of emissions within its jurisdiction as part of a county-wide effort to account for GHG emissions generated within Sacramento County. The inventory, described in detail in this chapter, is the first step to reduce GHG emissions. These efforts to reduce emissions are consistent with State policy and current regulation from AB 32 directing the State of California to reduce GHG emissions to 1990 levels by 2020.

The City of Elk Grove lies within Sacramento County, covers approximately 44 square miles, and has a population of 139,542 (County of Sacramento 2007; California Department of Finance 2008). Agriculture is a large part of Elk Grove's economy although it has expanded to include technology, professional service, commercial and retail enterprises as a thriving part of its economy. Elk Grove maintains a rich educational environment and is home to many recreational opportunities including golf courses, health clubs, parks, theaters, and restaurants as well as a wildlife refuge and natural riparian preserve.

The City of Elk Grove incorporated July 1, 2000 and operates on the Manager–City Council type of governance (City of Elk Grove 2008).

The majority of GHG emissions are produced through the burning of fossil fuels. The City of Elk Grove City-Wide GHG Inventory includes GHG emissions from direct and indirect sources. A direct emission source is defined as an on-site source of emissions such as the combustion of fossil fuel in a vehicle engine. An indirect emission source is defined as an emissions source generated offsite as a result of county operation, such as electricity consumption.

GHG emissions were inventoried for all operations within the City of Elk Grove's geographical boundaries (i.e. city limits). The City of Elk Grove City-Wide GHG Inventory includes GHG emissions from residential, commercial, industrial, transportation, and waste sectors. The government emissions inventory is described separately, and is a subset of the City of Elk Grove City-Wide GHG

Inventory . The government analysis divides emissions among buildings, vehicle fleet, employee commute, streetlights, water/sewage, and waste sectors.

Results

City-Wide Inventory

The City of Elk Grove City-Wide GHG Inventory encompasses emissions from commercial, industrial, and residential activities within the city limit.

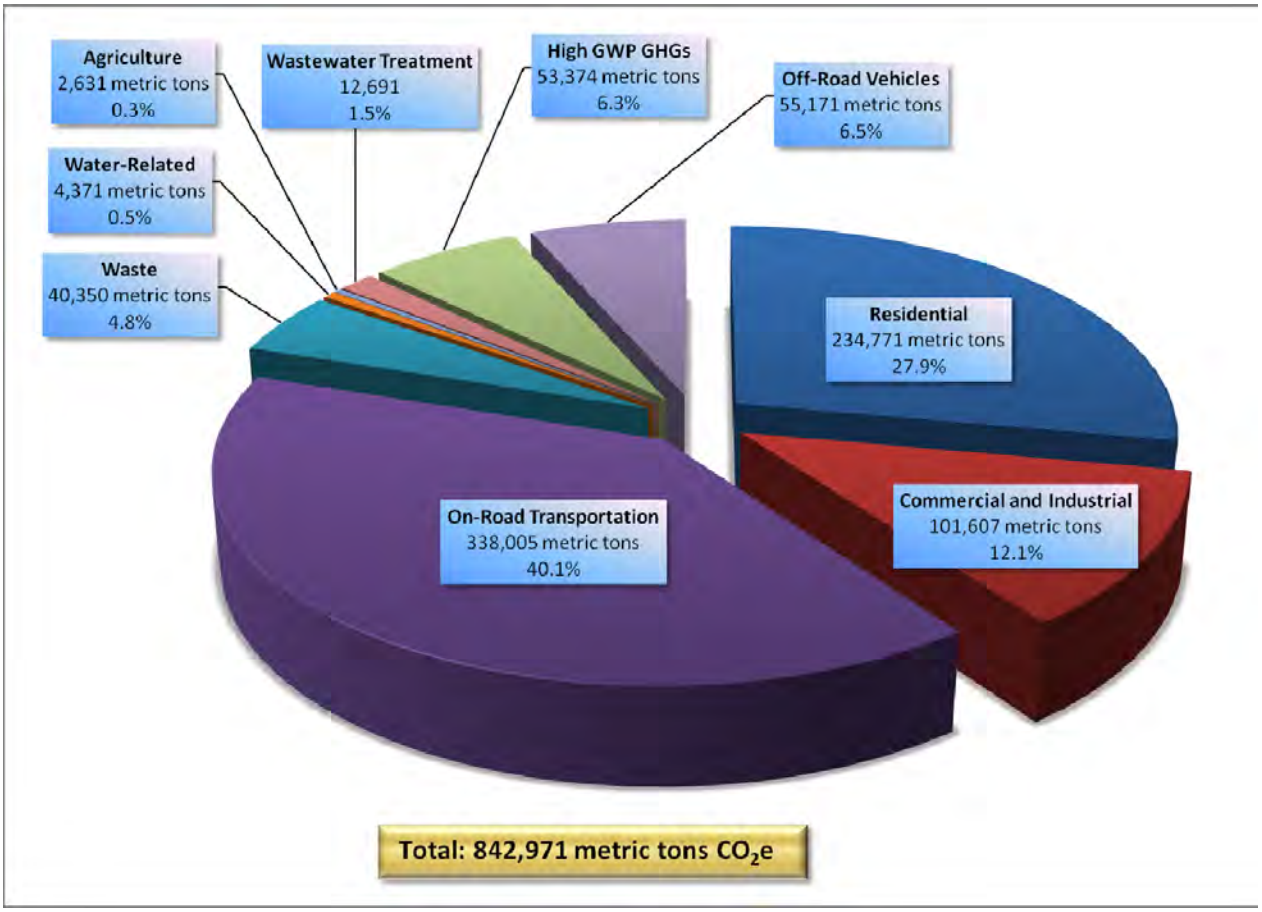
Table 3-1 quantifies the contributions of each sector to total 2005 city-wide emissions for Elk Grove. Figure 3-1 illustrates each sector's contribution to total city-wide emissions. On-road transportation accounted for 40.1% of overall emissions and is the largest contributing sector to overall emissions.

Table 3-1. 2005 GHG Emissions for the City of Elk Grove[1]

Sector	CO_2e (metric tons)	Percent
Residential	234,771	27.9
Commercial and Industrial	101,607	12.1
Industrial Specific	0	0.0
On-Road Transportation	338,005	40.1
Off-road Vehicle Use	55,171	6.5
Waste	40,350	4.8
Wastewater Treatment	12,691	1.5
Water-Related	4,371	0.5
Agriculture	2,631	0.3
High GWP GHGs	53,374	6.3
Total	**842,971**	**100.0**

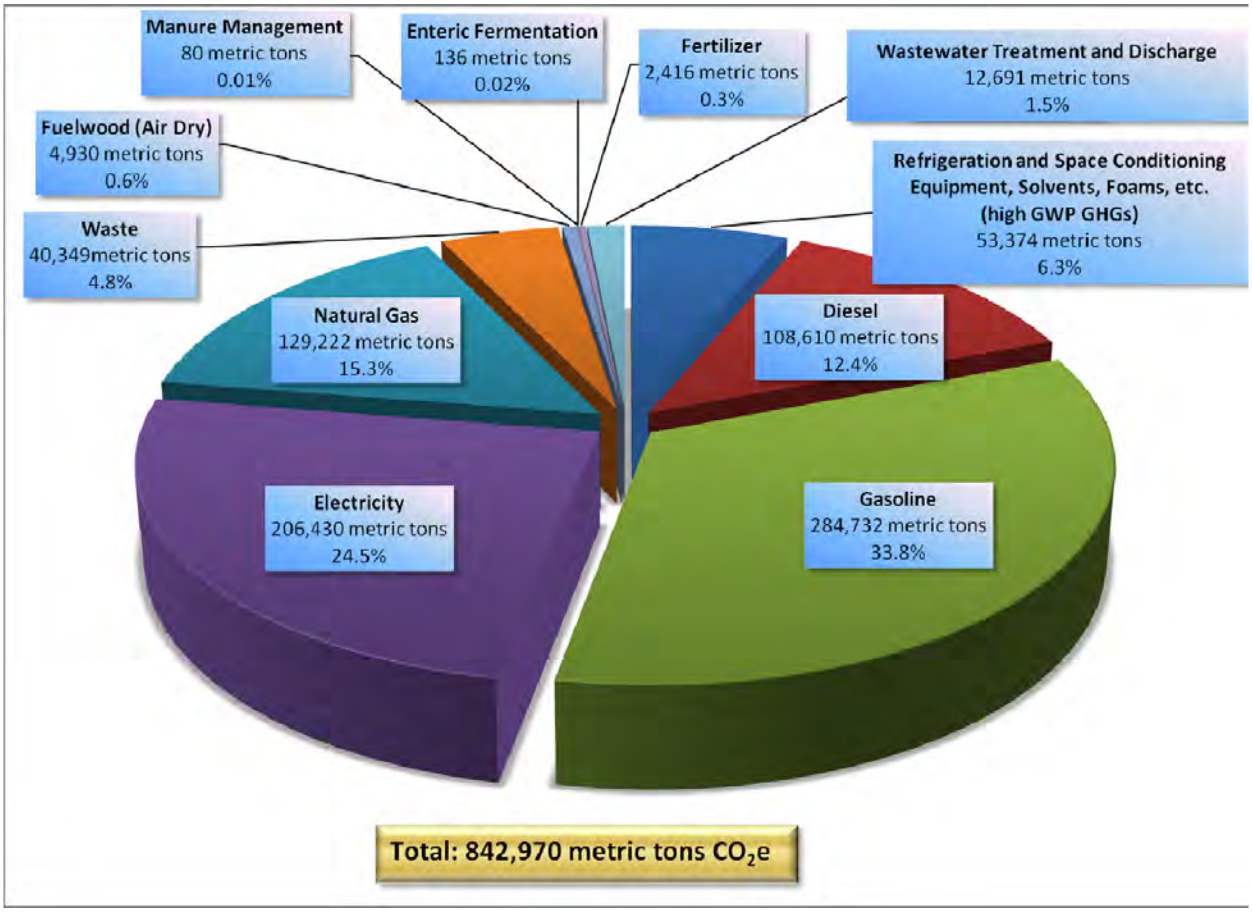
[1] Calculated using CACP software (Appendix A).

Figure 3-1. City of Elk Grove GHG Emissions for 2005 (metric tons CO_2e)



Total GHG emissions in 2005 for the City of Elk Grove amounted to 842,971 metric tons of CO_2e, the second largest incorporated city contributor to emissions. Figure 3-2 shows the contribution of each fuel type and emissions source to overall GHG emissions. Electricity, natural gas, gasoline, and diesel are the largest overall contributors to GHG emissions in Elk Grove.

Figure 3-2. City of Elk Grove GHG Emissions for 2005 by Source (metric tons CO_2e)



Emissions from the City of Elk Grove in 2005 accounted for 6.1% of overall GHG emissions for Sacramento County in 2005. Elk Grove 2005 per capita GHG emissions are 6.4 metric tons of CO_2e compared to county-wide per capita emissions of 10.0 metric tons and ARB target 2020 goal of 9.7 metric tons. Figure ES-5 compares 2005 per capita emissions for the cities, Sacramento County, and Unincorporated Sacramento County. City-wide emissions range from 20,382 (Isleton) to 6,556,875 (Unincorporated Sacramento County) metric tons of CO_2e, and per capita emissions range from 6.4 (Elk Grove) to 11.7 (Unincorporated Sacramento County) metric tons of CO_2e.

For detailed analysis of emissions inventory methodologies, see Appendix B.

Residential Emissions

As shown in Table 3-1, residential GHG emissions for the City of Elk Grove in 2005 amounted to 234,771 metric tons of CO_2e, which represents 27.9% of total city-wide emissions in Elk Grove.

Residential-sector GHG emissions mainly result from household use of electricity and natural gas. Residential emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E. Residential GHG emissions also include CH_4 and N_2O emissions from residential wood burning in Elk Grove residences. GHG emissions from residential wood burning were quantified using data from the SMAQMD (SMAQMD 2007).

Emissions were quantified using CACP emission factors. Emissions were apportioned by population data for the City of Elk Grove in 2005, available through the California Department of Finance (California Department of Finance 2008). Wood-burning contributions to GHG emissions were included because the SMAQMD introduced a wood stove change-out incentive program in Sacramento County that may reduce GHG emissions from wood burning (SMAQMD 2007).

Residential use of self-generated energy through the consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified due to lack of available data. It is expected that the GHG emissions from these sources are negligible. High GWP gases partially originate from the residential sector but are included in a separate category below. See Appendix B for a detailed description of calculations and methodology.

Commercial and Industrial Emissions

The commercial and industrial sector are combined because both SMUD and PG&E aggregate energy use data from these two sectors into their "commercial" sector. As shown in Table 3-1, commercial and industrial GHG emissions for the City of Elk Grove in 2005 amounted to 101,607 metric tons of CO_2e, which represents 12.1% of total emissions from Elk Grove in 2005.

Commercial- and industrial-sector GHG emissions mainly result from consumption of electricity and natural gas by commercial and industrial buildings. Commercial and industrial GHG emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E.

Energy generated through the commercial and industrial consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified due to lack of available data. Appendix B describes in detail the methodology used to quantify these emissions.

Industrial Specific Emissions

Industrial-sector GHG emissions mainly result from consumption of electricity and natural gas by industrial buildings. No GHG emissions for Elk Grove in 2005 were estimated for the industrial sector's use of electricity and natural gas (Ave pers. comm., Bruso pers. comm.). Companies that fall within the industrial sector may, by law, choose not to disclose energy use. In that case, energy consumed by the industrial sector may be included in the commercial sector to maintain confidentiality. See Appendix B for a detailed description of commercial and industrial emissions.

On-Road Transportation Emissions

GHG emissions from on-road transportation for the City of Elk Grove in 2005 amounted to 338,005 metric tons of CO_2e, which represents 40.1% of total city-wide emissions. Emissions from on-road vehicle use, including heavy-duty trucks and buses, were quantified using average annual VMT for the City of Elk Grove in 2005. VMT data for 2005 was obtained from the Caltrans HPMS 2005 Public Road Data (Caltrans 2006). A significant portion of highway VMT may be attributed to employee commute trips within the county. Therefore, the county-wide highway VMT was apportioned by highway miles located in the City of Elk Grove. Approximately 3% of highway miles are located within the City of Elk Grove. Approximately 29% of VMT and associated GHG emissions in Sacramento are due to travel on highways located in Elk Grove.

See Appendix B for a detailed description of calculations and methodology.

Off-Road Vehicle Emissions

Exhaust emissions from off-road vehicle use for the City of Elk Grove in 2005 amounted to 55,171 metric tons of CO_2e. Emissions were calculated using the California Air Resources Board OFFROAD 2007 air quality model. OFFROAD 2007 considers emissions from off-road equipment including recreational boats, recreational vehicles, industrial equipment, construction equipment, and lawn and garden equipment, as well as equipment dealing with airport ground support, military, agriculture, rail operation, and more (California Air Resources Board 2006). County-wide emissions were apportioned by population in the City of Elk Grove using California Department of Finance data for 2005 (California Department of Finance 2008).

See Appendix B for a detailed description of calculations and methodology.

Waste Emissions

Approximately 107,251 tons of waste was landfilled by the City of Elk Grove in 2005; 24% of landfilled waste is due to household (residential) disposal, and 76% of landfilled waste is due to business (commercial/industrial) disposal. The CIWMB estimates that only 41% of all generated waste was landfilled in 2005 because Elk Grove achieved a diversion rate of 59% for that year (California Integrated Waste Management Board 2008b). CH_4 emissions are released to the atmosphere as waste decomposes in the anaerobic environment created by a landfill. Approximately 38,104 metric tons of CO_2e were emitted as a result of landfilling of waste in 2005. An additional 2,246 metric tons of CO_2e were emitted as a result of CH_4 emissions from waste-in-place at landfills located in the City of Elk Grove (including Dixon Pit Landfill). Net waste emissions were 40,350 metric tons of CO_2e.

Waste emissions were calculated using waste stream profile information from the CIWMB, CH_4 control efficiencies for each landfill accepting waste from the city, and waste-in-place information from the Environmental Protection Agency (California Integrated Waste Management Board 2008c, Israel pers. comm., Environmental Protection Agency 1998, 2007).

Appendix B describes in detail the methodology used to quantify these emissions.

Wastewater Treatment Emissions

GHG emissions from domestic wastewater treatment required for the City of Elk Grove in 2005 amounted to 12,691 metric tons of CO_2e. Emissions from this source are included as per capita emissions of CH_4 and N_2O as calculated for the State of California (California Air Resources Board 2008a, 2008b).

Appendix B describes in detail the methodology used to quantify these emissions.

Water-Related Emissions

GHG emissions from electricity and natural gas consumption for water supply and irrigation infrastructure and wastewater collection and treatment facilities required for the City of Elk Grove in 2005 amounted to 4,371 metric tons of CO_2e, which represents 0.5% of overall emissions.

Appendix B describes in detail the methodology used to quantify these emissions.

Agricultural Emissions

Total agricultural emissions for the City of Elk Grove in 2005 were 2,631 metric tons of CO_2e. GHG emissions from enteric fermentation and manure management for cattle and swine, use of fertilizers, and emissions from dairy operations were considered. In 2005, the City of Elk Grove had no dairy activities. Agricultural emissions within Elk Grove resulted from cattle and swine enteric fermentation (136 metric tons of CO_2e), cattle and swine manure management (79 metric tons of CO_2e), and from fertilizer application (2,416 metric tons of CO_2e). See Appendix B for a detailed description of calculations and methodology.

High GWP GHG Emissions

Emissions from high GWP GHGs, including chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs) used as substitutes for ozone-depleting substances, for the City of Elk Grove in 2005 amounted to 53,374 metric tons of CO_2e. Emissions were calculated based on the California Air Resources Board per capita estimate for California (California Air Resources Board 2007). Appendix B describes in detail the methodology used to quantify these emissions.

Government Inventory

The government GHG inventory encompasses emissions from sources under the City of Elk Grove's jurisdiction, including government buildings, vehicle fleet, and employee commute, as well as streetlights and water/wastewater treatment and supply within the boundaries of the City of Elk Grove. Although in some cases different data sources were used to develop the government GHG inventory, this inventory is a subset of the City of Elk Grove City-Wide GHG Inventory. Elk Grove's government GHG inventory represents 1.0% of the total City of Elk Grove City-Wide GHG Inventory. Total government GHG emissions by sector are summarized in Table 3-2.

Government-related emissions from the City of Elk Grove in 2005 accounted for 3.1% of overall GHG emissions for Sacramento County governments in 2005. Government emissions range from 42 (Isleton) to 170,818 (Unincorporated Sacramento County) metric tons of CO_2e.

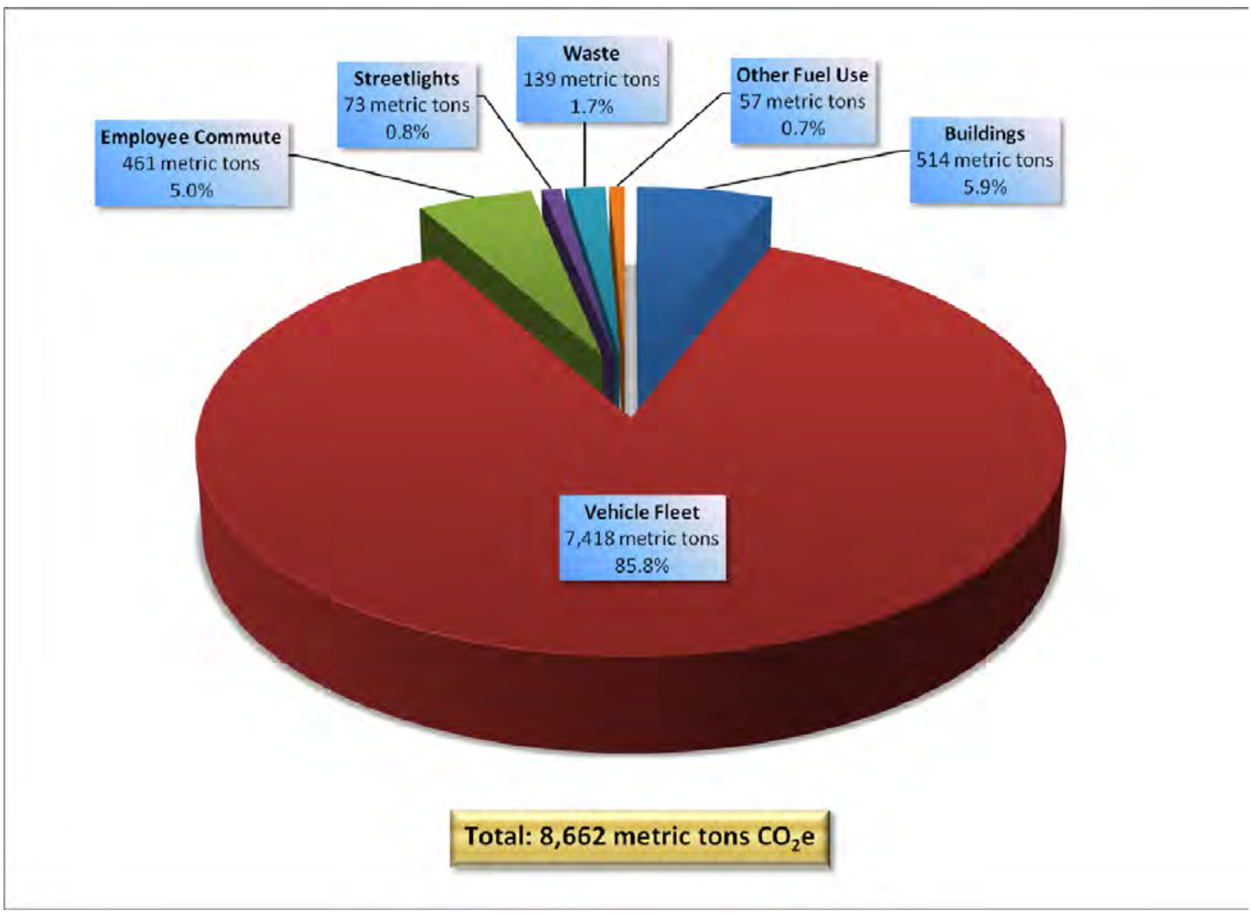
Table 3-2. 2005 Government GHG Emissions for the City of Elk Grove[1]

Sector	CO_2e (metric tons)	Percent
Buildings	514	5.9
Vehicle Fleet	7,418	85.8
Employee Commute	461	5.3
Streetlights and Traffic Signals	73	0.8
Waste	139	1.6
Other Fuel Use	57	0.7
Total	**8,662**	**100.0**

[1] Calculated using CACP software.

Figure 3-3 illustrates the contribution of each sector to the total government emissions for the City of Elk Grove in 2005. For detailed analysis of emissions methodologies for the government sector, see Appendix C.

Figure 3-3. City of Elk Grove Government Emissions for 2005 (metric tons CO_2e)



Buildings

As shown in Table 3-2, GHG emissions from building energy consumption amounted to 514 metric tons of CO_2e, which represents 5.9% of total government emissions for the City of Elk Grove. Electricity, natural gas, and other fuel consumption for government facilities were obtained from SMUD, PG&E, and city staff (Ave pers. comm., Bruso pers. comm., Shalamunec pers. comm.). The City of Elk Grove had 257 employees and five government buildings in operation in 2005, or a total of 164,185 square feet of floor space (Shalamunec pers. comm.). Appendix C describes in detail the methodology used to quantify these emissions.

Vehicle Fleet

The largest source of emissions from government operations resulted from use of the vehicle fleet. Vehicle fleet emissions amounted to 7,418 metric tons of CO_2e in 2005. Vehicle fleet emissions include government fleet, waste collection fleet, E-Tran buses, and street-sweeping vehicles operating within Elk Grove limits. For this reason, vehicle fleet emissions dominate Elk Grove's inventory. See Appendix C for a detailed description of calculations and methodology.

Employee Commute

As shown in Table 3-2, GHG emissions from City of Elk Grove employee commuting amounted to 461 metric tons of CO_2e in 2005. GHG emissions resulting from employee commutes were calculated based on commute statistics provided by the City of Elk Grove (Shalamunec pers. comm.). Appendix C describes in detail the methodology used to quantify these emissions.

Streetlights and Traffic Signals

As Table 3-2 illustrates, electricity consumption of City of Elk Grove–owned streetlights and traffic signals amounted to 73 metric tons of CO_2e, which represents 0.8% of the total Elk Grove emissions. Electricity use for Elk Grove streetlights and traffic signals was provided by SMUD (Ave pers. comm.). See Appendix C for a detailed description of calculations and methodology.

Waste

Waste generation specific to City of Elk Grove government facilities amounted to 139 metric tons of CO_2e in 2005, which represents 1.6% of overall government emissions. Elk Grove generated 340 tons of trash in 2007, and diverted 250 tons to recycling and 40 tons to composting. All waste landfilled by the City of Elk Grove, including government waste generation, was included in the City of Elk Grove City-Wide GHG Inventory. Appendix C describes in detail the methodology used to quantify these emissions.

Other Fuel Use

Use of fuels such as kerosene, propane, and heavy fuel oil in government operation were considered. Use of these fuels resulted in emissions of 57 metric tons of CO_2e in 2007. Diesel fuel combustion by generators, equipment, and other stationary sources was provided by the city (Shalamunec pers. comm.). See Appendix C for a detailed description of calculations and methodology.

Summary

GHG emissions for the City of Elk Grove in 2005 amounted to 842,971 metric tons of CO_2e. Per capita emissions were 6.4 metric tons of CO_2e compared to county-wide per capita emissions of 10.0 metric tons and ARB target 2020 goal of 9.7 metric tons. The main sources of GHG emissions in the City of Elk Grove were transportation (393,176 metric tons CO_2e from fuel combustion) and buildings (336,378 metric tons CO_2e from electricity and natural gas consumption), representing 47% and 40% of net city-wide emissions, respectively.

Government GHG emissions for Elk Grove amounted to 8,662 metric tons of CO_2e in 2005. The main sources of GHG emissions for government operations were vehicle fleet (7,418 metric tons CO_2e from fuel combustion) and buildings (514 metric tons CO_2e from electricity and natural gas consumption), representing 86% and 6% of net government emissions, respectively.

Chapter 4
Greenhouse Gas Emissions Inventory for the City of Folsom

Introduction

In recognition of the rising concern over the threat of climate change, the City of Folsom, along with all incorporated cities within Sacramento County, opted to join the International Council for Local Environmental Initiatives (ICLEI) program. Folsom committed to conduct an inventory of emissions within its jurisdiction as part of a county-wide effort to account for GHG emissions generated within Sacramento County. The inventory, described in detail in this chapter, is the first step in a county-wide effort to reduce GHG emissions. These efforts to reduce emissions are consistent with State policy and current regulation from AB 32 directing the State of California to reduce GHG emissions to 1990 levels by 2020.

The City of Folsom lies within Sacramento County, covers approximately 15 square miles, and has a population of 72,590 (County of Sacramento 2009c; California Department of Finance 2008). Folsom is a high-tech town, with businesses ranging from local to large international operations. Folsom maintains a rich historical heritage. Many residents appreciate historic Old Town Folsom, enjoy the recreational activities offered by Folsom Lake, and have access to large retail shopping centers.

The City of Folsom incorporated in 1946 and operates on the Charter City type of governance (County of Sacramento 2009c; City of Folsom 2009)

The majority of GHG emissions are produced through the burning of fossil fuels. The City of Folsom City-Wide GHG Inventory includes GHG emissions from direct and indirect sources. A direct emission source is defined as an onsite source of emissions such as the combustion of fossil fuel in a vehicle engine. An indirect emission source is defined as an emissions source generated offsite as a result of county operation, such as electricity consumption.

GHG emissions were inventoried for all operations within the City of Folsom's geographical boundaries (i.e. city limits). The City of Folsom City-Wide GHG Inventory includes GHG emissions from residential, commercial, industrial, transportation, and waste sectors. The government GHG emissions inventory is described separately, and is a subset of the City of Folsom City-Wide GHG Inventory. The government analysis divides emissions among government buildings, vehicle fleet, employee commute, streetlights, water/sewage, and waste sectors.

Results

City-Wide Inventory

The City of Folsom City-Wide GHG Inventory encompasses emissions from commercial, industrial, and residential activities within the city limits.

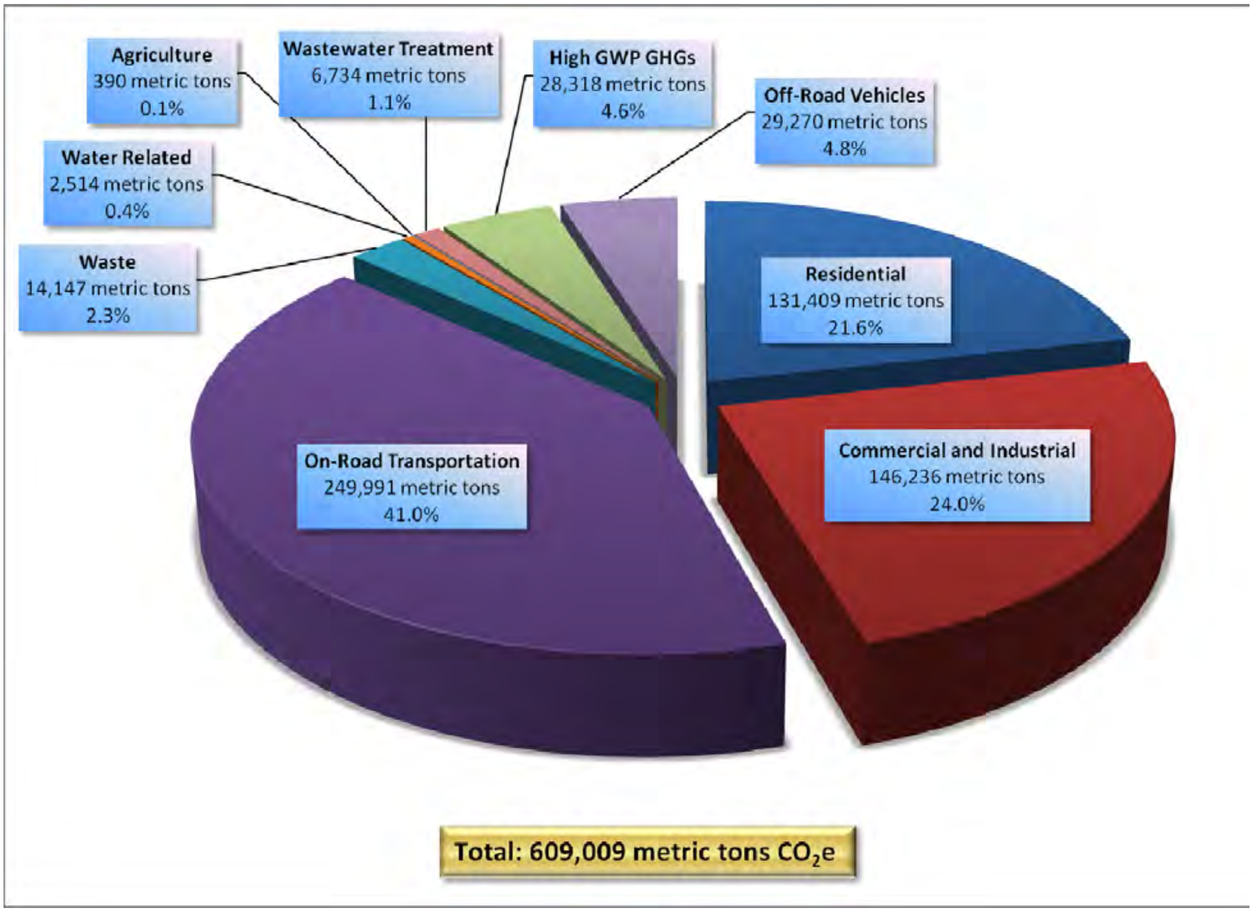
Table 4-1 quantifies the contributions of each sector to total 2005 city-wide emissions for the City of Folsom. Figure 4-1 illustrates each sector's contribution to total city-wide emissions. On-road transportation accounted for 41.1% of overall emissions and is the largest contributing sector to overall emissions.

Table 4-1. 2005 GHG Emissions for the City of Folsom[1]

Sector	CO_2e (metric tons)	Percent
Residential	131,409	21.6
Commercial and Industrial	146,236	24.0
Industrial Specific	0	0.0
On-Road Transportation	249,991	41.1
Off-road Vehicle Use	29,270	4.8
Waste	14,147	2.3
Wastewater Treatment	6,734	1.1
Water-Related	2,514	0.4
Agriculture	390	0.1
High GWP GHGs	28,318	4.7
Total	**609,009**	**100.0**

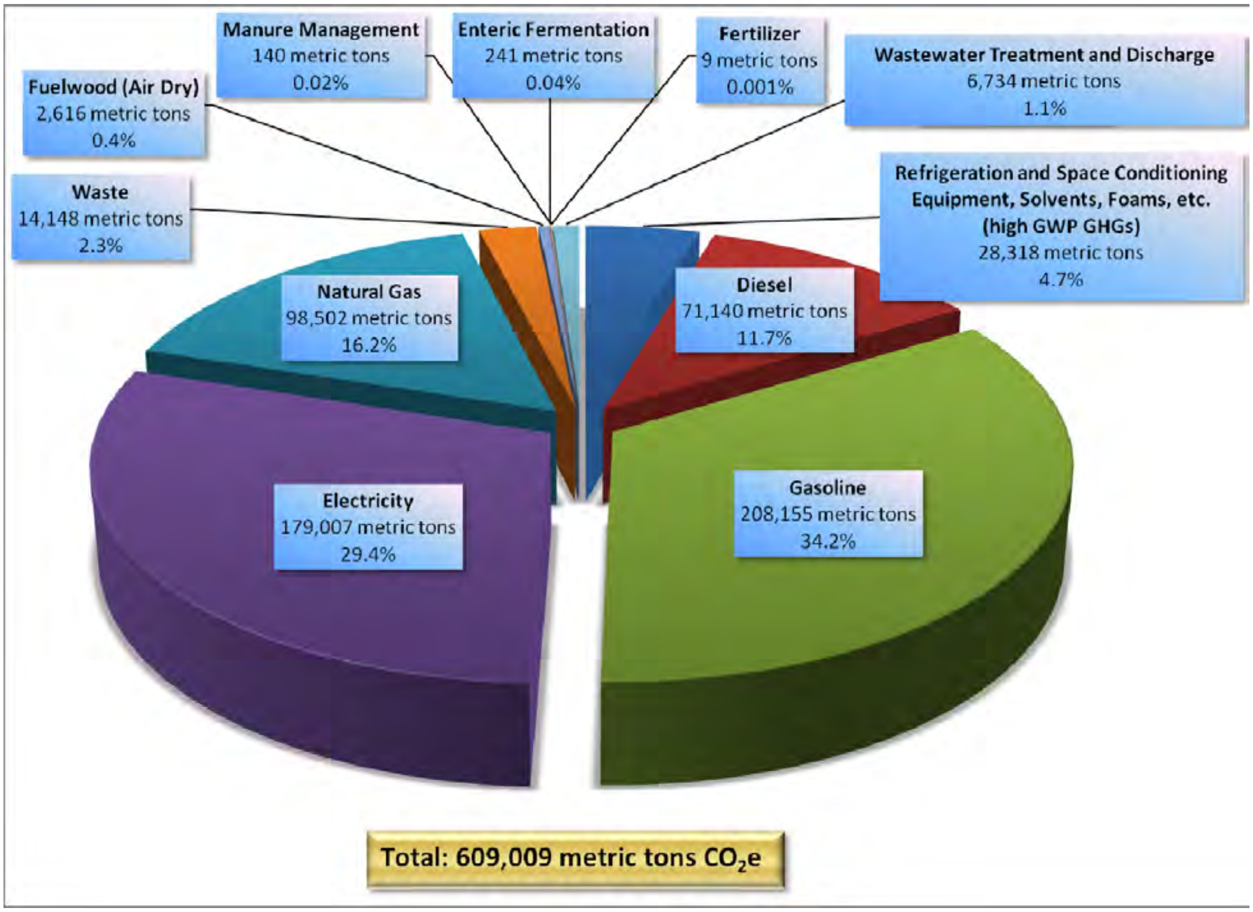
[1] Calculated using CACP software (Appendix A).

Figure 4-1. City of Folsom GHG Emissions for 2005 (metric tons CO_2e)



Total GHG emissions in 2005 for the City of Folsom amounted to 609,009 metric tons of CO_2e, the third-largest incorporated city contributor to emissions. Figure 4-2 shows the contribution of each fuel type and emissions source to overall GHG emissions. Electricity, natural gas, gasoline, and diesel are the largest overall contributors to GHG emissions in the City of Folsom.

Figure 4-2. City of Folsom GHG Emissions for 2005 by Source (metric tons CO_2e)



Emissions from the City of Folsom in 2005 accounted for 4.4% of overall GHG emissions for Sacramento County in 2005. City of Folsom 2005 per capita GHG emissions are 8.8 metric tons of CO_2e compared to county-wide per capita emissions of 10.0 metric tons and ARB target 2020 goal of 9.7 metric tons. Figure ES-5 compares 2005 per capita emissions for the cities, Sacramento County, and Unincorporated Sacramento County. City-wide emissions range from 20,382 (Isleton) to 6,556,875 (Unincorporated Sacramento County) metric tons of CO_2e, and per capita emissions range from 6.4 (Elk Grove) to 11.7 (Unincorporated Sacramento County) metric tons of CO_2e.

A discussion of City of Folsom GHG emissions for each major sector is presented below. For detailed analysis of emissions inventory methodologies, see Appendix B.

Residential Emissions

As shown in Table 4-1, residential GHG emissions for the City of Folsom in 2005 amounted to 131,409 metric tons of CO_2e, which represents 21.6% of total city-wide emissions in Folsom.

Residential-sector GHG emissions mainly result from household use of electricity and natural gas. Residential emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E. Residential GHG emissions also include CH_4 and N_2O emissions from residential wood burning in Folsom residences. GHG emissions from residential wood burning were quantified using data from the SMAQMD (SMAQMD 2007).

Emissions were quantified using CACP emission factors. Emissions were apportioned by population data for the City of Folsom in 2005, available through the California Department of Finance (California Department of Finance 2008). Wood-burning contributions to GHG emissions were included because the SMAQMD introduced a wood stove change-out incentive program in Sacramento County that may reduce GHG emissions from wood burning (SMAQMD 2007).

Residential use of self-generated energy through the consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified due to lack of available data. It is expected that the GHG emissions from these sources are negligible. High GWP gases partially originate from the residential sector but are included in a separate category below. See Appendix B for a detailed description of calculations and methodology.

Commercial and Industrial Emissions

The commercial and industrial sector are combined because both SMUD and PG&E aggregate energy use data from these two sectors into their “commercial” sector. As shown in Table 4-1, commercial and industrial GHG emissions for the City of Folsom in 2005 amounted to 146,236 metric tons of CO_2e, which represents 24.0% of total emissions from Folsom in 2005.

Commercial- and industrial-sector GHG emissions mainly result from consumption of electricity and natural gas by commercial and industrial buildings. Commercial and industrial GHG emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E.

Energy generated through the commercial and industrial consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified due to lack of available data. Appendix B describes in detail the methodology used to quantify these emissions.

Industrial Specific Emissions

Industrial-sector GHG emissions mainly result from consumption of electricity and natural gas by industrial buildings. There were no GHG emissions for the City of Folsom in 2005 estimated for the industrial sector's use of electricity and natural gas (Ave pers. comm., Bruso pers. comm.). Companies that fall within the industrial sector may, by law, choose not to disclose energy use. In that case, energy consumed by the industrial sector may be included in the commercial sector to maintain confidentiality. See Appendix B for a detailed description of commercial and industrial emissions.

On-Road Transportation Emissions

GHG emissions from on-road transportation for the City of Folsom in 2005 amounted to 249,991 metric tons of CO_2e, which represents 41.1% of total Folsom emissions. Emissions from on-road vehicle use, including heavy-duty trucks and buses, were quantified using average annual VMT for Folsom in 2005 (Caltrans 2006). VMT data for 2005 was obtained from the Caltrans HPMS 2005 Public Road Data (Caltrans 2006). A significant portion of highway VMT may be attributed to employee commute trips within the county. Therefore, the county-wide highway VMT was apportioned by highway miles located in Folsom. Approximately 3% of highway miles are located within Folsom. Approximately 37% of VMT and associated GHG emissions in Folsom are a result of travel on highways located in Folsom.

See Appendix B for a detailed description of calculations and methodology.

Off-Road Vehicle Emissions

Exhaust emissions from off-road vehicle use for the City of Folsom in 2005 amounted to 29,270 metric tons of CO_2e, which represents 4.8% of overall emissions. Emissions were calculated using the California Air Resources Board OFFROAD 2007 air quality model. OFFROAD 2007 considers emissions from off-road equipment including recreational boats, recreational vehicles, industrial equipment, construction equipment, and lawn and garden equipment, as well as equipment dealing with airport ground support, military, agriculture, rail operation, and more (California Air Resources Board 2006). County-wide emissions were apportioned by population in Folsom using California Department of Finance data for 2005 (California Department of Finance 2008).

See Appendix B for a detailed description of calculations and methodology.

Waste Emissions

Approximately 74,635 tons of waste was landfilled by the City of Folsom in 2005; 50% of landfilled waste is due to household (residential) disposal, and 50% of landfilled waste is due to business (commercial/industrial) disposal. The CIWMB estimates that only 53% of all generated waste was landfilled in 2004 because Folsom achieved a diversion rate of 47% for that year (California Integrated Waste Management Board 2008b). Emissions from the landfilling of waste amounted to 14,147 metric tons of CO_2e in 2005. CH_4 emissions are released to the atmosphere as waste decomposes in the anaerobic environment created by a landfill. Waste emissions were calculated using waste stream profile information from the CIWMB, CH_4 control efficiencies for each landfill accepting waste from the city, and waste-in-place information from the EPA Environmental Protection Agency (California Integrated Waste Management Board 2008c, Israel pers. comm., Environmental Protection Agency 1998).

Appendix B describes in detail the methodology used to quantify these emissions.

Wastewater Treatment Emissions

GHG emissions from domestic wastewater treatment required for the City of Folsom in 2005 amounted to 6,734 metric tons of CO_2e, which represents 1.1% of overall emissions. Emissions from this source are included as per capita emissions of CH_4 and N_2O as calculated for the State of California (California Air Resources Board 2008a, 2008b).

Appendix B describes in detail the methodology used to quantify these emissions.

Water-Related Emissions

GHG emissions from electricity and natural gas consumption for water supply and irrigation infrastructure and wastewater collection and treatment facilities required for the City of Folsom in 2005 amounted to 2,734 metric tons of CO_2e, which represents 0.4% of overall emissions.

Appendix B describes in detail the methodology used to quantify these emissions.

Agricultural Emissions

Total agricultural emissions for the City of Folsom in 2005 were 390 metric tons of CO_2e. GHG emissions from enteric fermentation and manure management for cattle and swine, use of fertilizers, and emissions from dairy operations were considered. In 2005, Folsom had no dairy activities. Agricultural emissions within the City of Folsom resulted from cattle and swine enteric fermentation (241 metric tons of CO_2e), cattle and swine manure management (140 metric tons of CO_2e), and from fertilizer application (nine metric tons of CO_2e). See Appendix B for a detailed description of calculations and methodology.

High GWP GHG Emissions

Emissions from high GWP GHGs, including chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs) used as substitutes for ozone-depleting substances, for the City of Folsom in 2005 amounted to 28,318 metric tons of CO_2e. Emissions were calculated based on the California Air Resources Board per capita estimate for California (California Air Resources Board 2007). Appendix B describes in detail the methodology used to quantify these emissions.

Government Inventory

The government GHG inventory encompasses emissions from sources under the City of Folsom's jurisdiction, including government buildings, vehicle fleet, and employee commute, as well as streetlights and water/wastewater treatment and supply within the boundaries of the City of Folsom. Although in some cases different data sources were used to develop the government GHG inventory, this inventory is a subset of the City of Folsom City-Wide GHG Inventory. Folsom's government GHG inventory represents 1.6% of the total City of Folsom City-Wide GHG Inventory . Total government GHG emissions by sector are summarized in Table 4-2.

Government-related emissions from the City of Folsom in 2005 accounted for 3.6% of overall GHG emissions for Sacramento County governments in 2005. Government emissions range from 42 (Isleton) to 170,818 (Unincorporated Sacramento County) metric tons of CO_2e.

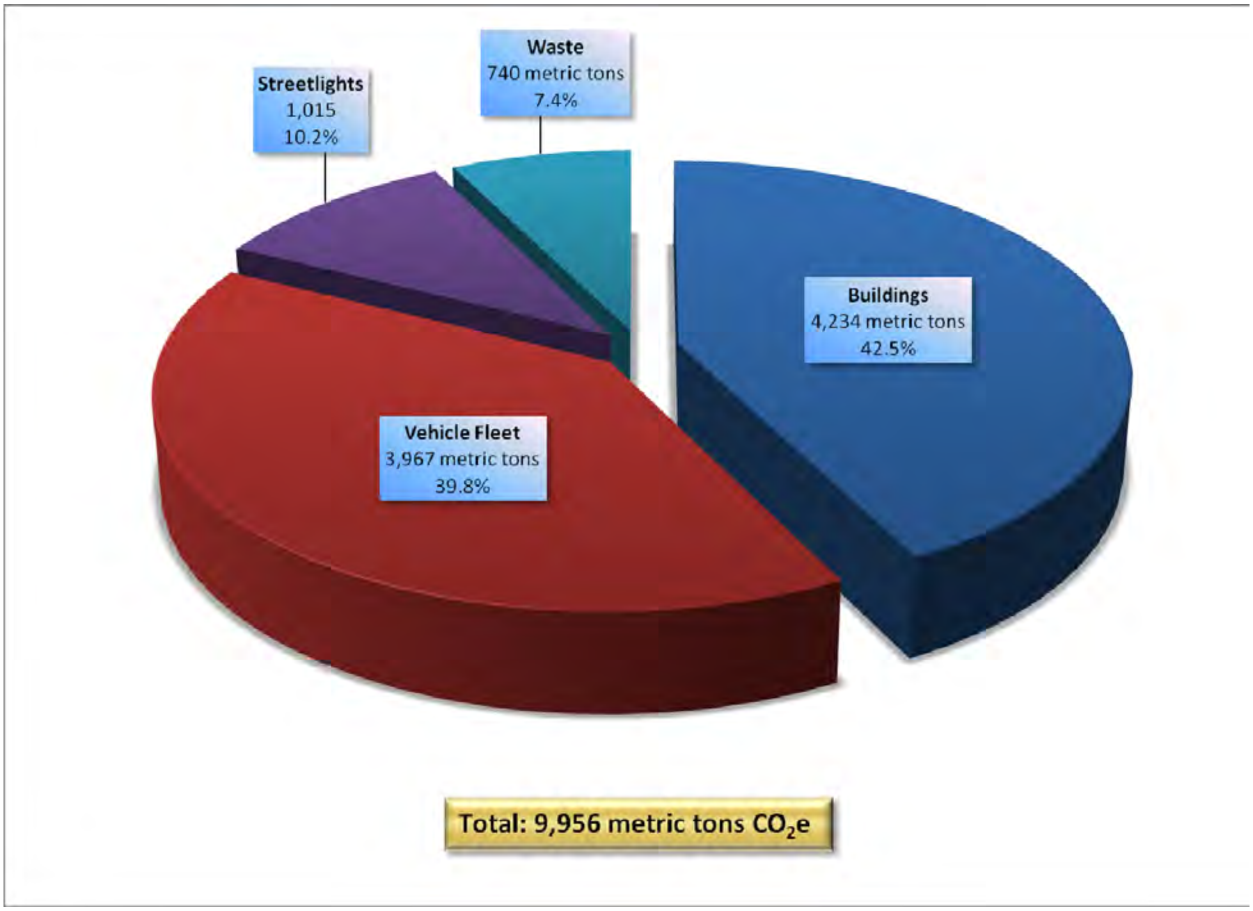
Table 4-2. 2005 Government GHG Emissions for the City of Folsom[1]

Sector	CO_2e (metric tons)	Percent
Buildings	4,234	42.5
Vehicle Fleet	3,967	39.8
Employee Commute	0	0.0
Streetlights and Traffic Signals	1,015	10.2
Waste	740	7.4
Other Fuel Use	0	0.0
Total	**9,956**	**100.0**

[1] Calculated using CACP software (Appendix A).

Figure 4-3 illustrates the contribution of each sector to the total government emissions for the City of Folsom in 2005. For detailed analysis of emissions methodologies for the government sector, see Appendix C.

Figure 4-3. City of Folsom Government GHG Emissions for 2005 (metric tons CO_2e)



Buildings

As shown in Table 4-2, GHG emissions from building energy consumption amounted to 4,234 metric tons of CO_2e, which represents 42.5% of total government emissions for the City of Folsom. Electricity, natural gas, and other fuel consumption for Folsom government facilities were obtained from SMUD, PG&E, and city staff (Ave pers. comm., Bruso pers. comm., Palmer pers. comm.). The City of Folsom had 512 employees and 26 government buildings in operation in 2005, covering 301,508 square feet of floor space (Palmer pers. comm.). Appendix C describes in detail the methodology used to quantify these emissions.

Vehicle Fleet

The largest source of emissions from government operations resulted from use of the vehicle fleet. Vehicle fleet emissions amounted to 3,967 metric tons of CO_2e in 2005. Vehicle fleet emissions include government fleet vehicles ranging from mid-size vehicles to heavy trucks. See Appendix C for a detailed description of calculations and methodology.

Employee Commute

GHG emissions from City of Folsom employee commuting could not be computed for 2005. Specific employee commute data for 2005 were unavailable. Based on consultation with ICLEI staff, unless commute data is sufficiently accurate, it should not be included in the inventory because any measures taken to reduce emissions in this sector would not be captured accurately. ICLEI recommends conducting an employee commute survey requesting commute information for 2005, which would be retroactively added to the inventory (Zahner pers. comm.).

Streetlights and Traffic Signals

As Table 4-2 illustrates, electricity consumption of City of Folsom-owned streetlights and traffic signals amounted to 1,015 metric tons of CO_2e, which represents 10.2% of the total Folsom emissions. Electricity use for City of Folsom streetlights traffic signals was provided by SMUD (Ave pers. comm.). See Appendix C for a detailed description of calculations and methodology.

Waste

Emissions from the landfilling of waste in 2005 amounted to 740 metric tons of CO_2e, which represents 7.4% of overall government emissions. The City of Folsom generated 3,719 tons of trash in 2005, and diverted 1,448 tons to recycling, composting, and incineration. All waste landfilled by the City of Folsom, including government waste generation, was included in the City of Folsom City-Wide GHG Inventory. Appendix C describes in detail the methodology used to quantify these emissions.

Other Fuel Use

Use of fuels such as kerosene, propane, and heavy fuel oil in Folsom government operation were considered. Use of these fuels resulted in emissions of 0 metric tons of CO_2e in 2005. See Appendix C for a detailed description of calculations and methodology.

Summary

GHG emissions for the City of Folsom in 2005 amounted to 609,009 metric tons of CO_2e. Per capita emissions were 8.8 metric tons of CO_2e, compared to county-wide per capita emissions of 10.0 metric tons and ARB target 2020 goal of 9.7 metric tons. The main sources of GHG emissions in the City of Folsom were transportation (279,261 metric tons CO_2e from fuel combustion) and buildings (277,645 metric tons CO_2e from electricity and natural gas consumption), both representing 46% of net city-wide emissions.

Government GHG emissions for Folsom were 9,956 metric tons of CO_2e in 2005. The main sources of GHG emissions for government operations were buildings (4,234 metric tons CO_2e from electricity and natural gas consumption) and vehicle fleet (3,967 metric tons CO_2e from fuel combustion), representing 43% and 40% of net government emissions, respectively.

Chapter 5
Greenhouse Gas Emissions Inventory for the City of Galt

Introduction

In recognition of the rising concern over the threat of climate change the City of Galt, along with all incorporated cities within Sacramento County, opted to join the International Council for Local Environmental Initiatives (ICLEI) program. The City committed to conduct an inventory of emissions within its jurisdiction as part of a county-wide effort to account for GHG emissions generated within Sacramento County. The inventory, described in detail in this chapter, is the first step in a county-wide effort to reduce GHG emissions. These efforts to reduce emissions are consistent with State policy and current regulation from AB 32 directing the State of California to reduce GHG emissions to 1990 levels by 2020.

The City of Galt lies within Sacramento County, covers approximately five square miles, and has a population of 23,913 (County of Sacramento 2009d; California Department of Finance 2008). The City is well known for its weekly Galt Market, one of California's largest outdoor retail and wholesale markets. The City of Galt maintains a rich historical heritage. Many residents appreciate the small town feel and historic Old Town Galt.

The City of Galt incorporated in 1946 and operates on the Manager–City Council type of governance (County of Sacramento 2009d; City of Galt 2005)

The majority of GHG emissions are produced through the burning of fossil fuels. The City of Galt City-Wide GHG Inventory includes GHG emissions from direct and indirect sources. A direct emission source is defined as an on-site source of emissions such as the combustion of fossil fuel in a vehicle engine. An indirect emission source is defined as an emissions source generated offsite as a result of county operation, such as electricity consumption.

GHG emissions were inventoried for all operations within the City of Galt's geographical boundaries (i.e. city limits). The City of Galt City-Wide GHG Inventory includes GHG emissions from residential, commercial, industrial, transportation, and waste sectors. The government GHG emissions inventory is described separately, and is a subset of the City of Galt City-Wide GHG Inventory. The government analysis divides emissions among buildings, vehicle fleet, employee commute, streetlights, water/sewage, and waste sectors.

Results

City-Wide Inventory

The City of Galt City-Wide GHG Inventory encompasses emissions from residential, commercial, industrial, and residential activities as well as emissions from transportation and waste sectors within the city limits.

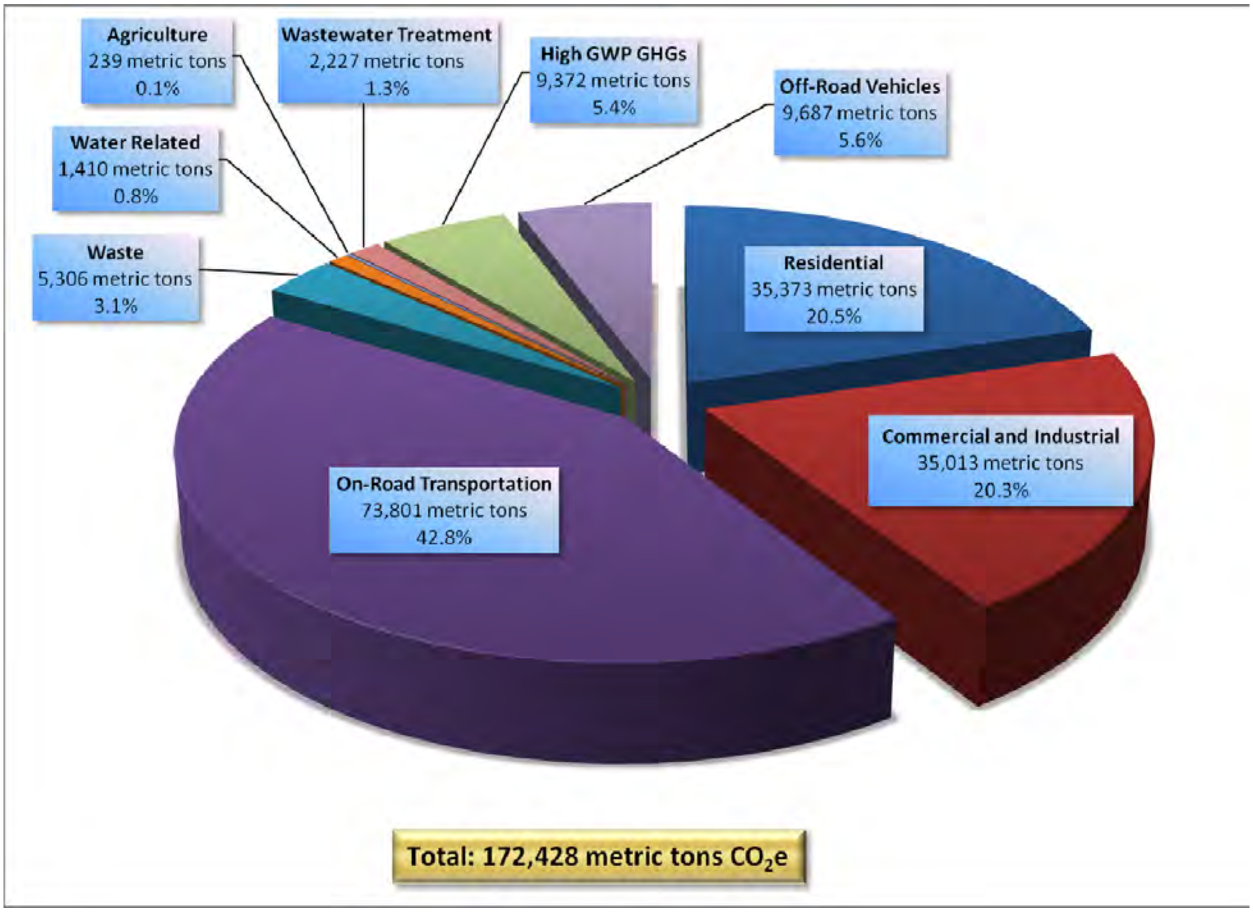
Table 5-1 quantifies the contributions of each sector to total 2005 city-wide emissions for Galt. Figure 5-1 illustrates each sector's contribution to total city-wide emissions for Galt. On-road transportation accounted for 42.8% of overall emissions and is the largest contributing sector to overall emissions.

Table 5-1. 2005 GHG Emissions for the City of Galt[1]

Sector	CO_2e (metric tons)	Percent
Residential	35,373	20.5
Commercial and Industrial	35,013	20.3
Industrial Specific	0	0.0
On-Road Transportation	73,801	42.8
Off-road Vehicle Use	9,687	5.6
Waste	5,306	3.1
Wastewater Treatment	2,227	1.3
Agriculture	239	0.1
Water-Related	1,410	0.8
High GWP GHGs	9,372	5.4
Total	**172,428**	**100.0**

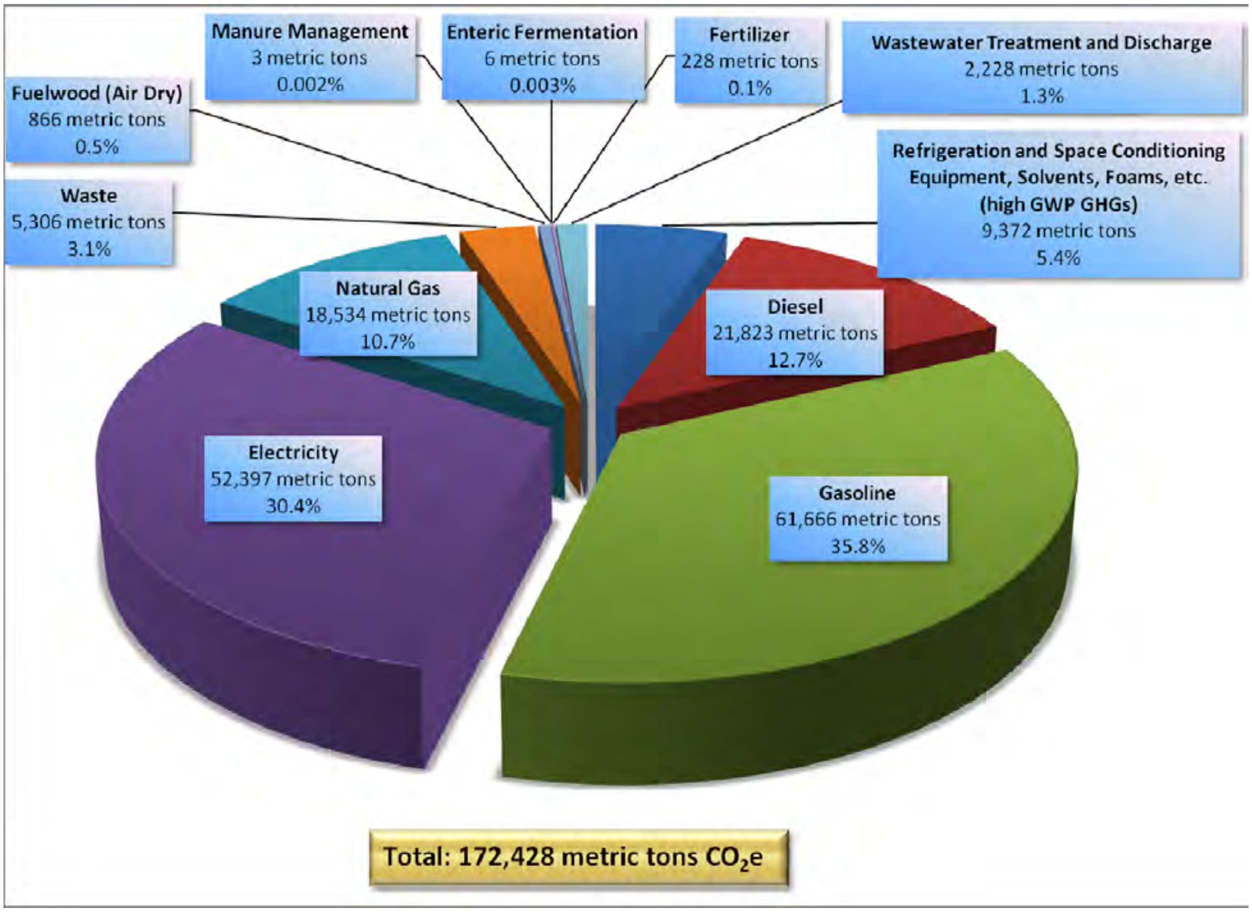
[1] Calculated using CACP software (Appendix A).

Figure 5-1. City of Galt GHG Emissions for 2005 (metric tons CO_2e)



Total GHG emissions in 2005 for the City of Galt amounted to 172,428 metric tons of CO_2e the sixth-largest incorporated city contributor to emissions. Figure 5-2 shows the contribution of each fuel type and emissions source to overall GHG emissions. Electricity, natural gas, gasoline, and diesel are the largest overall contributors to GHG emissions in the City of Galt.

Figure 5-2. City of Galt GHG Emissions for 2005 by Source (metric tons CO_2e)



Emissions from the City of Galt in 2005 accounted for 1.2% of overall GHG emissions for Sacramento County in 2005. City of Galt 2005 per capita GHG emissions are 7.5 metric tons of CO_2e, compared to county-wide per capita emissions of 10.0 metric tons and ARB target 2020 goal of 9.7 metric tons. Figure ES-5 compares 2005 per capita emissions for the cities, Sacramento County, and Unincorporated Sacramento County. City-wide emissions range from 20,382 (Isleton) to 6,556,875 (Unincorporated Sacramento County) metric tons of CO_2e, and per capita emissions range from 6.4 (Elk Grove) to 11.7 (Unincorporated Sacramento County) metric tons of CO_2e.

A discussion of City of Galt GHG emissions for each major sector is presented below. For detailed analysis of emissions inventory methodologies, refer to Appendix B.

Residential Emissions

As shown in Table 5-1, residential GHG emissions for the City of Galt in 2005 amounted to 35,373 metric tons of CO_2e, which represents 20.5% of total city-wide emissions in Galt.

Residential-sector GHG emissions mainly result from household use of electricity and natural gas. Residential emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E. Residential GHG emissions also include CH_4 and N_2O emissions residential wood burning in Galt residences. GHG emissions from residential wood burning were quantified using data from the SMAQMD (SMAQMD 2007).

Emissions were quantified using CACP emission factors. Emissions were apportioned by population data for the City of Galt in 2005, available through the California Department of Finance (California Department of Finance 2008). Wood-burning contributions to GHG emissions were included because the SMAQMD introduced a wood stove change-out incentive program in Sacramento County that may reduce GHG emissions from wood burning (SMAQMD 2007).

Residential use of self-generated energy through the consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified due to lack of available data. It is expected that the GHG emissions from these sources are negligible. High GWP gases partially originate from the residential sector but are included in a separate category below. See Appendix B for a detailed description of calculations and methodology.

Commercial and Industrial Emissions

The commercial and industrial sector are combined because both SMUD and PG&E aggregate energy use data from these two sectors into their "commercial" sector. As shown in Table 5-1, commercial and industrial GHG emissions for the City of Galt in 2005 amounted to 35,013 metric tons of CO_2e, which represents 20.3% of total emissions from the City in 2005.

Commercial- and industrial-sector GHG emissions mainly result from consumption of electricity and natural gas by commercial and industrial buildings. Commercial and industrial GHG emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E.

Energy generated through the commercial and industrial consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified due to lack of available data. Appendix B describes in detail the methodology used to quantify these emissions.

Industrial Specific Emissions

Industrial-sector GHG emissions mainly result from consumption of electricity and natural gas by industrial buildings. There were no GHG emissions for the City of Galt in 2005 estimated for the industrial sector's use of electricity and natural gas (Ave pers. comm., Bruso pers. comm.). Companies that fall within the industrial sector may, by law, choose not to disclose energy use. In that case, energy consumed by the industrial sector may be included in the commercial sector to maintain confidentiality. See Appendix B for a detailed description of commercial and industrial emissions.

On-Road Transportation Emissions

GHG emissions from on-road transportation for the City of Galt in 2005 amounted to 73,801 metric tons of CO_2e, which represents 42.8% of total City emissions. Emissions from on-road vehicle use, including heavy-duty trucks and buses, were quantified using average annual VMT for the City of Galt in 2005. VMT data for 2005 was obtained from the Caltrans HPMS 2005 Public Road Data (Caltrans 2006). A significant portion of highway VMT may be attributed to employee commute trips within the county. Therefore, the county-wide highway VMT was apportioned by highway miles located in the City of Galt. Approximately 1% of highway miles are located within the City of Galt. Approximately 64% of VMT and associated GHG emissions in Galt are due to travel on highways located in the City of Galt.

See Appendix B for a detailed description of calculations and methodology.

Off-Road Vehicle Emissions

Exhaust emissions from off-road vehicle use for the City of Galt in 2005 amounted to 9,687 metric tons of CO_2e, which represents 5.6% of overall emissions. Emissions were calculated using the California Air Resources Board OFFROAD 2007 air quality model. OFFROAD 2007 considers emissions from off-road equipment including recreational boats, recreational vehicles, industrial equipment, construction equipment, and lawn and garden equipment as well as equipment dealing with airport ground support, military, agriculture, rail operation, and more (California Air Resources Board 2006). County-wide emissions were apportioned by population in the City of Galt using California Department of Finance data for 2005 (California Department of Finance 2008).

See Appendix B for a detailed description of calculations and methodology.

Waste Emissions

Approximately 17,344 tons of waste was landfilled by the City of Galt in 2005; 32% of landfilled waste is due to household (residential) disposal, and 68% of landfilled waste generation is due to business (commercial/industrial) disposal. The CIWMB estimates that only 43% of all generated waste was landfilled in 2005 because Galt achieved a diversion rate of 57% for that year (California Integrated Waste Management Board 2008b). CH_4 emissions are released to the atmosphere as waste decomposes in the anaerobic environment created by a landfill. Approximately 5,306 metric tons of CO_2e were emitted as a result of landfilling of waste in 2005. Waste emissions were calculated using waste stream profile information from the CIWMB, CH_4 control efficiencies for each landfill accepting waste from the city, and waste-in-place information from the EPA (California Integrated Waste Management Board 2008c, Israel pers. comm., Environmental Protection Agency 1998).

Appendix B describes in detail the methodology used to quantify these emissions.

Wastewater Treatment Emissions

GHG emissions from domestic wastewater treatment required for the City of Galt in 2005 amounted to 2,227 metric tons of CO_2e, which represents 1.3% of overall emissions. Emissions from this source are included as per capita emissions of CH_4 and N_2O as calculated for the State of California (California Air Resources Board 2008a, 2008b).

Appendix B describes in detail the methodology used to quantify these emissions.

Water-Related Emissions

GHG emissions from electricity and natural gas consumption for water supply and irrigation infrastructure and wastewater collection and treatment facilities required for the City of Galt in 2005 amounted to 1,410 metric tons of CO_2e, which represents 0.8% of overall emissions.

Appendix B describes in detail the methodology used to quantify these emissions.

Agricultural Emissions

Total agricultural emissions for the City of Galt in 2005 were 239 metric tons of CO_2e. GHG emissions from enteric fermentation and manure management for cattle and swine, use of fertilizers, and emissions from dairy operations were considered. In 2005, the City of Galt had no dairy activities. Agricultural emissions within Galt resulted from cattle and swine enteric fermentation (six metric tons of CO_2e), cattle and swine manure management (three metric tons of CO_2e), and from fertilizer application (230 metric tons of CO_2e). See Appendix B for a detailed description of calculations and methodology.

High GWP GHG Emissions

Emissions from high GWP GHGs, including chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs) used as substitutes for ozone-depleting substances, for the City of Galt in 2005 amounted to 9,372 metric tons of CO_2e. Emissions were calculated based on the California Air Resources Board per capita estimate for California (California Air Resources Board 2007). Appendix B describes in detail the methodology used to quantify these emissions.

Government Inventory

The government GHG inventory encompasses emissions from sources under the City of Galt's jurisdiction, including government buildings, vehicle fleet, and employee commute, as well as streetlights and water/wastewater treatment and supply within the boundaries of the City of Galt. Although in some cases different data sources were used to develop the government GHG inventory, this inventory is a subset of the City of Galt City-Wide GHG Inventory. The City of Galt's government GHG inventory represents 2.0% of the total City of Galt City-Wide GHG Inventory. Total government GHG emissions by sector are summarized in Table 5-2.

Government-related emissions from the City of Galt in 2005 accounted for 1.2% of overall GHG emissions for Sacramento County governments in 2005. Government emissions range from 42 (Isleton) to 170,818 (Unincorporated Sacramento County) metric tons of CO_2e.

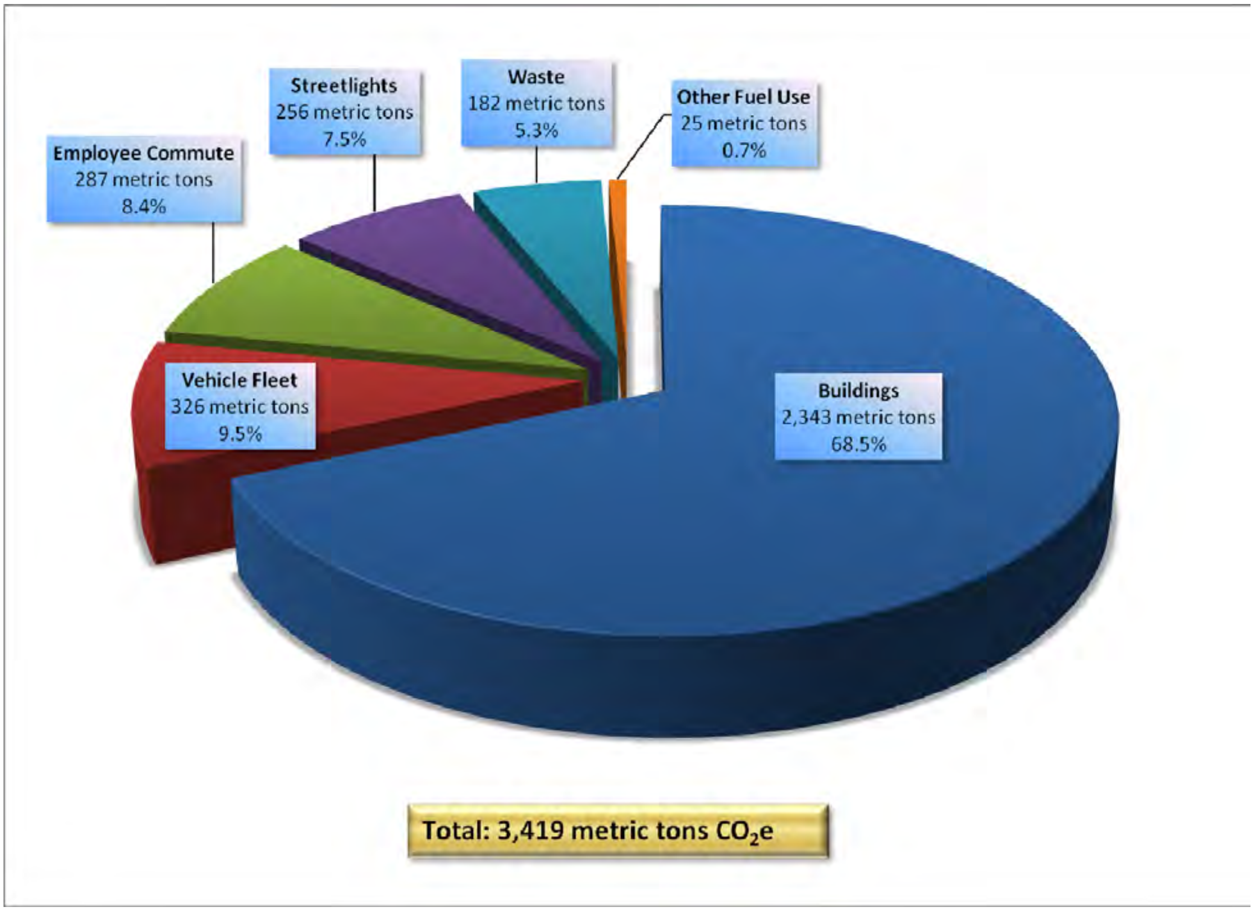
Table 5-2. 2005 Government GHG Emissions for the City of Galt[1]

Sector	CO_2e (metric tons)	Percent
Buildings	2,343	68.5
Vehicle Fleet	326	9.5
Employee Commute	287	8.4
Streetlights and Traffic Signals	256	7.5
Waste	182	5.3
Other Fuel Use	25	0.7
Total	**3,419**	**100.0**

[1] Calculated using CACP software.

Figure 5-3 illustrates the contribution of each sector to the total government emissions for the City of Galt in 2005. For detailed analysis of emissions methodologies for the government sector, see Appendix C.

Figure 5-3. City of Galt Government GHG Emissions for 2005 (metric tons CO_2e)



Buildings

As shown in Table 5-2, GHG emissions from building energy consumption amounted to 2,343 metric tons of CO_2e, which represents 68.5% of total government emissions for the City of Galt. Electricity, natural gas, and other fuel consumption for government facilities were obtained from SMUD, PG&E, and City staff (Ave pers. comm., Bruso pers. comm., Kiriu pers. comm.). The City of Galt had 173 employees and 20 government buildings in operation in 2005 (Kiriu pers. comm.). Appendix C describes in detail the methodology used to quantify these emissions.

Vehicle Fleet

The largest source of emissions from government operations resulted from use of the vehicle fleet. Vehicle fleet emissions amounted to 326 metric tons of CO_2e in 2005. Vehicle fleet emissions include government fleet vehicles ranging from mid-size vehicles to heavy trucks as well as some diesel construction equipment. See Appendix C for a detailed description of calculations and methodology.

Employee Commute

As shown in Table 5-2, GHG emissions from City of Galt employee commuting amounted to 287 metric tons of CO_2e in 2005, which amounts to 8.4% of overall government emissions. GHG emissions resulting from employee commutes were calculated based on a commute survey provided by city staff (Kiriu pers. comm.). Appendix C describes in detail the methodology used to quantify these emissions.

Streetlights and Traffic Signals

As Table 5-2 illustrates, electricity consumption of City of Galt–owned streetlights and traffic signals amounted to 256 metric tons of CO_2e, which represents 7.5% of the total Galt emissions inventory. Electricity use for City of Galt streetlights was provided by SMUD (Ave pers. comm.). See Appendix C for a detailed description of calculations and methodology.

Waste

As shown in Table 5-2, GHG emissions from waste generation specific to City of Galt government facilities amounted to 182 metric tons of CO_2e in 2005, which represents 5.3% of overall government emissions. Galt generated 582 tons of trash in 2005, and diverted 158 tons to recycling and 610 tons to composting. All waste landfilled by Galt, including government waste generation, was included in the City of Galt City-Wide GHG Inventory. Appendix C describes in detail the methodology used to quantify these emissions.

Other Fuel Use

Use of fuels such as kerosene, propane, and heavy fuel oil in government operation were considered. Use of these fuels resulted in emissions of 25 metric tons of CO_2e in 2005. Fuels including propane and diesel were combusted for generators, stationary sources, and some off-road equipment (Kiriu pers. comm.). See Appendix C for a detailed description of calculations and methodology.

Summary

GHG emissions for the City of Galt in 2005 amounted to 172,428 metric tons of CO_2e. Per capita emissions were7.5 metric tons of CO_2e, compared to county-wide per capita emissions of 10.0 metric tons and ARB target 2020 goal of 9.7 metric tons. The main sources of GHG emissions in the City of Galt were transportation (83,488 metric tons CO_2e from fuel combustion) and buildings (70,386 metric tons CO_2e from electricity and natural gas consumption), representing 48% and 41% of net city-wide emissions, respectively.

Government GHG emissions for Galt amounted to 3,419 metric tons of CO_2e in 2005. The main sources of GHG emissions for government operations were buildings (2,343 metric tons CO_2e from electricity and natural gas consumption) and vehicle fleet (326 metric tons CO_2e from fuel combustion), representing 69% and 10% of net government emissions, respectively.

Chapter 6

Greenhouse Gas Emissions Inventory for the City of Isleton

Introduction

In recognition of the rising concern over the threat of climate change the City of Isleton, along with all incorporated cities within Sacramento County, opted to join the International Council for Local Environmental Initiatives (ICLEI) program. The City committed to conduct an inventory of emissions within its jurisdiction as part of a county-wide effort to account for GHG emissions generated within Sacramento County. The inventory, described in detail in this chapter, is the first step to reduce GHG emissions. These efforts to reduce emissions are consistent with State policy and current regulation from AB 32 directing the State of California to reduce GHG emissions to 1990 levels by 2020.

The City of Isleton lies within Sacramento County (one of the original 27 counties of the State of California), covers approximately 252 acres, and has a population of 817 (County of Sacramento 2009e; California Department of Finance 2008). The City is located along the Sacramento River in the Sacramento Delta. Several community celebrations are held throughout the year, such as the well-known Crawdad Festival, presented by the City of Isleton Chamber of Commerce. Many residents appreciate the small-town feel and historic Old Town.

The City of Isleton incorporated in 1923 and operates on the Manager–City Council type of governance (County of Sacramento 2009e; City of Isleton 2008).

The majority of GHG emissions are produced through the burning of fossil fuels. The City of Isleton City-Wide GHG Inventory includes GHG emissions from direct and indirect sources. A direct emission source is defined as an on-site source of emissions such as the combustion of fossil fuel in a vehicle engine. An indirect emission source is defined as an emissions source generated offsite as a result of county operation, such as electricity consumption.

GHG emissions were inventoried for all operations within City of Isleton's geographical boundaries (i.e. city limits). The City of Isleton City-Wide GHG Inventory includes GHG emissions from residential, commercial, industrial, transportation, and waste sectors. The government GHG inventory is described separately, and is a subset of the City of Isleton City-Wide GHG Inventory. The government analysis divides emissions among buildings, vehicle fleet, employee commute, streetlights, water/sewage, and waste sectors.

Results

City-Wide Inventory

The City of Isleton City-Wide GHG Inventory encompasses emissions from commercial, industrial, and residential activities within the city limits.

Table 6-1 quantifies the contributions of each sector to total 2005 city-wide emissions for the City of Isleton. Figure 6-1 illustrates each sector's contribution to total city-wide emissions for Isleton. On-road transportation accounted for 85.2% of overall emissions and is the largest contributing sector to overall emissions. Transportation emissions are relatively high because the number of highway miles located in Isleton per capita is much higher than for other cities, and highway-related emissions were apportioned by mile[8].

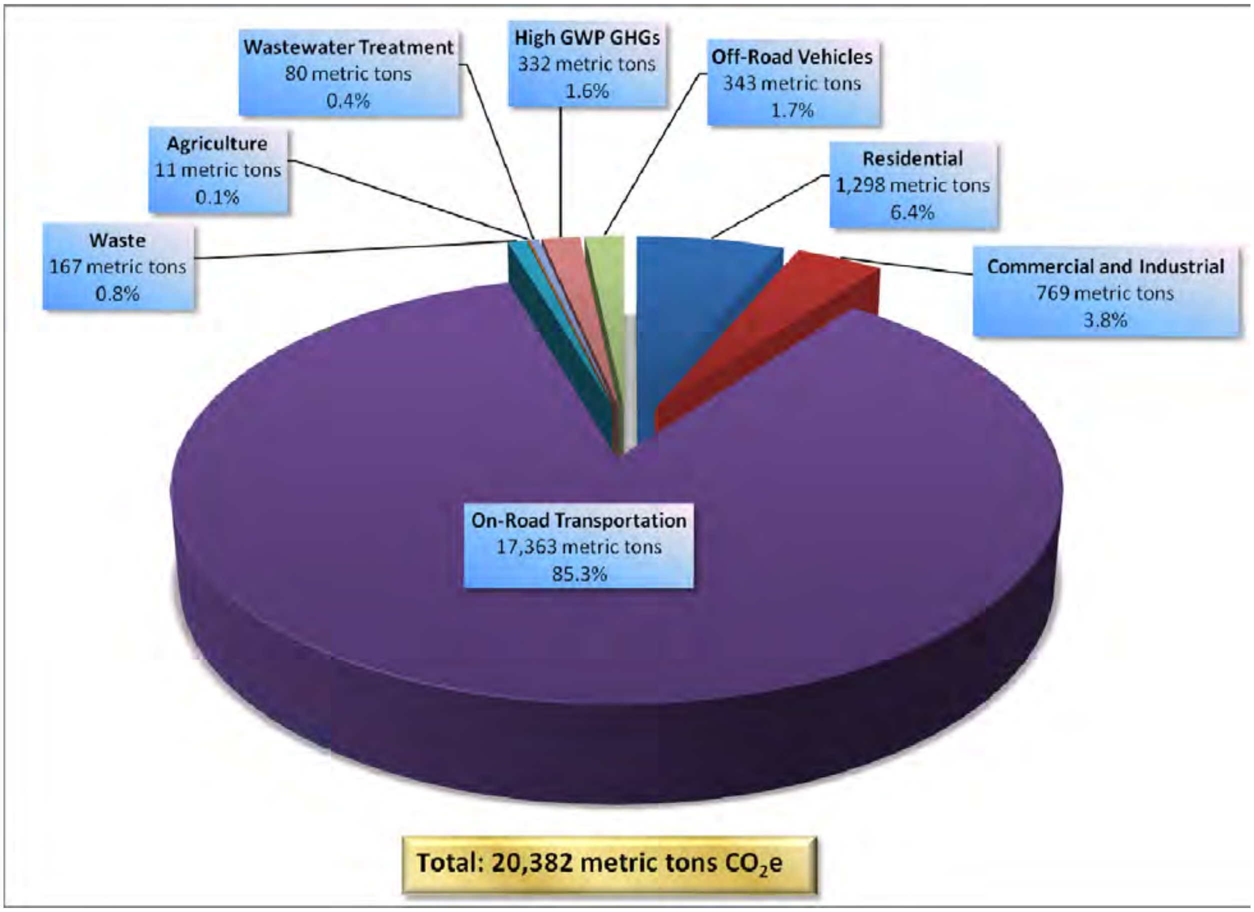
Table 6-1. 2005 GHG Emissions for the City of Isleton[1]

Sector	CO_2e (metric tons)	Percent
Residential	1,298	6.4
Commercial and Industrial	769	3.8
Industrial Specific	0	0.0
On-Road Transportation	17,363	85.2
Off-road Vehicle Use	343	1.7
Waste	167	0.8
Wastewater Treatment	80	0.4
Water Related	19	0.1
Agriculture	11	0.1
High GWP GHGs	332	1.6
Total	**20,382**	**100.0**

[1] Calculated using CACP software (Appendix A).

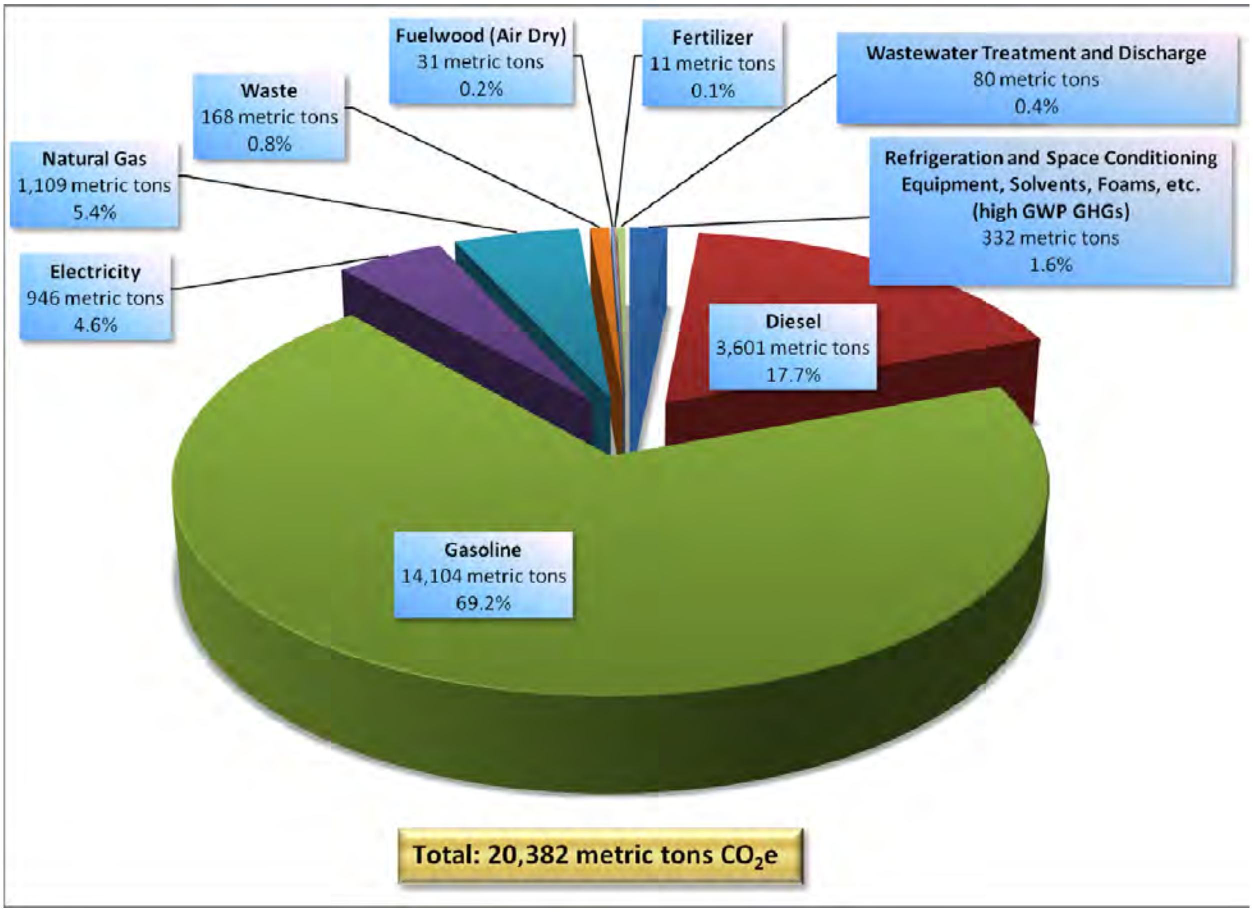
[8] Isleton has 0.06% of the total Sacramento County population but 0.5% of total highway miles within its city limits (Appendix B).

Figure 6-1. City of Isleton GHG Emissions for 2005 (metric tons CO_2e)



Total GHG emissions in 2005 for the City of Isleton amounted to 20,382 metric tons of CO_2e, the seventh-largest incorporated city contributor to emissions. Figure 6-2 shows the contribution of each fuel type and emissions source to overall GHG emissions. Electricity, natural gas, gasoline, and diesel are the largest overall contributors to GHG emissions in the City of Isleton.

Figure 6-2. City of Isleton GHG Emissions for 2005 by Source (metric tons CO_2e)



Emissions from the City of Isleton in 2005 accounted for 0.2% of overall GHG emissions for Sacramento County in 2005. City of Isleton 2005 per capita GHG emissions are 25 metric tons of CO_2e, compared to county-wide per capita emissions of 10.0 metric tons and ARB target 2020 goal of 9.7 metric tons. Figure ES-5 compares 2005 per capita emissions for the cities, Sacramento County, and Unincorporated Sacramento County. City-wide emissions range from 20,382 (Isleton) to 6,556,875 (Unincorporated Sacramento County) metric tons of CO_2e, and per capita emissions range from 6.4 (Elk Grove) to 11.7 (Unincorporated Sacramento County) metric tons of CO_2e. Isleton per capita emissions are much higher than other cities because of the highway VMT traveled in Isleton: approximately 97% of total VMT and associated GHG emissions in Isleton are due to travel on highway miles located in the City of Isleton. The number of highway miles located in Isleton per capita is much higher than for other cities: Isleton has 0.06% of the total Sacramento County population but 0.5% of total highway miles within its city limits.

A discussion of City of Isleton GHG emissions for each major sector is presented below. For detailed analysis of emissions inventory methodologies, refer to Appendix B.

Residential Emissions

As shown in Table 6-1, residential GHG emissions for the City of Isleton in 2005 amounted to 1,298 metric tons of CO_2e, which represents 6.4% of total city-wide emissions in Isleton.

Residential-sector GHG emissions mainly result from household use of electricity and natural gas. Residential emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E. Residential GHG emissions also include CH_4 and N_2O emissions from residential wood burning in Isleton residences. GHG emissions from residential wood burning were quantified using data from the SMAQMD (SMAQMD 2007).

Emissions were quantified using CACP emission factors. Emissions were apportioned by population data for the City of Isleton in 2005, available through the California Department of Finance (California Department of Finance 2008). Wood-burning contributions to GHG emissions were included because the SMAQMD introduced a wood stove change-out incentive program in Sacramento County that may reduce GHG emissions from wood burning (SMAQMD 2007).

Residential use of self-generated energy through the consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified due to lack of available data. It is expected that the GHG emissions from these sources are negligible. High GWP gases partially originate from the residential sector but are included in a separate category below. See Appendix B for a detailed description of calculations and methodology.

Commercial and Industrial Emissions

The commercial and industrial sector are combined because both SMUD and PG&E aggregate energy use data from these two sectors into their “commercial” sector. As shown in Table 6-1, commercial and industrial GHG emissions for the City of Isleton in 2005 amounted to 769 metric tons of CO_2e, which represents 3.8% of total emissions from the City in 2005.

Commercial- and industrial-sector GHG emissions mainly result from consumption of electricity and natural gas by commercial and industrial buildings. Commercial and industrial GHG emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E.

Energy generated through the commercial and industrial consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified due to lack of available data. Appendix B describes in detail the methodology used to quantify these emissions.

Industrial Specific Emissions

Industrial-sector GHG emissions mainly result from consumption of electricity and natural gas by industrial buildings. There were no GHG emissions for the City of Isleton in 2005 estimated for the industrial sector's use of electricity and natural gas (Bruso pers. comm.). Companies that fall within the industrial sector may, by law, choose not to disclose energy use. In that case, energy consumed by the industrial sector may be included in the commercial sector to maintain confidentiality. See Appendix B for a detailed description of commercial and industrial emissions.

On-Road Transportation Emissions

GHG emissions from on-road transportation for the City of Isleton in 2005 amounted to 17,363 metric tons of CO_2e, which represents 85.2% of total emissions for the City of Isleton. Emissions from on-road vehicle use, including heavy-duty trucks and buses, were quantified using average annual VMT for the City of Isleton in 2005. VMT data for 2005 was obtained from the Caltrans HPMS 2005 Public Road Data (California Department of Transportation 2006). A significant portion of highway VMT may be attributed to employee commute trips within the county. Therefore, the county-wide highway VMT was apportioned by highway miles located in the City of Isleton. Approximately 1% of highway miles are located within the City of Isleton. Approximately 97% of VMT and associated GHG emissions in Isleton are due to travel on highways located in Isleton.

Isleton's estimated per capita emissions of 25 metric tons of CO_2e are the largest of all the cities due to transportation emissions; the number of highway miles located in Isleton per capita is much higher than for other cities. We believe that the per-capita VMT and associated transportation-related GHG emissions are much lower than those presented in this report. Without further study, such as traffic counts on Isleton highways, we cannot present more accurate VMT and related emissions. See Appendix B for a detailed description of calculations and methodology.

Off-Road Vehicle Emissions

Exhaust emissions from off-road vehicle use for the City of Isleton in 2005 amounted to 343 metric tons of CO_2e, which represents 1.7% of overall emissions. Emissions were calculated using the California Air Resources Board

OFFROAD 2007 air quality model. OFFROAD 2007 considers emissions from off-road equipment including recreational boats, recreational vehicles, industrial equipment, construction equipment, and lawn and garden equipment, as well as equipment dealing with airport ground support, military, agriculture, rail operation, and more (California Air Resources Board 2006). County-wide emissions were apportioned by population in the City of Isleton using California Department of Finance data for 2005 (California Department of Finance 2008).

See Appendix B for a detailed description of calculations and methodology.

Waste Emissions

Approximately 750 tons of waste was landfilled by the City of Isleton in 2005; 46% of landfilled waste is due to household (residential) disposal, and 54% of landfilled waste is due to business (commercial/industrial) disposal. The CIWMB estimates that only 41% of all generated waste was landfilled in 2005, because Isleton achieved a diversion rate of 59% for that year (California Integrated Waste Management Board 2008b). CH_4 emissions are released to the atmosphere as waste decomposes in the anaerobic environment created by a landfill. Approximately 167 metric tons of CO_2e were emitted as a result of landfilling of waste in 2005. Waste emissions were calculated using waste stream profile information from the CIWMB, CH_4control efficiencies for each landfill accepting waste from the city, and waste-in-place information from the EPA (California Integrated Waste Management Board 2008c, Israel pers. comm., Environmental Protection Agency 1998).

Appendix B describes in detail the methodology used to quantify these emissions.

Wastewater Treatment Emissions

GHG emissions from domestic wastewater treatment required for the City of Isleton in 2005 amounted to 80 metric tons of CO_2e, which represents 0.4% of overall emissions. Emissions from this source are included as per capita emissions of CH_4 andN_2O as calculated for the State of California (California Air Resources Board 2008a, 2008b).

Appendix B describes in detail the methodology used to quantify these emissions.

Water-Related Emissions

GHG emissions from electricity and natural gas consumption for water supply and irrigation infrastructure and wastewater collection and treatment facilities required for the City of Isleton in 2005 amounted to 19 metric tons of CO_2e, which represents 0.1% of overall emissions.

Appendix B describes in detail the methodology used to quantify these emissions.

Agricultural Emissions

Total agricultural emissions for the City of Isleton in 2005 were 11 metric tons of CO_2e. GHG emissions from enteric fermentation and manure management for cattle and swine, use of fertilizers, and emissions from dairy operations were considered. In 2005, the City of Isleton had no cattle, swine, or dairy activities. Agricultural emissions within the City resulted from fertilizer application (11 metric tons of CO_2e). See Appendix B for a detailed description of calculations and methodology.

High GWP GHG Emissions

Emissions from high GWP GHGs, including chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs) used as substitutes for ozone-depleting substances, for the City of Isleton in 2005 amounted to 332 metric tons of CO_2e. Emissions calculated based on the California Air Resources Board per capita estimate for California (California Air Resources Board 2007). Appendix B describes in detail the methodology used to quantify these emissions.

Government Inventory

The city of Isleton did not provide government operations information. Data presented below were collected from PG&E. (Bruso pers. comm.). This data and the associated GHG emissions are presented for consistency with the other government inventories. The government GHG inventory encompasses emissions from sources under the City of Isleton's jurisdiction, including government buildings. The government GHG inventory is a subset of the City of Isleton City-Wide GHG Inventory. The government GHG inventory represents 0.2% of the total City of Isleton City-Wide GHG Inventory. Total government GHG emissions by sector are summarized in Table 6-2.

Government-related emissions from the City of Isleton in 2005 accounted for 0.02% of overall GHG emissions for Sacramento County governments in 2005. Government emissions range from 42 (Isleton) to 170,818 (Unincorporated Sacramento County) metric tons of CO_2e.

Table 6-2. 2005 Government GHG Emissions for the City of Isleton[1]

Sector	CO_2e (metric tons)	Percent
Buildings	42	100.0
Vehicle Fleet	0	0.0
Employee Commute	0	0.0
Streetlights and Traffic Signals	0	0.0
Waste	0	0.0
Other Fuel Use	0	0.0
Total	**42**	**100.0**

[1] Calculated using CACP software. See Appendix C for a detailed discussion of scaling methodology.

Government building contributed 100% of all government emissions for the City of Isleton in 2005. Isleton is very small and therefore has very little government activity. For detailed analysis of emissions methodologies for the government sector, see Appendix C.

Buildings

As shown in Table 6-2, GHG emissions from building energy consumption amounted to 42 metric tons of CO_2e, which represents 100% of total government emissions for the City of Isleton. Electricity, natural gas, and other fuel consumption for government facilities were obtained from PG&E (Bruso pers. comm.). Appendix C describes in detail the methodology used to quantify these emissions.

Vehicle Fleet

Isleton vehicle fleet data were unavailable.

Employee Commute

Isleton employee commute data were unavailable.

Streetlights and Traffic Signals

Isleton streetlight and traffic signal data were unavailable.

Waste

Isleton government generated waste data were unavailable.

Summary

GHG emissions for the City of Isleton in 2005 amounted to 20,382 metric tons of CO_2e. Per capita emissions were 25.0 metric tons CO_2e, compared to county-wide per capita emissions of 10.0 metric tons and ARB target 2020 goal of 9.7 metric tons. The main sources of GHG emissions in the City of Isleton were transportation (17,706 metric tons CO_2e from fuel combustion) and buildings (2,067 metric tons CO_2e from electricity and natural gas consumption), representing 87% and 10% of net city-wide emissions, respectively.

Government GHG emissions for the City of Isleton amounted to 42 metric tons of CO_2e in 2005 based on buildings alone. As discussed, data on other government operations was not available.

Chapter 7
Greenhouse Gas Emissions Inventory for the City of Rancho Cordova

Introduction

In recognition of the rising concern over the threat of climate change the City of Rancho Cordova, along with all incorporated cities within Sacramento County, opted to join the International Council for Local Environmental Initiatives (ICLEI) program. The City committed to conduct an inventory of emissions within its jurisdiction as part of a county-wide effort to account for GHG emissions generated within Sacramento County. The inventory, described in detail in this chapter, is the first step to reduce GHG emissions. These efforts to reduce emissions are consistent with State policy and current regulation from AB 32 directing the State of California to reduce GHG emissions to 1990 levels by 2020.

The City of Rancho Cordova lies within Sacramento County, covers approximately 35 square miles, and has an estimated population of 60,975 (County of Sacramento 2009f; California Department of Finance 2008). The City has made strides toward enhancing its image and the pride of its residents by improving City services, neighborhood cooperation, and promoting investment in retail and other services within the community. The City of Rancho Cordova incorporated in 2003 and operates on the Manager–City Council type of governance (County of Sacramento 2009f; City of Rancho Cordova 2008).

The majority of GHG emissions are produced through the burning of fossil fuels. The City of Rancho Cordova City-Wide GHG Inventory includes GHG emissions from direct and indirect sources. A direct emission source is defined as an on-site source of emissions such as the combustion of fossil fuel in a vehicle engine. An indirect emission source is defined as an emissions source generated offsite as a result of facility operation, such as electricity consumption.

City of Rancho Cordova GHG emissions were inventoried for all operations within Rancho Cordova’s geographical boundaries (i.e. city limits). The City of Rancho Cordova City-Wide GHG Inventory includes GHG emissions from residential, commercial, industrial, transportation, and waste sectors. The government GHG inventory is described separately, and is a subset of the City of Rancho Cordova City-Wide GHG Inventory. The government analysis divides emissions among buildings, vehicle fleet, employee commute, streetlights, water/sewage, and waste sectors.

Government GHG emissions for the City of Rancho Cordova were inventoried for the year 2007 rather than 2005. Between 2005 and 2007, Rancho Cordova underwent large growth of government operations and felt that a baseline GHG inventory for the year 2005 would inaccurately reflect the scale of Rancho Cordova's operations. Because Rancho Cordova was incorporated recently, the 2005 base year does not reflect a municipal agency meeting typical and normal municipal service demands. Consequently, this analysis presents activity data and associated emissions for the year 2007. In addition, the city recommends that 2007 be used as a baseline for any performance standards or GHG reduction measures that might be proposed in the future.

In an effort to determine GHG emissions related to the government operations of Rancho Cordova for the year 2005, emissions for 2007 in each sector were scaled back based on the change the city's population from 2005 to 2007. Rancho Cordova's total population increased from 56,432 to 60,975, an increase of 8.1% during this time period. Service levels did not change substantially between 2005 and 2007, and as a result, emissions are not likely to have changed substantially from 2005 to 2007. The only difference from 2005 to 2007 is that there was a transfer of services from other service providers (such as the county) to the City (or from facility rental to facility ownership). This change isn't necessarily reflected in the city government's change in operating expenses. Growth in population more accurately reflects the scale of governmental services provided to the people of Rancho Cordova. The City feels 8% is a more realistic growth rate for the City. Consequently, 2007 emissions for Rancho Cordova were multiplied by 92.5% to represent population growth (56,432/60,975).[9]

Data for 2005 in some sectors were available from SMUD and PG&E, including electricity and natural gas consumption for buildings and streetlights. This data was not used because it likely does not reflect actual energy use by Rancho Cordova in 2005 including all contracted services.

Results

City-Wide Inventory

The City of Rancho Cordova City-Wide GHG Inventory encompasses emissions from commercial, industrial, and residential activities within the city limit.

Table 7-1 quantifies the contributions of each sector to total 2005 city-wide emissions for the City of Rancho Cordova. Figure 7-1 illustrates each sector's contribution to total city-wide emissions. On-road transportation accounted for 45.1% of overall emissions and is the largest contributing sector to overall emissions.

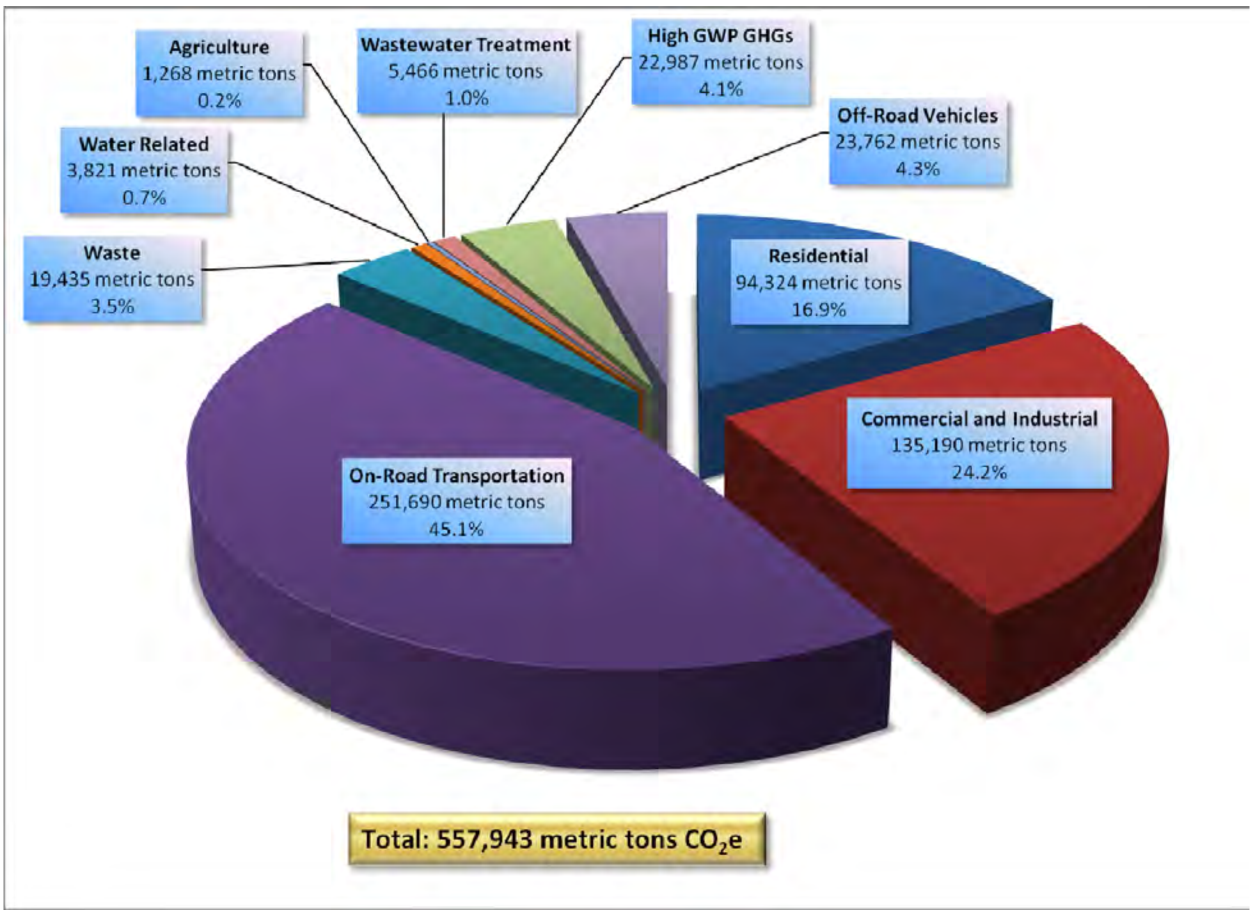
[9] See Appendix C for a detailed discussion of scaling methodology.

Table 7-1. 2005 GHG Emissions for the City of Rancho Cordova[1]

Sector	CO_2e (metric tons)	Percent
Residential	94,324	16.9
Commercial and Industrial	135,190	24.2
Industrial Specific	0	0.0
On-Road Transportation	251,690	45.1
Off-road Vehicle Use	23,762	4.3
Waste	19,435	3.5
Wastewater Treatment	5,466	1.0
Water Related	3,821	0.7
Agriculture	1,268	0.2
High GWP GHGs	22,987	4.1
Total	**557,943**	**100.0**

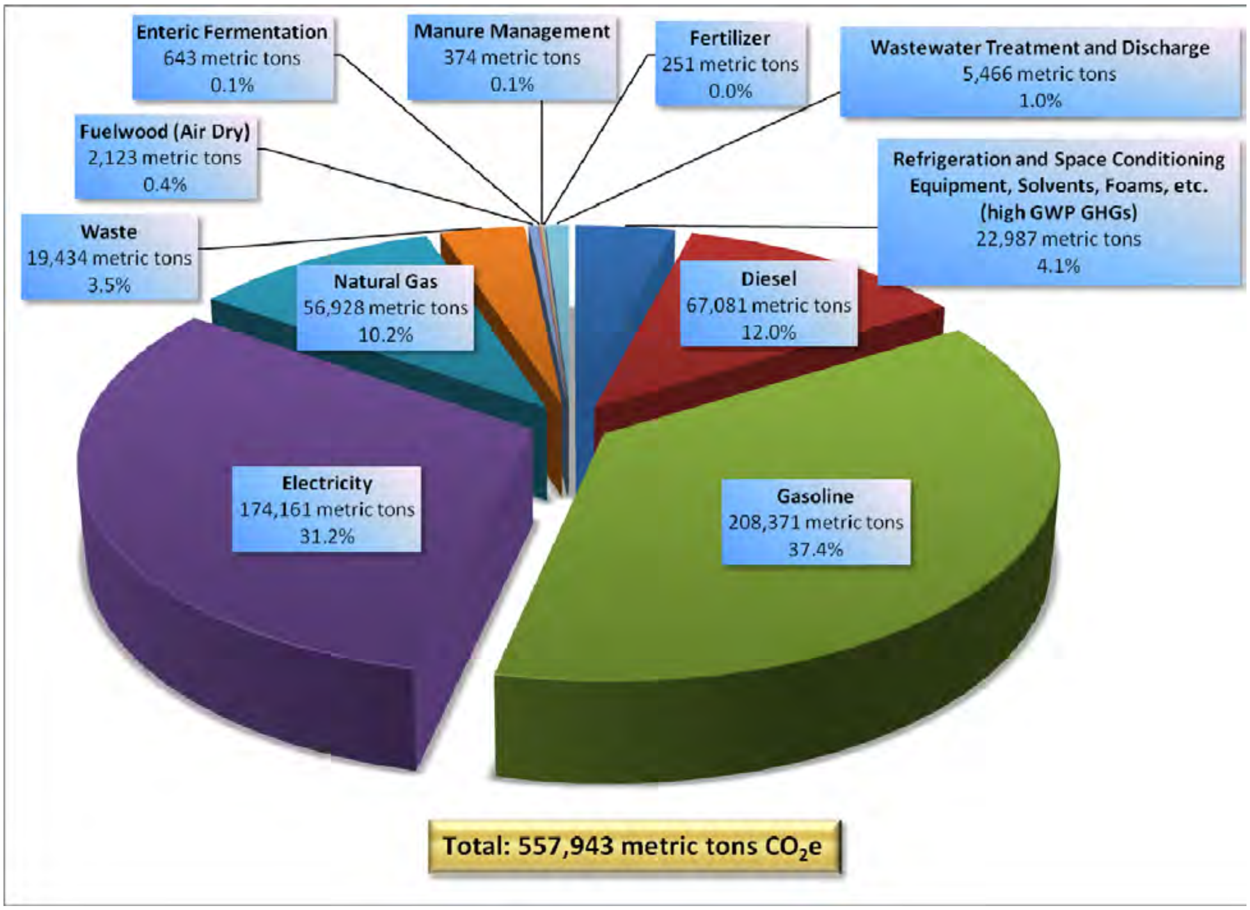
[1] Calculated using CACP software (Appendix A).

Figure 7-1. City of Rancho Cordova GHG Emissions for 2005 (metric tons CO_2e)



Total GHG emissions in 2005 for the City of Rancho Cordova amounted to 557,943 metric tons of CO_2e, the fifth largest incorporated city contributor to emissions. Figure 7-2 shows the contribution of each fuel type and emissions source to overall GHG emissions. Electricity, natural gas, gasoline, and diesel are the largest overall contributors to GHG emissions in the City of Rancho Cordova.

Figure 7-2. City of Rancho Cordova GHG Emissions for 2005 by Source (metric tons CO_2e)



Emissions from the City of Rancho Cordova in 2005 accounted for 4.0% of overall GHG emissions for Sacramento County in 2005. City of Rancho Cordova 2005 per capita GHG emissions are 9.9 metric tons CO_2 compared to county-wide per capita emissions of 10.0 metric tons and ARB target 2020 goal of 9.7 metric tons CO_2. Figure ES-5 compares 2005 per capita emissions for the cities, Sacramento County, and Unincorporated Sacramento County. City-wide emissions range from 20,382 (Isleton) to 6,556,875 (Unincorporated Sacramento County) metric tons of CO_2e, and per capita emissions range from 6.4 (Elk Grove) to 11.7 (Unincorporated Sacramento County) metric tons of CO_2e.

For detailed analysis of emissions inventory methodologies, refer to Appendix B.

Residential Emissions

As shown in Table 7-1, residential GHG emissions for the City of Rancho Cordova in 2005 amounted to 94,324 metric tons of CO_2e, which represents 16.9% of total city-wide emissions in Rancho Cordova.

Residential-sector GHG emissions mainly result from household use of electricity and natural gas. Residential emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E. Residential GHG emissions also include CH_4 and N_2O emissions from residential wood burning in Rancho Cordova residences. GHG emissions from residential wood burning were quantified using data from the SMAQMD (SMAQMD 2007).

Emissions were quantified using CACP emission factors. Emissions were apportioned by population data for the City of Rancho Cordova in 2005, available through the California Department of Finance (California Department of Finance 2008). Wood-burning contributions to GHG emissions were included because the SMAQMD introduced a wood stove change-out incentive program in Sacramento County that may reduce GHG emissions from wood burning (SMAQMD 2007).

Residential use of self-generated energy through the consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified due to lack of available data. It is expected that the GHG emissions from these sources are negligible. High GWP gases partially originate from the residential sector but are included in a separate category below. See Appendix B for a detailed description of calculations and methodology.

Commercial and Industrial Emissions

The commercial and industrial sector are combined because both SMUD and PG&E aggregate energy use data from these two sectors into their "commercial" sector. As shown in Table 7-1, commercial and industrial GHG emissions for the City of Rancho Cordova in 2005 amounted to 135.190 metric tons of CO_2e, which represents 24.2% of total emissions from the City in 2005.

Commercial- and industrial-sector GHG emissions mainly result from consumption of electricity and natural gas by commercial and industrial buildings. Commercial and industrial GHG emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E.

Energy generated through the commercial and industrial consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified due to lack of available data. Appendix B describes in detail the methodology used to quantify these emissions.

Industrial Specific Emissions

Industrial-sector GHG emissions mainly result from consumption of electricity and natural gas by industrial buildings. In 2005, there were no GHG emissions for the City of Rancho Cordova in 2005 estimated for the industrial sector's use of electricity and natural gas (Ave pers. comm., Bruso pers. comm.). Companies that fall within the industrial sector may, by law, choose not to disclose energy use. In that case, energy consumed by the industrial sector may be included in the commercial sector to maintain confidentiality. See Appendix B for a detailed description of commercial and industrial emissions.

On-Road Transportation Emissions

GHG emissions from on-road transportation for the City of Rancho Cordova in 2005 amounted to 251,690 metric tons of CO_2e, which represents 45.1% of total City emissions. Emissions from on-road vehicle use, including heavy-duty trucks and buses, were quantified using average annual VMT for the City of Rancho Cordova in 2005. VMT data for 2005 was obtained from the Caltrans HPMS 2005 Public Road Data (California Department of Transportation 2006). A significant portion of highway VMT may be attributed to employee commute trips within the county. Therefore, the county-wide highway VMT was apportioned by highway miles located in the City of Rancho Cordova. Approximately 2% of highway miles are located within the City of Rancho Cordova. Approximately 28.2% of VMT and associated GHG emissions in Rancho Cordova are due to travel on highways located in Rancho Cordova.

See Appendix B for a detailed description of calculations and methodology.

Off-Road Vehicle Emissions

Exhaust emissions from off-road vehicle use for the City of Rancho Cordova in 2005 amounted to 23,762 metric tons of CO2e, which represents 4.3% of overall emissions. Emissions were calculated using the California Air Resources Board OFFROAD 2007 air quality model. OFFROAD 2007 considers emissions from off-road equipment including recreational boats, recreational vehicles, industrial equipment, construction equipment, and lawn and garden equipment, as well as equipment dealing with airport ground support, military, agriculture, rail operation, and more (California Air Resources Board 2006). County-wide emissions were apportioned by population in the City of Rancho Cordova using California Department of Finance data for 2005 (California Department of Finance 2008).

See Appendix B for a detailed description of calculations and methodology.

Waste Emissions

Approximately 65,131 tons of waste was landfilled by the City of Rancho Cordova in 2005; 17% of landfilled waste is due to household (residential) disposal, and 83% of landfilled waste is due to business (commercial/industrial) disposal. The CIWMB estimates that only 52% of all generated waste was landfilled in 2006, because Rancho Cordova achieved a diversion rate of 48% for that year (California Integrated Waste Management Board 2008b). CH_4 emissions are released to the atmosphere as waste decomposes in the anaerobic environment created by a landfill. Approximately 19,435 metric tons of CO_2e were emitted as a result of landfilling of waste in 2005.

Waste emissions were calculated using waste stream profile information from the CIWMB and CH_4 control efficiencies for each landfill accepting waste from the city , and waste-in-place information from the Environmental Protection Agency (California Integrated Waste Management Board 2008c, Israel pers. comm., Environmental Protection Agency 1998).

Appendix B describes in detail the methodology used to quantify these emissions.

Wastewater Treatment Emissions

GHG emissions from domestic wastewater treatment required for the City of Rancho Cordova in 2005 amounted to 5,466 metric tons of CO_2e, which represents 1.0% of overall emissions. Emissions from this source are included as per capita emissions of CH_4 and N_2O as calculated for the State of California (California Air Resources Board 2008a, 2008b).

Appendix B describes in detail the methodology used to quantify these emissions.

Water-Related Emissions

GHG emissions from electricity and natural gas consumption for water supply and irrigation infrastructure and wastewater collection and treatment facilities required for the City of Rancho Cordova in 2005 amounted to 3,821 metric tons of CO_2e, which represents 0.7% of overall emissions.

Appendix B describes in detail the methodology used to quantify these emissions.

Agricultural Emissions

Total agricultural emissions for the City of Rancho Cordova in 2005 were 1,268 metric tons of CO_2e. GHG emissions from enteric fermentation and manure management for cattle and swine, use of fertilizers, and emissions from dairy operations were considered. In 2005, the City of Rancho Cordova had no dairy activities. Agricultural emissions within the City resulted from cattle and swine enteric fermentation (643 metric tons of CO_2e), cattle and swine manure management (374 metric tons of CO_2e), and from fertilizer application (251 metric tons of CO_2e). See Appendix B for a detailed description of calculations and methodology.

High GWP GHG Emissions

Emissions from high GWP GHGs, including chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs) used as substitutes for ozone-depleting substances, for the City of Rancho Cordova in 2005 amounted to 22,987 metric tons of CO_2e. Emissions calculated based on the California Air Resources Board per capita estimate for California (California Air Resources Board 2007). Appendix B describes in detail the methodology used to quantify these emissions.

Government Inventory

The government GHG inventory encompasses emissions from sources under the City of Rancho Cordova's jurisdiction, including government buildings, vehicle fleet, and employee commute, as well as streetlights and water/wastewater treatment and supply within the boundaries of the City of Rancho Cordova. Although in some cases different data sources were used to develop the government GHG inventory, this inventory is a subset of the City of Rancho Cordova City-Wide GHG Inventory. The City of Rancho Cordova's government GHG inventory represents 0.2% of the total City of Rancho Cordova City-Wide GHG Inventory. Total government GHG emissions by sector for 2007 are summarized in Table 7-2.

Government-related emissions from the City of Rancho Cordova in 2005 accounted for 0.4% of overall GHG emissions for Sacramento County governments in 2005. Government emissions range from 42 (Isleton) to 170,818 (Unincorporated Sacramento County) metric tons of CO_2e.

As discussed in the introduction to this chapter, government GHG emissions for the City of Rancho Cordova were inventoried for the year 2007 rather than 2005 due to recent large growth of government operations. Consequently, this analysis presents activity data and associated emissions for the year 2007. The City of Rancho Cordova was incorporated in 2003; the 2005 base year does not reflect a municipal agency meeting typical and normal municipal service demands.

Emissions for 2007 in each sector were scaled back to 2005 based on population growth from 2005 to 2007.

Rancho Cordova total population increased 8.1% during this two-year time period. It was assumed that population growth would be a reasonable proxy for determining GHG emissions, and 2007 emissions for each city were multiplied by 92.5% (56,432/60,975)[10]. While data for 2005 in some sectors was available from SMUD and PG&E, including electricity and natural gas consumption for buildings and streetlights, this data was not used because it likely does not reflect actual energy use by the City of Rancho Cordova in 2005, including all contracted services. Total government GHG emissions by sector for 2005 are summarized in Table 7-3.

Two additional methods of backcasting were considered but not used. First, emissions could be backcasted by net change in operating expenses from fiscal year 2004–2005 to 2006–2007. The budget for almost all areas of governmental services increased during this time period, including city council, finance, police, public works, and facilities management, to name a few. Total expenses operational increased 83.4%. According to Paul Junker, Planning Director for the city of Rancho Cordova, these increases in budget do not necessarily represent a similar increase in actual services or GHG-generating activities. Most of this increase is likely due to a transfer of emissions from one entity to another rather than new emissions (i.e. Rancho Cordova taking over certain services previously provided by the county). In some cases the increase in expenses merely represents rising costs and economic shifts (Junker pers. comm.). For example, the city did not own the City Hall complex in 2005 and now does. For these reasons, this method of backcasting was not used to calculate government operating expenses.

Second, emissions could be backcasted by net change in energy use and associated GHG emissions between 2005 and 2007. Because electricity and natural gas data for both years was available from the utilities, a scaling factor representing the change could be used to estimate emissions from vehicle fleet, employee commute, and any additional fuel usage. GHG emissions from Rancho Cordova's energy use grew by 232% during this time period. A scaling factor of 30% could be used to backcast emissions based on this growth. However, energy use for 2005 likely does not reflect actual energy use by Rancho Cordova, including all contracted services. For this reason, this method of backcasting was not used.

[10] The population of Rancho Cordova was 56,432 on 1/1/2006, and 60,975 on 1/1/2008 (California Department of Finance 2008).

Table 7-2. 2007 Government GHG Emissions for the City of Rancho Cordova[1]

Sector	CO_2e (metric tons)	Percent
Buildings	650	60.7
Vehicle Fleet	55	5.1
Employee Commute	321	30.0
Traffic Signals[2]	44	4.1
Waste	0	0.0
Other Fuel Use	0	0.0
Total	**1,070**	**100.0**

[1] Calculated using CACP software. See Appendix C for a detailed discussion of scaling methodology.
[2] Streetlights operated by Sacramento County (McCormick pers. comm.).

Figure 7-3 illustrates the contribution of each sector to the total government emissions for the City of Rancho Cordova in 2007. Figure 7-4 illustrates the contribution of each sector to the total government emissions for the City of Rancho Cordova in 2005. For detailed analysis of emissions methodologies for the government sector, refer to Appendix C.

Table 7-3. 2005 Government GHG Emissions for the City of Rancho Cordova[1]

Sector	CO_2e (metric tons)	Percent
Buildings	602	60.7
Vehicle Fleet	51	5.1
Employee Commute	297	30.0
Traffic Signals[2]	41	4.1
Waste	0	0.0
Other Fuel Use	0	0.0
Total	**990**	**100.0**

[1] Calculated using CACP software and scaling back based on population growth. See Appendix C for a detailed discussion of scaling methodology.
[2] Streetlights operated by Sacramento County (McCormick pers. comm.).

Figure 7-3. City of Rancho Cordova Government GHG Emissions for 2007 (metric tons CO_2e)

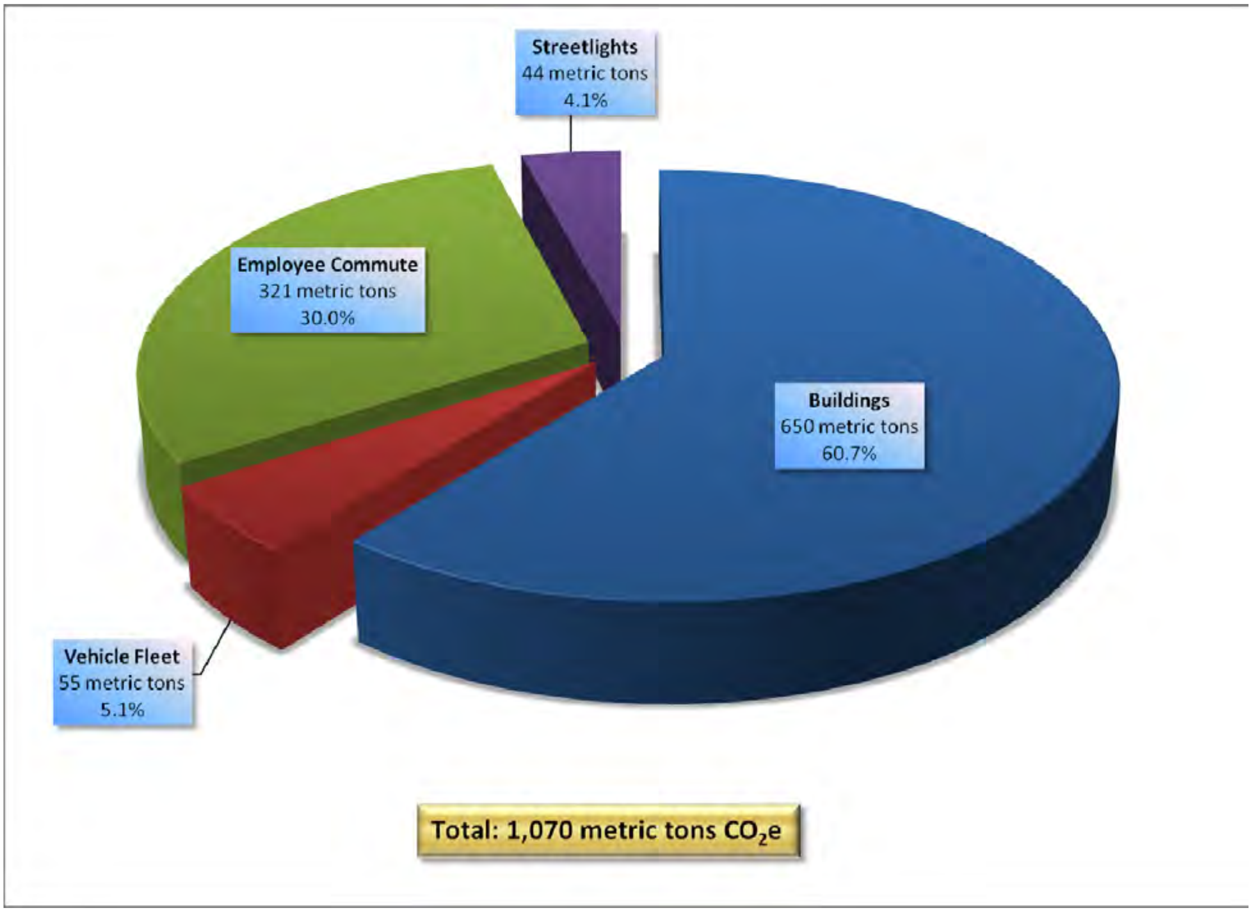
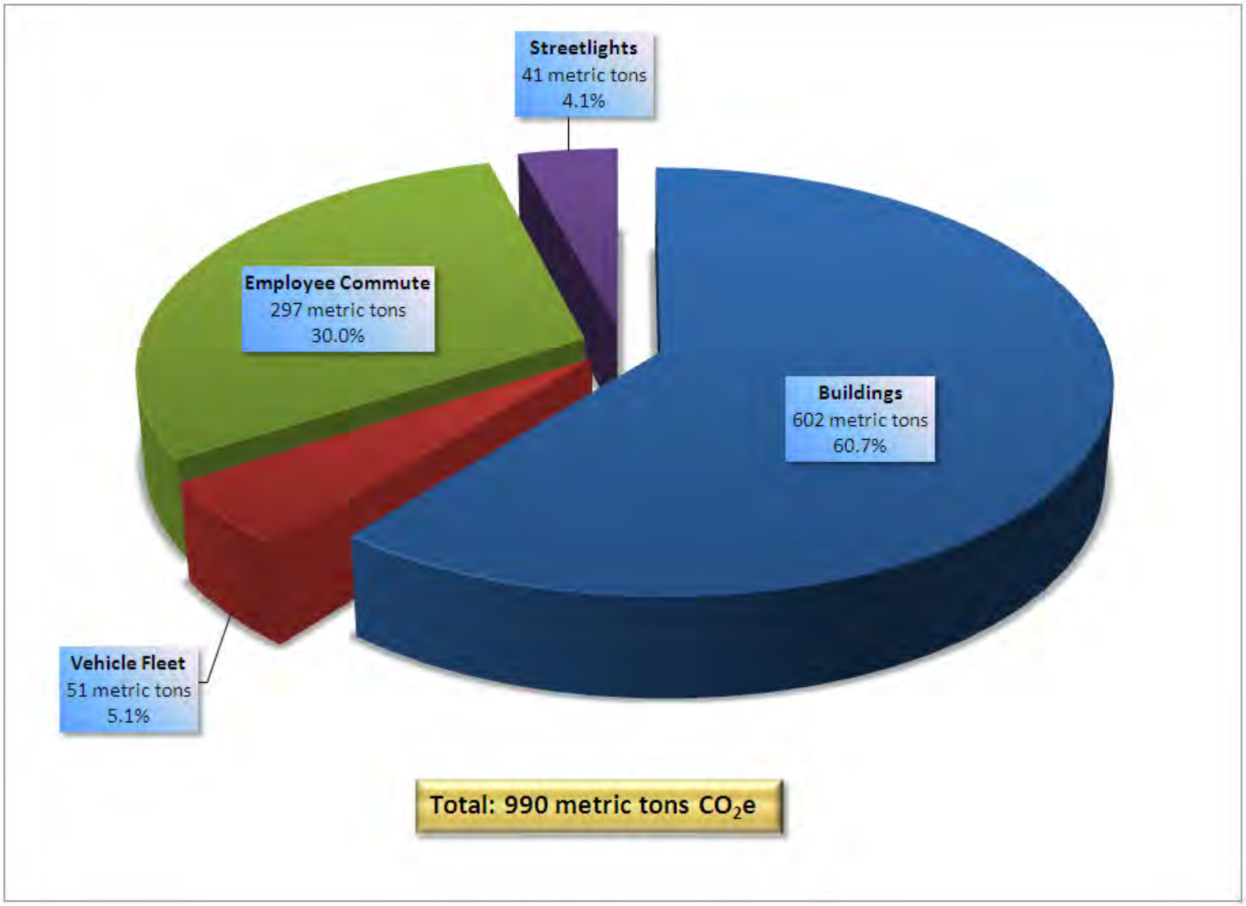


Figure 7-4. City of Rancho Cordova Government GHG Emissions for 2005 (CO_2e)



Buildings

As shown in Tables 7-2 and 7-3, GHG emissions from building energy consumption amounted to 650 metric tons of CO_2e in 2007 and 602 metric tons of CO_2e in 2005, which represents 60.7% of total government emissions for Rancho Cordova. Electricity, natural gas, and other fuel consumption for government facilities were obtained from SMUD, PG&E, and city staff (Ave pers. comm., Bruso pers. comm., McCormick pers. comm.). The City of Rancho Cordova had 73 employees and three government buildings in operation in 2007. Rancho Cordova rents 4,108 rentable square feet of a building for Animal Control, Code Enforcement, and Building Inspector staff, totaling 11 employees in 2007. Data for energy usage of this building was not available, because the City of Rancho Cordova does not have operational or financial control over gas or electricity for this building (McCormick pers. comm.). Appendix C describes in detail the methodology used to quantify these emissions.

Vehicle Fleet

Vehicle fleet emissions amounted to 55 metric tons of CO_2e in 2007 and 51 metric tons of CO_2e in 2005 based on budgetary backcasting. Vehicle fleet emissions include government fleet vehicles ranging from mid-size vehicles to heavy trucks. The City operated between six and 14 vehicles in 2007. The City of Rancho Cordova did not keep track of mileage for their fleet in 2007, but is in the process of doing so as of October 2008 (McCormick pers. comm.) See Appendix C for a detailed description of calculations and methodology.

Employee Commute

As shown in Tables 7-2 and 7-3, GHG emissions from employee commuting amounted to 321 metric tons of CO_2e in 2007, which represents 35.8% of overall government emissions, and 297 metric tons of CO_2e in 2005 based on population backcasting. GHG emissions resulting from employee commutes in 2007 were calculated based on a commute survey provided by the City of Rancho Cordova (McCormick pers. comm.). Appendix C describes in detail the methodology used to quantify these emissions.

Streetlights and Traffic Signals

As Tables 7-2 and 7-3 illustrate, electricity consumption of Rancho Cordova–owned streetlights and traffic signals amounted to 44 metric tons of CO_2e in 2007 and 41 metric tons of CO_2e in 2005, representing 4.1% of overall government emissions. Electricity use for City of Rancho Cordova streetlights and traffic signals was provided by SMUD (Ave pers. comm). In 2007, street lights in the City of Rancho Cordova were owned and operated by Sacramento County. Therefore, their energy usage was not included in this inventory (McCormick pers. comm.). See Appendix C for a detailed description of calculations and methodology.

Waste

Waste generation specific to City of Rancho Cordova government facilities could not be separated from total estimated city-wide waste generation, and it is unclear whether this will be feasible to capture in future inventories. Waste services for Rancho Cordova operations are contracted to Allied Waste Services. The City of Rancho Cordova has one five-yard trash bin collected two times per week, and one four-yard recycle bin collected two times per week. Because it is unknown how full the bins are when they are collected, waste generation was not estimated. All waste landfilled by the City of Rancho Cordova, including city government waste generation, was included in the City of Rancho Cordova City-Wide GHG Inventory. Appendix C describes in detail the methodology used to quantify these emissions.

Other Fuel Use

Use of fuels such as kerosene, propane, and heavy fuel oil in City of Rancho Cordova government operation were considered. Use of these fuels resulted in no CO_2e emissions in 2007.

Summary

GHG emissions for the City of Rancho Cordova in 2005 amounted to 557,943 metric tons of CO_2e. Per capita emissions were 9.9 metric tons of CO_2e, compared to county-wide per capita emissions of 10.0 metric tons and ARB target 2020 goal of 9.7 metric tons. The main sources of GHG emissions in the City of Rancho Cordova were transportation (275,452 metric tons CO_2e from fuel combustion) and buildings (229,514 metric tons CO_2e from electricity and natural gas consumption), representing 49% and 41% of net city-wide emissions, respectively.

Government GHG emissions for Rancho Cordova amounted to 1,070 metric tons of CO_2e in 2007, and 990 metric tons of CO_2e in 2005. The main sources of GHG emissions for government operations for 2007 were buildings (650 metric tons CO_2e from electricity and natural gas consumption) and employee commute (321 metric tons CO_2e from fuel combustion), representing 61% and 30% of net government emissions respectively. The main sources of GHG emissions in 2005 were buildings (602 metric tons CO_2e from electricity and natural gas consumption) and employee commute (297 metric tons CO_2e from fuel combustion), representing 61% and 30% of net government emissions, respectively.

Chapter 8
Greenhouse Gas Emissions Inventory for the City of Sacramento

Introduction

In recognition of the rising concern over the threat of climate change, the City of Sacramento, along with all incorporated cities within Sacramento County, opted to join the International Council for Local Environmental Initiatives (ICLEI) program. The City of Sacramento committed to conduct an inventory of emissions within its jurisdiction as part of a county-wide effort to account for GHG emissions generated within Sacramento County. The inventory, described in detail in this chapter, is the first step in an effort to reduce GHG emissions. These efforts to reduce emissions are consistent with State policy and current regulation from AB 32 directing the State of California to reduce GHG emissions to 1990 levels by 2020.

The City of Sacramento lies within Sacramento County, covers approximately 99 square miles, and has a population of 475,743 (County of Sacramento 2009g; California Department of Finance 2008). The City is home to several professional sports teams, most notably the Sacramento Kings men's basketball team, Sacramento Monarchs women's basketball team, and Sacramento River Cats minor league baseball team. The City of Sacramento houses the State Capitol, Sutter's Fort, the Sacramento Zoo, the Sacramento Convention Center, and several museums. The City of Sacramento maintains a rich historical heritage, and encourages residents to visit historic Old Town Sacramento.

The City of Sacramento incorporated in 1849 and operates on the Charter City type of governance (County of Sacramento 2009g; City of Sacramento 2009)

The majority of GHG emissions are produced through the burning of fossil fuels. The City of Sacramento City-Wide GHG Inventory includes GHG emissions from direct and indirect sources. A direct emission source is defined as an on-site source of emissions such as the combustion of fossil fuel in a vehicle engine. An indirect emission source is defined as an emissions source generated offsite as a result of county operation, such as electricity consumption.

City of Sacramento GHG emissions were inventoried for all operations within Sacramento's geographical boundaries (i.e., city limits). The City of Sacramento City-Wide GHG Inventory includes GHG emissions from residential, commercial, industrial, transportation, and waste sectors. The government GHG inventory is described separately, and is a subset of the City of Sacramento City-Wide GHG Inventory. The government analysis divides emissions among buildings, vehicle fleet, employee commute, streetlights, water/sewage, and waste sectors.

The City of Sacramento government recently joined CCAR and is in the process of certifying and reporting government emissions for 2006 and onward. Inventories previously certified by CCAR were used to estimate government emissions in this inventory. The CCAR GHG inventory for the City of Sacramento (year 2005) is available on CCAR's website (California Climate Action Registry 2009b). Data from this CCAR report were used for the Sacramento County and City of Sacramento government inventories. For government operations beyond the scope of the CCAR report, data was collected from city staff (Roberts pers. comm.). Electricity and natural gas consumption for the remaining incorporated governments was supplied by SMUD and PG&E (Ave pers. comm., Bruso pers. comm.).

Results

City-Wide Inventory

The City of Sacramento City-Wide GHG Inventory encompasses emissions from commercial, industrial, and residential activities within the city limit.

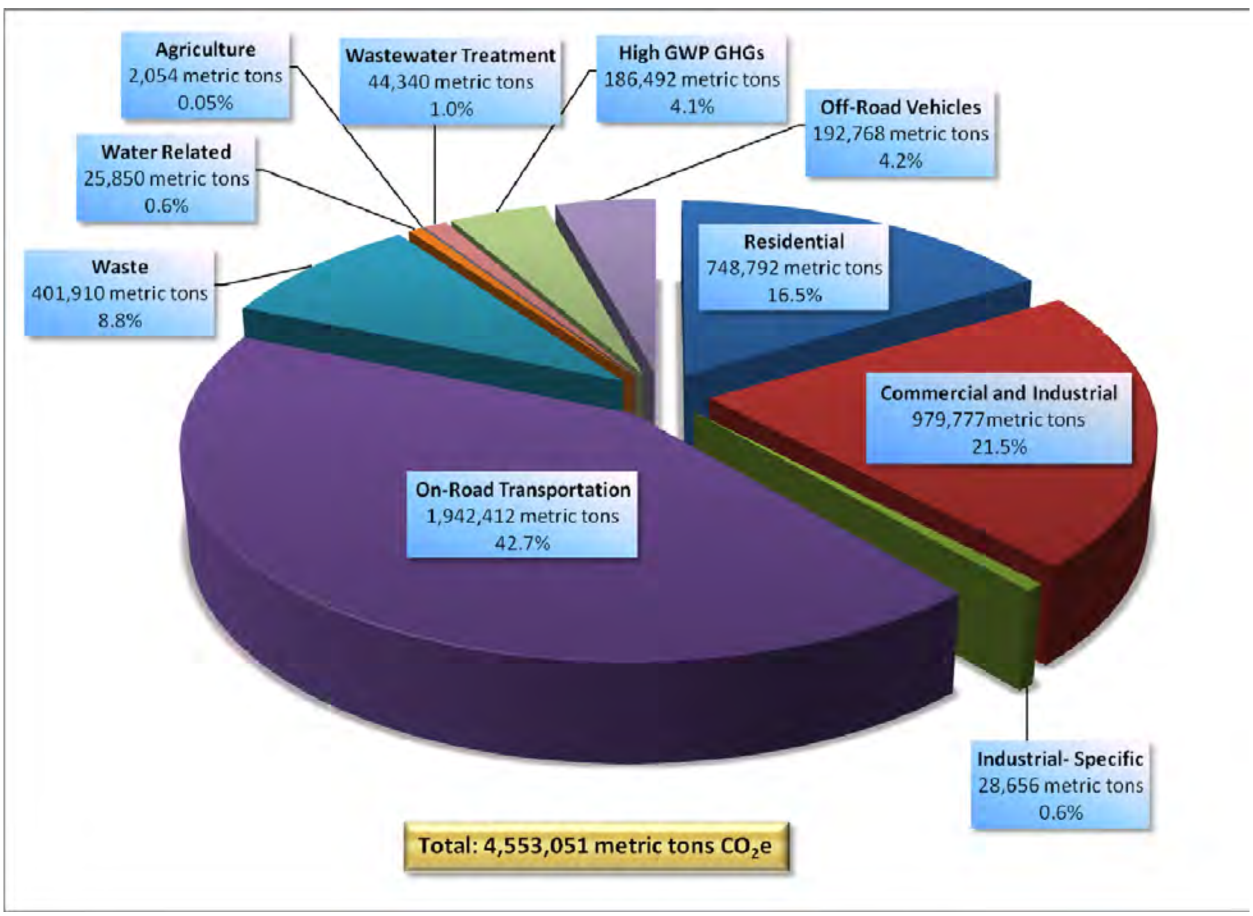
Table 8-1 quantifies the contributions of each sector to total 2005 city-wide emissions for the City of Sacramento. Figure 8-1 illustrates each sector's contribution to total city-wide emissions. On-road transportation accounted for 42.7% of overall emissions and is the largest contributing sector to overall emissions.

Table 8-1. 2005 GHG Emissions for the City of Sacramento[1]

Sector	CO_2e (metric tons)	Percent
Residential	748,792	16.5
Commercial and Industrial	979,777	21.5
Industrial Specific	28,656	0.6
On-Road Transportation	1,942,412	42.7
Off-road Vehicle Use	192,768	4.2
Waste	401,910	8.8
Wastewater Treatment	44,340	1.0
Water Related	25,850	0.6
Agriculture	2,054	0.0
High GWP GHGs	186,492	4.1
Total	**4,553,051**	**100.0**

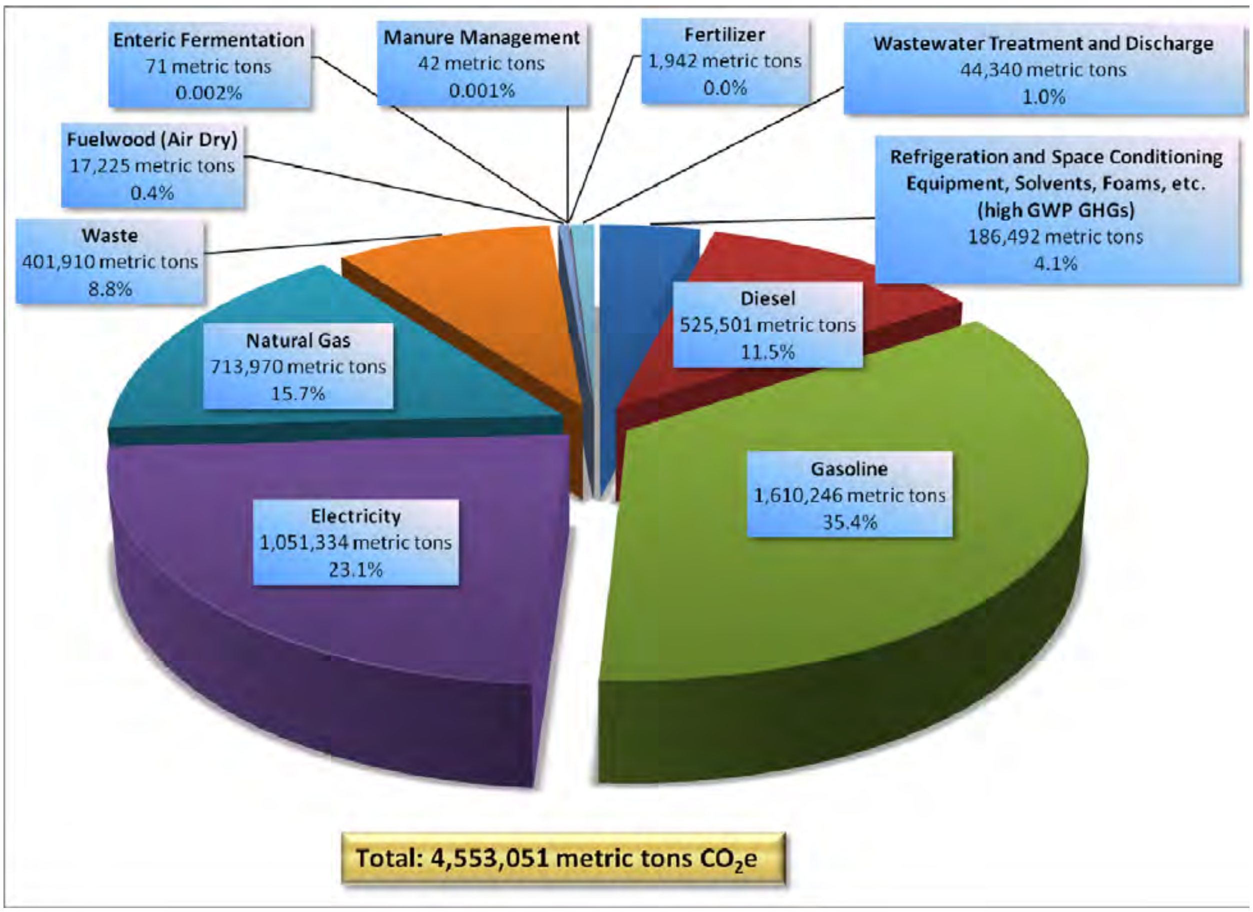
[1] Calculated using CACP Software (Appendix A)..

Figure 8-1. City of Sacramento GHG Emissions for 2005 (metric tons CO_2e)



Total GHG emissions in 2005 for the City of Sacramento amounted to 4,553,051 metric tons of CO_2e, the largest incorporated city contributor to emissions. Figure 8-2 shows the contribution of each fuel type and emissions source to overall GHG emissions. Electricity, natural gas, gasoline and diesel are the largest overall contributors to GHG emissions in the City of Sacramento.

Figure 8-2. City of Sacramento GHG Emissions for 2005 by Source (metric tons CO_2e)



Emissions from the City of Sacramento in 2005 accounted for 32.8% of overall GHG emissions for Sacramento County in 2005. City of Sacramento 2005 per capita GHG emissions are 9.9 metric tons of CO_2e compared to county-wide per capita emissions of 10.0 metric tons and ARB goal of 9.7 metric tons of CO_2e. Figure ES-5 compares 2005 per capita emissions for the cities, Sacramento County, and Unincorporated Sacramento County. City-wide emissions range from 20,382 (Isleton) to 6,556,875 (Unincorporated Sacramento County) metric tons of CO_2e, and per capita emissions range from 6.4 (Elk Grove) to 11.7 (Unincorporated Sacramento County) metric tons of CO_2e.

A discussion of City of Sacramento GHG emissions for each major sector is presented below. For detailed analysis of emissions inventory methodologies, refer to Appendix B.

Residential Emissions

As shown in Table 8-1, residential GHG emissions for the City of Sacramento in 2005 amounted to 748,792 metric tons of CO_2e, which represents 16.5% of total city-wide emissions in Sacramento.

Residential-sector GHG emissions mainly result from household use of electricity and natural gas. Residential emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E. Residential GHG emissions also include CH_4 and N_2O emissions from residential wood burning in the City of Sacramento residences. GHG emissions from residential wood burning were quantified using data from the SMAQMD (SMAQMD 2007).

Emissions were quantified using CACP emission factors. Emissions were apportioned by population data for the City of Sacramento in 2005, available through the California Department of Finance (California Department of Finance 2008). Wood-burning contributions to GHG emissions were included because the SMAQMD introduced a wood stove change-out incentive program in Sacramento County that may reduce GHG emissions from wood burning (SMAQMD 2007).

Residential use of self-generated energy through the consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified due to lack of available data. It is expected that the GHG emissions from these sources are negligible. High GWP gases partially originate from the residential sector but are included in a separate category below. See Appendix B for a detailed description of calculations and methodology.

Commercial and Industrial Emissions

The commercial and industrial sector are combined because both SMUD and PG&E aggregate energy use data from these two sectors into their “commercial” sector. As shown in Table 8-1, commercial and industrial GHG emissions for the City of Sacramento in 2005 amounted to 979,777 metric tons of CO_2e, which represents 21.5% of total emissions from Sacramento in 2005.

Commercial- and industrial-sector GHG emissions mainly result from consumption of electricity and natural gas by commercial and industrial buildings. Commercial and industrial GHG emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E.

Energy generated through the commercial and industrial consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified due to a lack of available data. Appendix B describes in detail the methodology used to quantify these emissions.

Industrial Specific Emissions

Industrial-sector GHG emissions mainly result from consumption of electricity and natural gas by industrial buildings. Major industrial sources in the City of Sacramento include the SMUD power plants, UC Davis Medical Center, and the Sacramento Cogeneration and Power Authority. The majority of industrial emissions are related to energy generation, which are accounted for in the emission factors for electricity supplied by SMUD and PG&E. Approximately 28,656 metric tons of CO_2e were emitted as a result of industrial operations in the City of Sacramento in 2005 (Bruso pers. comm.). Companies that fall within the industrial sector may, by law, choose not to disclose energy use. In that case, energy consumed by the industrial sector may be included in the commercial sector to maintain confidentiality. See Appendix B for a detailed description of commercial and industrial emissions.

On-Road Transportation Emissions

GHG emissions from on-road transportation for the City of Sacramento in 2005 amounted to 1,942,412 metric tons of CO_2e, which represents 42.7% of total City of Sacramento emissions. Emissions from on-road vehicle use, including heavy-duty trucks and buses, were quantified using average annual VMT for the City of Sacramento in 2005. VMT data for 2005 was obtained from the Caltrans HPMS 2005 Public Road Data (Caltrans 2006). A significant portion of highway VMT may be attributed to employee commute trips within the county. Therefore, the county-wide highway VMT was apportioned by highway miles located in the City of Sacramento. Approximately 27% of highway miles are located within the City of Sacramento. Approximately 44% of VMT and associated GHG emissions in Sacramento are due to travel on highways located in the City of Sacramento.

See Appendix B for a detailed description of calculations and methodology.

Off-Road Vehicle Emissions

Exhaust emissions from off-road vehicle use for the City of Sacramento in 2005 amounted to 192,768 metric tons of CO_2e, which represents 4.2% of overall emissions. Emissions were calculated using the California Air Resources Board OFFROAD 2007 air quality model. OFFROAD 2007 considers emissions from off-road equipment including recreational boats, recreational vehicles, industrial equipment, construction equipment, and lawn and garden equipment, as well as equipment dealing with airport ground support, military, agriculture, rail operation, and more (California Air Resources Board 2006). County-wide emissions were apportioned by population in the City of Sacramento using California Department of Finance data for 2005 (California Department of Finance 2008).

See Appendix B for a detailed description of calculations and methodology.

Waste Emissions

Approximately 684,088 tons of waste was landfilled by the City of Sacramento in 2005; 34% of landfilled waste is due to household (residential) disposal, and 66% of landfilled waste is due to business (commercial/industrial) disposal. The CIWMB estimates that only 57% of all generated waste was landfilled in 2005, because Sacramento achieved a diversion rate of 43% for that year (California Integrated Waste Management Board 2008a, 2008b). CH_4 emissions are released to the atmosphere as waste decomposes in the anaerobic environment created by a landfill. Approximately 364,904 metric tons of CO_2e were emitted as a result of landfilling of waste in 2005. An additional 37,006 metric tons of CO_2e were emitted as a result of CH_4 emissions from waste-in-place at landfills located in the City of Sacramento (including L&D landfill and Sac City Landfill). Net waste emissions were 401,910 metric tons of CO_2e.

Waste emissions were calculated using waste stream profile information from the CIWMB, CH_4 control efficiencies for each landfill accepting waste from the city, and legacy waste-in-place information from the Environmental Protection Agency (California Integrated Waste Management Board 2008c, Israel pers. comm., Environmental Protection Agency 1998, 2007).

Appendix B describes in detail the methodology used to quantify these emissions.

Wastewater Treatment Emissions

GHG emissions from domestic wastewater treatment required for the City of Sacramento in 2005 amounted to 44,340 metric tons of CO_2e, which represents 1.0% of overall emissions. Emissions from this source are included as per capita emissions of CH_4 and N_2O as calculated for the State of California (California Air Resources Board 2008d, 2008e).

Appendix B describes in detail the methodology used to quantify these emissions.

Water-Related Emissions

GHG emissions from electricity and natural gas consumption for water supply and irrigation infrastructure and wastewater collection and treatment facilities required for the City of Sacramento in 2005 amounted to 25,850 metric tons of CO_2e, which represents 0.6% of overall emissions.

Appendix B describes in detail the methodology used to quantify these emissions.

Agricultural Emissions

Total agricultural emissions for the City of Sacramento in 2005 were 2,054 metric tons of CO_2e. GHG emissions from enteric fermentation and manure management for cattle and swine, use of fertilizers, and emissions from dairy operations were considered. In 2005, the City of Sacramento had no dairy activities. Agricultural emissions within the City resulted from cattle and swine enteric fermentation (71 metric tons of CO_2e), cattle and swine manure management (41 metric tons of CO_2e), and from fertilizer application (1,942 metric tons of CO_2e). See Appendix B for a detailed description of calculations and methodology.

High GWP GHG Emissions

Emissions from high GWP GHGs, including chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs) used as substitutes for ozone-depleting substances, for the City of Sacramento in 2005 amounted to 186,492 metric tons of CO_2e. Emissions calculated based on the California Air Resources Board per capita estimate for California (California Air Resources Board 2007). Appendix B describes in detail the methodology used to quantify these emissions.

Government Inventory

The government GHG inventory encompasses emissions from sources under the City of Sacramento’s jurisdiction, including government buildings, vehicle fleet, and employee commute, as well as streetlights and water/wastewater treatment and supply within the boundaries of the City of Sacramento. Although in some cases different data sources were used to develop the government GHG inventory, this inventory is a subset of the City of Sacramento City-Wide GHG Inventory. The City of Sacramento’s government GHG inventory represents 1.7% of the total city-wide inventory. Total government GHG emissions by sector are summarized in Table 8-2.

Government-related emissions from the City of Sacramento in 2005 accounted for 28.6% of overall GHG emissions for Sacramento County governments in 2005. Government emissions range from 42 (Isleton) to 170,818 (Unincorporated Sacramento County) metric tons of CO_2e.

Table 8-2. 2005 Government GHG Emissions for the City of Sacramento[1]

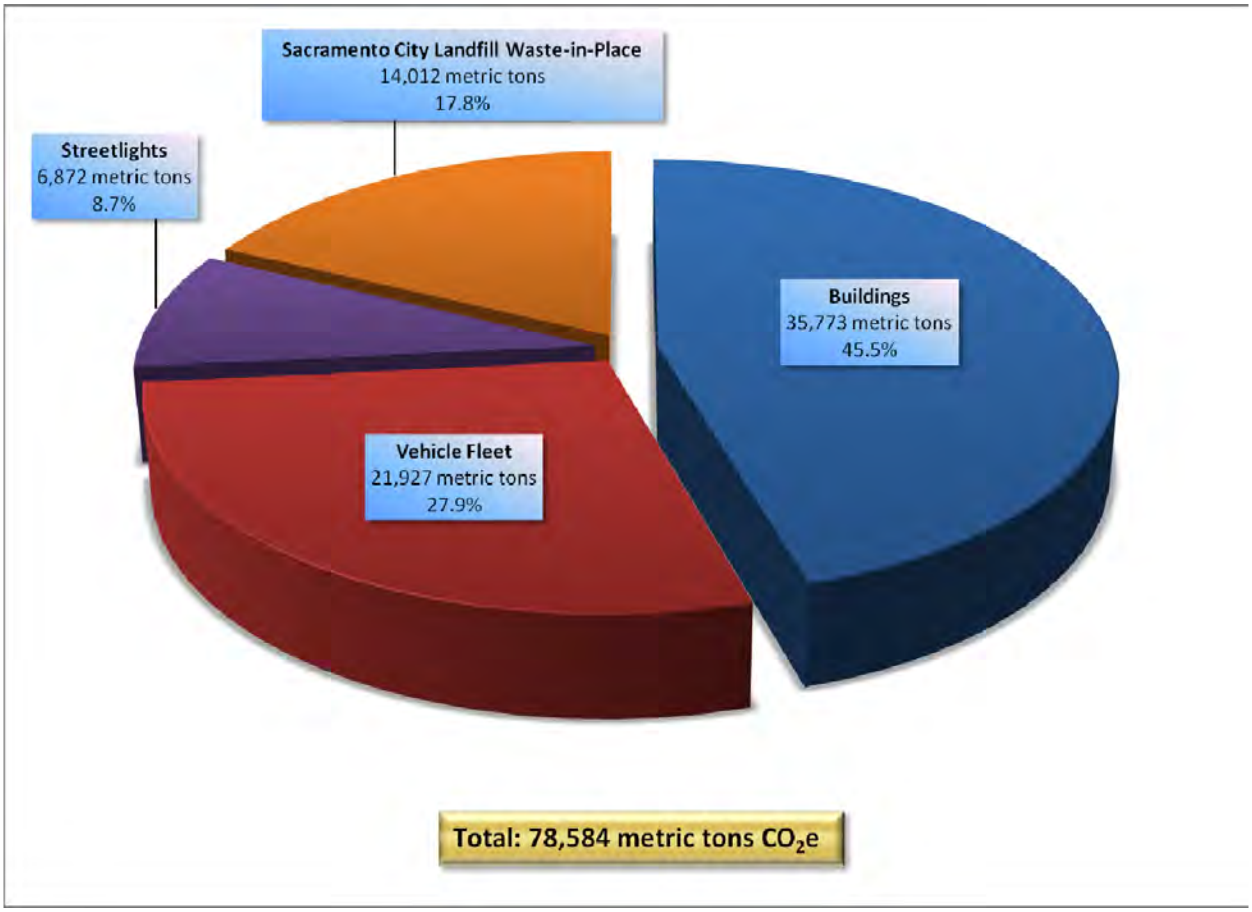
Sector	CO_2e (metric tons)	Percent
Buildings	35,773	45.5
Vehicle Fleet	21,927	27.9
Employee Commute	0	0.0
Streetlights and Traffic Signals	6,872	8.7
Waste	0	0.0
Sacramento City Landfill Waste in Place	14,012	17.8
Total	**78,584**	**100.0**

[1] Calculated using the CACP software.

The 2005 CCAR GHG inventory for the City of Sacramento was used for the government GHG inventory. For government operations beyond the scope of the CCAR report, data was collected from the governments themselves (Roberts pers. comm.). Electricity and natural gas consumption for the remaining incorporated governments was supplied by SMUD and PG&E (Ave pers. comm., Bruso pers. comm.). The GHG inventories certified by CCAR only include activity and associated emissions directly managed by the City of Sacramento. The inventory report has undergone a comprehensive verification and auditing process. For these reasons, data supplied by the CCAR-verified reports, instead of data supplied directly by the utilities, were used for the City of Sacramento government GHG inventory.

Figure 8-3 illustrates the contribution of each sector to the total government emissions for the City of Sacramento in 2005. For detailed analysis of emissions methodologies for the government sector, see Appendix C.

Figure 8-3. City of Sacramento Government GHG Emissions for 2005 (metric tons CO_2e)



Buildings

As shown in Table 8-2, GHG emissions from building energy consumption amounted to 35,773 metric tons of CO_2e, which represents 45.5% of total government emissions for the City of Sacramento. Electricity, natural gas, and other fuel consumption for government facilities were obtained from staff (Roberts pers. comm.). According to city staff, energy use related to water supply and distribution is included in this category. The city of Sacramento has its own water utility and it is the biggest user in terms of government operations (Roberts pers. comm.). Appendix C describes in detail the methodology used to quantify these emissions.

Vehicle Fleet

The second largest source of emissions from government operations resulted from use of the vehicle fleet. Vehicle fleet emissions amounted to 21,927 metric tons of CO_2e in 2005, which represents 27.9% of total government emissions for the City of Sacramento. See Appendix C for a detailed description of calculations and methodology.

Employee Commute

GHG emissions from employee commuting were not quantified for 2005. Based on consultation with ICLEI staff, unless commute data is sufficiently accurate, it should not be included in the inventory because any measures taken to reduce emissions in this sector would not be captured accurately. ICLEI recommends conducting an employee commute survey requesting commute information for 2005, which would be added retroactively to the inventory (Zahner pers. comm.).

Streetlights and Traffic Signals

As Table 8-2 illustrates, electricity consumption of City of Sacramento-owned streetlights and traffic signals amounted to 6,872 metric tons of CO_2e, which represents 8.7% of the total City of Sacramento GHG inventory. Electricity use for City of Sacramento streetlights and traffic signals was provided by SMUD (Ave pers. comm.). See Appendix C for a detailed description of calculations and methodology.

Waste

Waste generation specific to City of Sacramento government facilities could not be separated from total estimated city-wide waste generation, and it is unclear whether this will be feasible to capture in future inventories. All waste landfilled by the City of Sacramento, including government waste generation, was included in the City of Sacramento City-Wide GHG Inventory. Appendix C describes in detail the methodology used to quantify these emissions.

Waste-in-Place

The City of Sacramento government controls the closed Sacramento City Landfill within city boundaries. Waste-in-place at this landfill resulted in emissions of 14,012 metric tons of CO_2e in 2005. Appendix C describes in detail the methodology used to quantify these emissions.

Summary

GHG emissions for the City of Sacramento in 2005 amounted to 4,553,051 metric tons of CO_2e. Per capita emissions were 9.9 metric tons of CO_2e, compared to averaged county-wide per capita emissions of 10.0 metric tons and ARB target 2020 goal of 9.7 metric tons of tons of CO_2e. The main sources of GHG emissions in the City of Sacramento were transportation (2,135,180 metric tons CO_2e from fuel combustion) and buildings (1,728,569 metric tons CO_2e from electricity and natural gas consumption), representing 47% and 38% of net city-wide emissions, respectively.

Government GHG emissions for the City of Sacramento amounted to 78,584 metric tons of CO_2e in 2005. The main sources of GHG emissions for government operations were buildings (35,773 metric tons CO_2e from electricity and natural gas consumption) and vehicle fleet (21,927 metric tons CO_2e from fuel combustion), representing 46% and 28% of net government emissions, respectively.

Chapter 9
Greenhouse Gas Emissions Inventory for Unincorporated Sacramento County

Introduction

In recognition of the rising concern over the threat of climate change, Sacramento County, along with all incorporated cities within Sacramento County, opted to join the International Council for Local Environmental Initiatives (ICLEI) program. The county committed to conduct an inventory of emissions within its jurisdiction as part of a county-wide effort to account for GHG emissions generated with Sacramento County. The Sacramento County government has jurisdiction over Unincorporated Sacramento County. Therefore, Unincorporated Sacramento County was inventoried. The inventory, described in detail in this chapter, is the first step in an effort to reduce GHG emissions. These efforts to reduce emissions are consistent with State policy and current regulation from AB 32 directing the State of California to reduce GHG emissions to 1990 levels by 2020.

Sacramento County, one of the original 27 counties of the State of California, covers approximately 994 square miles and has a current population of 1,424,415 (County of Sacramento 2009h; County of Sacramento 2009i). Unincorporated Sacramento County spans 813 square miles and has a population of 860,901 (County of Sacramento 2009i; California Department of Finance 2008).

The majority of GHG emissions are produced through the burning of fossil fuels. The Unincorporated Sacramento County GHG Inventory includes GHG emissions from direct and indirect sources. A direct emission source is defined as an on-site source of emissions such as the combustion of fossil fuel in a vehicle engine. An indirect emission source is defined as an emissions source generated offsite as a result of operation, such as electricity consumption.

GHG emissions were inventoried for all operations within Unincorporated Sacramento County geographical boundaries. The Unincorporated Sacramento County GHG Inventory includes greenhouse gas emissions from residential, commercial, industrial, transportation, and waste sectors. The Sacramento International Airport lies within Unincorporated Sacramento County and is a large source of government GHG emissions. Most agricultural activities that occur within the county are located in Unincorporated Sacramento County. The most common agricultural products include milk, wine grapes, Bartlett pears, field corn, and turkeys (Sacramento County 2009a).

The government GHG inventory is described separately, and is a subset of the Unincorporated Sacramento County GHG Inventory. The government analysis divides emissions among buildings, vehicle fleet, employee commute, streetlights, water/sewage, and waste sectors.

The Sacramento County government recently joined CCAR and is in the process of certifying and reporting government emissions for 2007 and onward. Inventories previously certified by CCAR were used to estimate government emissions in this inventory. The CCAR GHG inventory for Sacramento County for the year 2006 is available on CCAR's website (California Climate Action Registry 2009b). Data from this CCAR report was used for the Sacramento County government GHG inventory (Mendonsa pers. comm.). For government operations beyond the scope of the CCAR report, data was collected from Sacramento County (Barry pers. comm). Electricity and natural gas consumption for the remaining incorporated governments was supplied by SMUD and PG&E (Ave pers. comm., Bruso pers. comm.). See Appendix C for more detailed information on the CCAR inventory.

Results

Unincorporated County Inventory

The Unincorporated Sacramento County GHG Inventory encompasses emissions from commercial, industrial, and residential activities within the boundaries of Unincorporated Sacramento County.

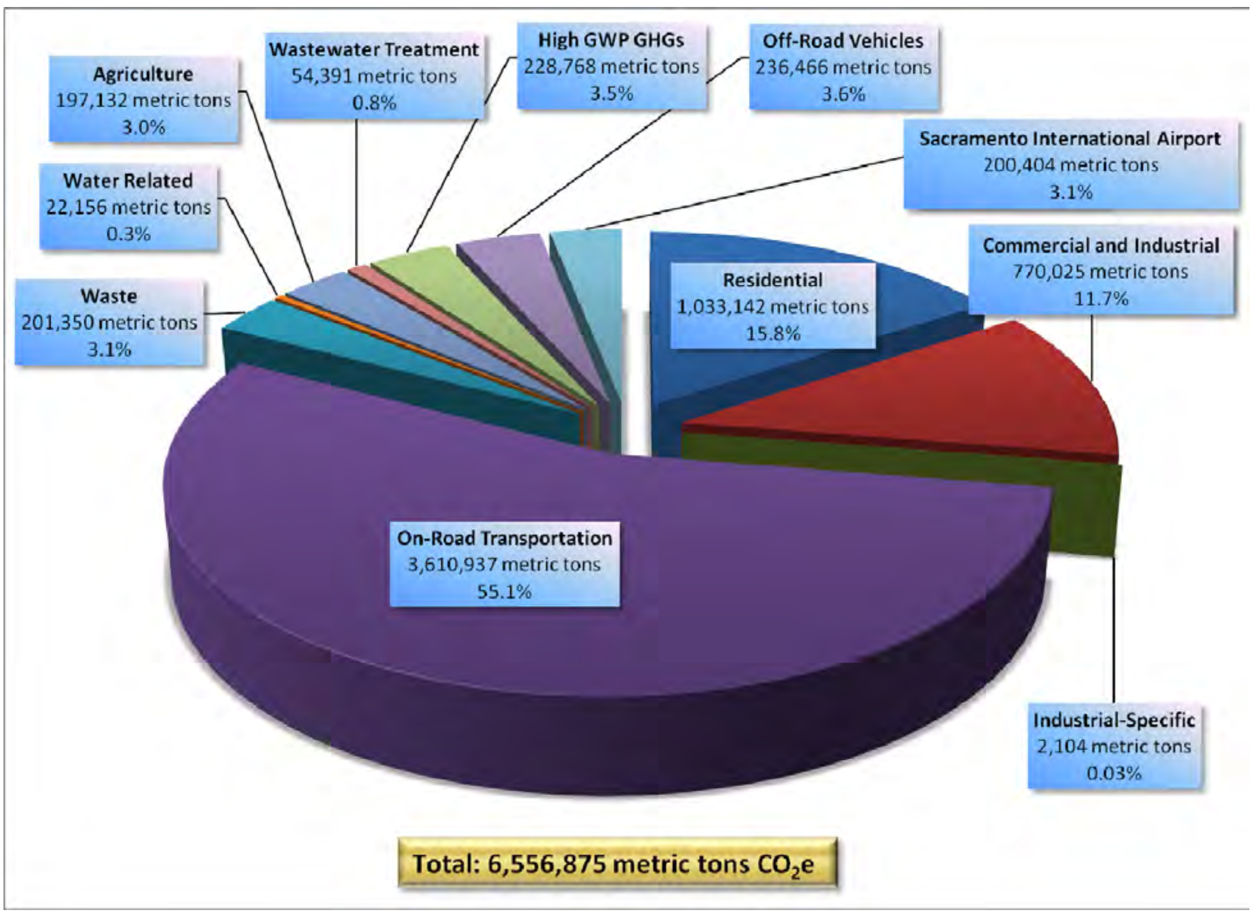
Table 9-1 quantifies the contributions of each sector to total 2005 emissions for Unincorporated Sacramento County. Figure 9-1 illustrates each sector's contribution to total emissions. On-road transportation accounted for 55.1% of overall emissions and is the largest contributing sector to overall emissions.

Table 9-1. 2005 GHG Emissions for Unincorporated Sacramento County[1]

Sector	CO_2e (metric tons)	Percent
Residential	1,033,142	15.8
Commercial and Industrial	770,025	11.7
Industrial Specific	2,104	0.0
On-Road Transportation	3,610,937	55.1
Off-road Vehicle Use	236,466	3.6
Waste	201,350	3.1
Wastewater Treatment	54,391	0.8
Agriculture	197,132	3.0
High GWP GHGs	228,768	3.5
Water-Related	22,156	0.3
Sacramento International Airport	200,404	3.1
Total	**6,556,875**	**100.0**

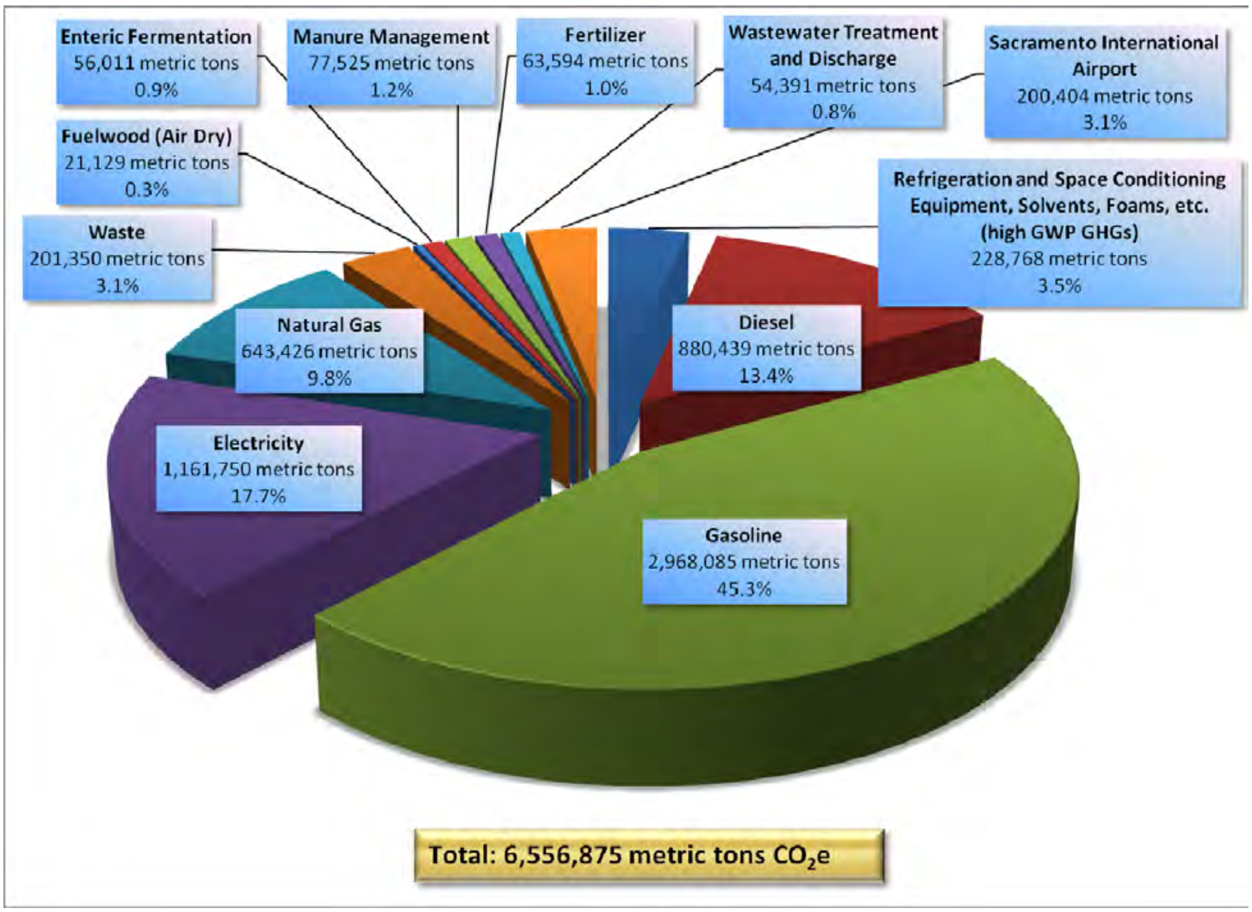
[1] Calculated using CACP software (Appendix A)..

Figure 9-1. Unincorporated Sacramento County GHG Emissions for 2005 (metric tons CO_2e)



Total GHG emissions in 2005 for Unincorporated Sacramento County amounted to 6,556,875 metric tons of CO_2e. Figure 9-2 shows the contribution of each fuel type and emissions source to overall GHG emissions. Electricity, natural gas, gasoline and diesel are the largest overall contributors to GHG emissions in Unincorporated Sacramento County.

Figure 9-2. Unincorporated Sacramento County GHG Emissions for 2005 by Source (metric tons CO_2e)



Emissions from Unincorporated Sacramento County in 2005 accounted for 47.2% of overall GHG emissions for Sacramento County in 2005. Unincorporated Sacramento County 2005 per capita GHG emissions are 11.7 metric tons per capita per year compared to county-wide per capita emissions of 10.0 metric tons and ARB target 2020 goal of 9.7 metric tons. Figure ES-5 compares 2005 per capita emissions for the cities, Sacramento County, and Unincorporated Sacramento County. City-wide emissions range from 20,382 (Isleton) to 6,556,875 (Unincorporated Sacramento County) metric tons of CO_2e, and per capita emissions range from 6.4 (Elk Grove) to 11.7 (Unincorporated Sacramento County) metric tons of CO_2e.

A discussion of the Unincorporated Sacramento County GHG emissions for each major sector is provided below. For detailed analysis of emissions inventory methodologies, see Appendix B.

Residential Emissions

As shown in Table 9-1, residential GHG emissions for Unincorporated Sacramento County in 2005 amounted to 1,033,142 metric tons of CO_2e, which represents 15.8% of total emissions.

Residential-sector GHG emissions mainly result from household use of electricity and natural gas. Residential emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E. Residential GHG emissions also include CH_4 and N_2O emissions from residential wood burning in Unincorporated Sacramento County residences. GHG emissions from residential wood burning were quantified using data from the SMAQMD (SMAQMD 2007).

Emissions were quantified using CACP emission factors. Emissions were apportioned by population data for Unincorporated Sacramento County in 2005, available through the California Department of Finance (California Department of Finance 2008). Wood-burning contributions to GHG emissions were included because the SMAQMD introduced a wood stove change-out incentive program in Sacramento County that may reduce GHG emissions from wood burning (SMAQMD 2007).

Residential use of self-generated energy through the consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified due to a lack of available data. It is expected that the GHG emissions from these sources are negligible. High GWP gases partially originate from the residential sector but are included in a separate category below. See Appendix B for a detailed description of calculations and methodology.

Commercial and Industrial Emissions

The commercial and industrial sector are combined because both SMUD and PG&E aggregate energy use data from these two sectors into their "commercial" sector. As shown in Table 9-1, commercial and industrial GHG emissions for Unincorporated Sacramento County in 2005 amounted to 770,025 metric tons of CO_2e, which represents 11.7% of total emissions in 2005.

Commercial- and industrial-sector GHG emissions mainly result from consumption of electricity and natural gas by commercial and industrial buildings. Commercial and industrial GHG emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E.

Energy generated through the commercial and industrial consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified due to a lack of available data. Appendix B describes in detail the methodology used to quantify these emissions.

Industrial Specific Emissions

Industrial-sector GHG emissions mainly result from consumption of electricity and natural gas by industrial buildings. There are no major industrial sources in the county. Approximately 2,104 metric tons of CO_2e were emitted as a result of industrial operations in Unincorporated Sacramento County in 2005 (Bruso pers. comm.). Companies that fall within the industrial sector may, by law, choose not to disclose energy use. In that case, energy consumed by the industrial sector may be included in the commercial sector to maintain confidentiality. See Appendix B for a detailed description of commercial and industrial emissions.

On-Road Transportation Emissions

GHG emissions from on-road transportation for Unincorporated Sacramento County in 2005 amounted to 3,610,937 metric tons of CO_2e, which represents 55.1% of total emissions. Emissions from on-road vehicle use, including heavy-duty trucks and buses, were quantified using average annual VMT for Unincorporated Sacramento County in 2005. VMT data for 2005 was obtained from the Caltrans HPMS 2005 Public Road Data (Caltrans 2006). A significant portion of highway VMT may be attributed to employee commute trips within the county. Therefore, the county-wide highway VMT was apportioned by highway miles located in Unincorporated Sacramento County. Approximately 61% of highway miles are located within Unincorporated Sacramento County. Approximately 54% of VMT and associated GHG emissions in Unincorporated Sacramento County are due to travel on highways located in Unincorporated Sacramento County.

See Appendix B for a detailed description of calculations and methodology.

Off-Road Vehicle Emissions

Exhaust emissions from off-road vehicle use for Unincorporated Sacramento County in 2005 amounted to 236,466 metric tons of CO_2e, which represents 3.6% of overall emissions. Emissions were calculated using the California Air Resources Board OFFROAD 2007 air quality model. OFFROAD 2007 considers emissions from off-road equipment including recreational boats, recreational vehicles, industrial equipment, construction equipment, and lawn and garden equipment, as well as equipment dealing with airport ground support, military, agriculture, rail operation, and more (California Air Resources Board 2006). County-wide emissions were apportioned by population in Unincorporated

Sacramento County using California Department of Finance data for 2005 (California Department of Finance 2008).

See Appendix B for a detailed description of calculations and methodology.

Waste Emissions

Approximately 610,772 tons of waste was landfilled by Unincorporated Sacramento County in 2005; 30% of landfilled waste is due to household (residential) disposal, and 70% of landfilled waste is due to business (commercial/industrial) disposal. The CIWMB estimates that only 41% of all generated waste was landfilled in 2005 because the county achieved a diversion rate of 59% for that year (California Integrated Waste Management Board 2008a, 2008b). CH_4 emissions are released to the atmosphere as waste decomposes in the anaerobic environment created by a landfill. Approximately 151,509 metric tons of CO_2e were emitted as a result of landfilling of waste in 2005. An additional 49,841 metric tons of CO_2e were emitted as a result of CH_4 emissions from waste-in-place at landfills located in Unincorporated Sacramento County (including Kiefer Landfill). Net waste emissions were 201,350 metric tons of CO_2e.

Waste emissions were calculated using waste stream profile information from the CIWMB, CH_4 control efficiencies for each landfill accepting waste from the city, and legacy waste-in-place information from the EPA (California Integrated Waste Management Board 2008c, Israel pers. comm., Environmental Protection Agency 1998, 2007).

Appendix B describes in detail the methodology used to quantify these emissions.

Wastewater Treatment Emissions

GHG emissions from domestic wastewater treatment required for Unincorporated Sacramento County in 2005 amounted to 54,391 metric tons of CO_2e, which represents 0.8% of overall emissions. Emissions from this source are included as per capita emissions of CH_4 and N_2O as calculated for the State of California (California Air Resources Board 2008a, 2008b).

Appendix B describes in detail the methodology used to quantify these emissions.

Water-Related Emissions

GHG emissions from electricity and natural gas consumption for water supply and irrigation infrastructure and wastewater collection and treatment facilities required for Unincorporated Sacramento County in 2005 amounted to 22,156 metric tons of CO_2e, which represents 0.3% of overall emissions.

Appendix B describes in detail the methodology used to quantify these emissions.

Agricultural Emissions

Total agricultural emissions for Unincorporated Sacramento County in 2005 were 197,132 metric tons of CO_2e. GHG emissions from enteric fermentation and manure management for cattle and swine, use of fertilizers, and emissions from dairy operations were considered. Agricultural emissions within Unincorporated Sacramento County resulted from cattle and swine enteric fermentation (12,073 metric tons of CO_2e), cattle and swine manure management (7,033 metric tons of CO_2e), dairy operations (114,432 metric tons of CO_2e), and from fertilizer application (63,594 metric tons of CO_2e). See Appendix B for a detailed description of calculations and methodology.

High GWP GHG Emissions

Emissions from high GWP GHGs, including chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs) used as substitutes for ozone-depleting substances, for Unincorporated Sacramento County in 2005 amounted to 228,768 metric tons of CO_2e. Emissions calculated based on the California Air Resources Board per capita estimate for California (California Air Resources Board 2007). Appendix B describes in detail the methodology used to quantify these emissions.

Sacramento International Airport Emissions

Sacramento International Airport is located in Unincorporated Sacramento County. Operations at the airport resulted in 200,404 metric tons of CO_2e in 2005 (County of Sacramento Department of Environmental Review and Assessment 2007). Appendix C describes in detail the methodology used to quantify these emissions.

Government Inventory

The government GHG inventory encompasses emissions from sources under the Sacramento County government's jurisdiction, including government buildings, vehicle fleet, and employee commute, as well as streetlights and water/wastewater treatment and supply within the boundaries of Sacramento County. Although in some cases different data sources were used to develop the government GHG inventory, this inventory is a subset of the Unincorporated

Sacramento County GHG Inventory. The Unincorporated Sacramento County government GHG inventory represents 2.6% of the total Unincorporated Sacramento County GHG Inventory. This percentage is higher than the incorporated governments because the International Airport is a significant source of GHG emissions. Total government GHG emissions by sector are summarized in Table 9-2.

Government-related emissions from Sacramento County in 2005 accounted for 62.1% of overall GHG emissions for Sacramento County governments in 2005. Government emissions range from 42 (Isleton) to 170,818 (Unincorporated Sacramento County) metric tons of CO_2e.

Table 9-2. 2005 Government GHG Emissions for Sacramento County[1]

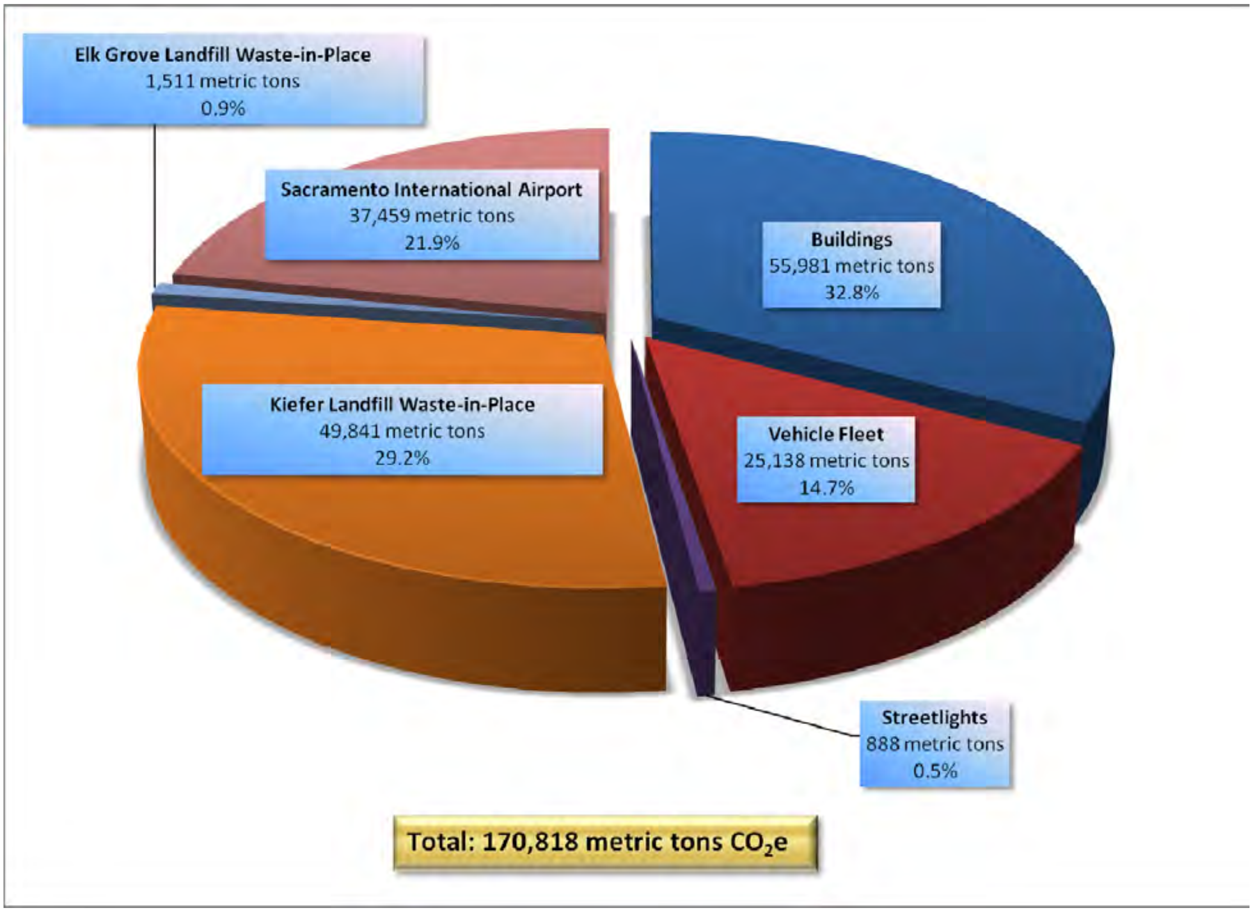
Sector	CO_2e (metric tons)	Percent
Buildings	55,981	32.8
Vehicle Fleet	25,138	14.7
Employee Commute	0	0.0
Streetlights and Traffic Signals	888	0.5
Waste	0	0.0
Kiefer Landfill Waste-in-Place	49,841	29.2
Elk Grove Landfill Waste-in-Place	1,511	0.9
Sacramento International Airport	37,459	21.9
Total	**170,818**	**100.0**

[1] Calculated using the CACP software.

The 2006 CCAR GHG inventory for Sacramento County was used for the government GHG inventory. For government operations beyond the scope of the CCAR report, data was collected from the governments themselves (Barry pers. comm.). Electricity and natural gas consumption for the remaining incorporated governments was supplied by SMUD and PG&E (Ave pers. comm., Bruso pers. comm.). The GHG inventories certified by CCAR only include activity and associated emissions directly managed by Sacramento County. The inventory report has undergone a comprehensive verification and auditing process (Mendonsa pers. comm.). Although the County CCAR report inventories emissions for the year 2006, this data is a good proxy for 2005 emissions because County operations have likely not grown more than 1% (Mendonsa pers. comm.). For these reasons, data supplied by the CCAR-verified reports, instead of data supplied directly by the utilities, were used for the Unincorporated Sacramento County Government GHG Inventory.

Figure 9-3 illustrates the contribution of each sector to the total government emissions for Sacramento County in 2005. For detailed analysis of emissions methodologies for the government sector, refer to Appendix C.

Figure 9-3. Sacramento County Government GHG Emissions for 2005 (metric tons CO_2e)



Buildings

As shown in Table 9-2, GHG emissions from building energy consumption amounted to 55,981 metric tons of CO_2e, which represents 32.8% of total government emissions. Electricity, natural gas, and other fuel consumption for Sacramento County government facilities were obtained from Sacramento County government staff (Mendonsa pers. comm.). Appendix C describes in detail the methodology used to quantify these emissions.

Vehicle Fleet

The fourth largest source of emissions from government operations resulted from use of the vehicle fleet. Vehicle fleet emissions amounted to 25,138 metric tons of CO_2e in 2005, which represents 14.7% of total government emissions for Unincorporated Sacramento County. See Appendix C for a detailed description of calculations and methodology.

Employee Commute

GHG emissions from employee commuting were not quantified for 2005. Based on consultation with ICLEI staff, unless commute data is sufficiently accurate, it should not be included in the inventory because any measures taken to reduce emissions in this sector would not be captured accurately. ICLEI recommends conducting an employee commute survey requesting commute information for 2005, which would be added retroactively to the inventory (Zahner pers. comm.).

Streetlights and Traffic Signals

As Table 9-2 illustrates, electricity consumption of Sacramento County–owned streetlights amounted to 888 metric tons of CO_2e, which represents 0.5% of the total GHG inventory. Electricity use data for Sacramento County streetlights was provided by Dan Mendonsa (Mendonsa pers. comm.). See Appendix C for a detailed description of calculations and methodology.

Waste

Waste generation specific to Sacramento County government facilities could not be separated from total estimated Unincorporated Sacramento County waste generation, and it is unclear whether it will be feasible to capture this data in future inventories. All waste landfilled by Unincorporated Sacramento County, including Sacramento County government waste generation, was included in the Unincorporated Sacramento County GHG inventory. Appendix C describes in detail the methodology used to quantify these emissions.

Kiefer Landfill Waste-in-Place

The Sacramento County government controls Kiefer Landfill. Waste-in-place at Kiefer Landfill in 2005 generated 49,841 metric tons of CO_2e in 2005. Appendix C describes in detail the methodology used to quantify these emissions.

Elk Grove Landfill Waste-in-Place

The Sacramento County government controls the Elk Grove Landfill. Waste-in-place at Elk Grove Landfill in 2005 generated 1,511 metric tons of CO_2e in 2005. Appendix C describes in detail the methodology used to quantify these emissions.

Sacramento International Airport

The Sacramento International Airport is located in Unincorporated Sacramento County and is owned by the Sacramento County government, and is therefore included in the government GHG inventory for Unincorporated Sacramento County (Barry pers. comm.). The county does not have control over aircraft technology (aircraft are regulated by the Federal Aviation Administration) nor over the activity or operations of the airlines. Consequently, GHG emissions from aircraft and ground support equipment were not included in the government GHG inventory. GHG emissions from airport on-site roadways, parking facilities, and off-airport roadways associated with the Sacramento International Airport were included in the Sacramento County government emissions inventory. These operations at the airport resulted in 37,459 metric tons of CO_2e in 2005 (County of Sacramento Department of Environmental Review and Assessment 2007). Appendix C describes in detail the methodology used to quantify these emissions.

Summary

GHG emissions for Unincorporated Sacramento County in 2005 amounted to 6,556,875 metric tons of CO_2e. Per capita emissions were 11.7 metric tons per capita per year, compared to averaged county-wide per capita emissions of 10.0 metric tons and ARB target 2020 goal of 9.7 metric tons. The main sources of GHG emissions in Unincorporated Sacramento County were transportation (3,847,403 metric tons CO_2e from fuel combustion) and buildings (1,803,167 metric tons CO_2e from electricity and natural gas consumption), representing and 58% and 28% of net county-wide emissions respectively.

Government GHG emissions for Unincorporated Sacramento County amounted to 170,818 metric tons of CO_2e in 2005. The main sources of GHG emissions for government operations were buildings (55,981 metric tons CO_2e from electricity and natural gas consumption) and Kiefer Landfill (49,841 metric tons CO_2e from methane), representing 33% and 29% of net government emissions respectively.

Chapter 10
Greenhouse Gas Emissions Inventory for Sacramento County

Introduction

In recognition of the rising concern over the threat of climate change, Sacramento County, along with all incorporated cities within Sacramento County, opted to join the International Council for Local Environmental Initiatives (ICLEI) program. The county committed to conduct an inventory of emissions within its jurisdiction as part of a county-wide effort to account for GHG emissions generated with Sacramento County. The county-wide inventory includes GHG emissions generated in the incorporated and Unincorporated Sacramento County. The inventory, described in detail in this chapter, is the first step in an effort to reduce GHG emissions. These efforts to reduce emissions are consistent with State policy and current regulation from AB 32 directing the State of California to reduce GHG emissions to1990 levels by 2020.

Sacramento County, one of the original 27 counties of the State of California, covers approximately 994 square miles and has a population of 1,424,415 (County of Sacramento 2009h; County of Sacramento 2009i). Sacramento County contains the incorporated cities of Sacramento, Citrus Heights, Elk Grove, Folsom, Rancho Cordova, Galt and Isleton. A large portion of Sacramento County remains unincorporated. Sacramento County is home to the State Capitol, Sacramento International Airport, and several professional sports teams.

The Sacramento International Airport lies within Unincorporated Sacramento County and is a large source of government GHG emissions. Most agricultural activities that occur within the county are located in Unincorporated Sacramento County. The most common agricultural products include milk, wine grapes, Bartlett pears, field corn, and turkeys (Sacramento County 2009h).

The majority of GHG emissions are produced through the burning of fossil fuels. The Sacramento County GHG Inventory includes GHG emissions from direct and indirect sources. A direct emission source is defined as an on-site source of emissions such as the combustion of fossil fuel in a vehicle engine. An indirect emission source is defined as an emissions source generated offsite as a result of county operation, such as electricity consumption.

GHG emissions were inventoried for all operations within the Sacramento County geographical boundaries. The Sacramento County GHG Inventory includes GHG emissions from residential, commercial, industrial, transportation, and waste sectors. The county government GHG inventory is described separately, and is a subset of the Sacramento County GHG Inventory. The government analysis divides emissions among buildings, vehicle fleet, employee commute, streetlights, and waste sectors.

Results

County Inventory

The Sacramento County GHG Inventory encompasses emissions from commercial, industrial, and residential activities within the boundaries of the County.

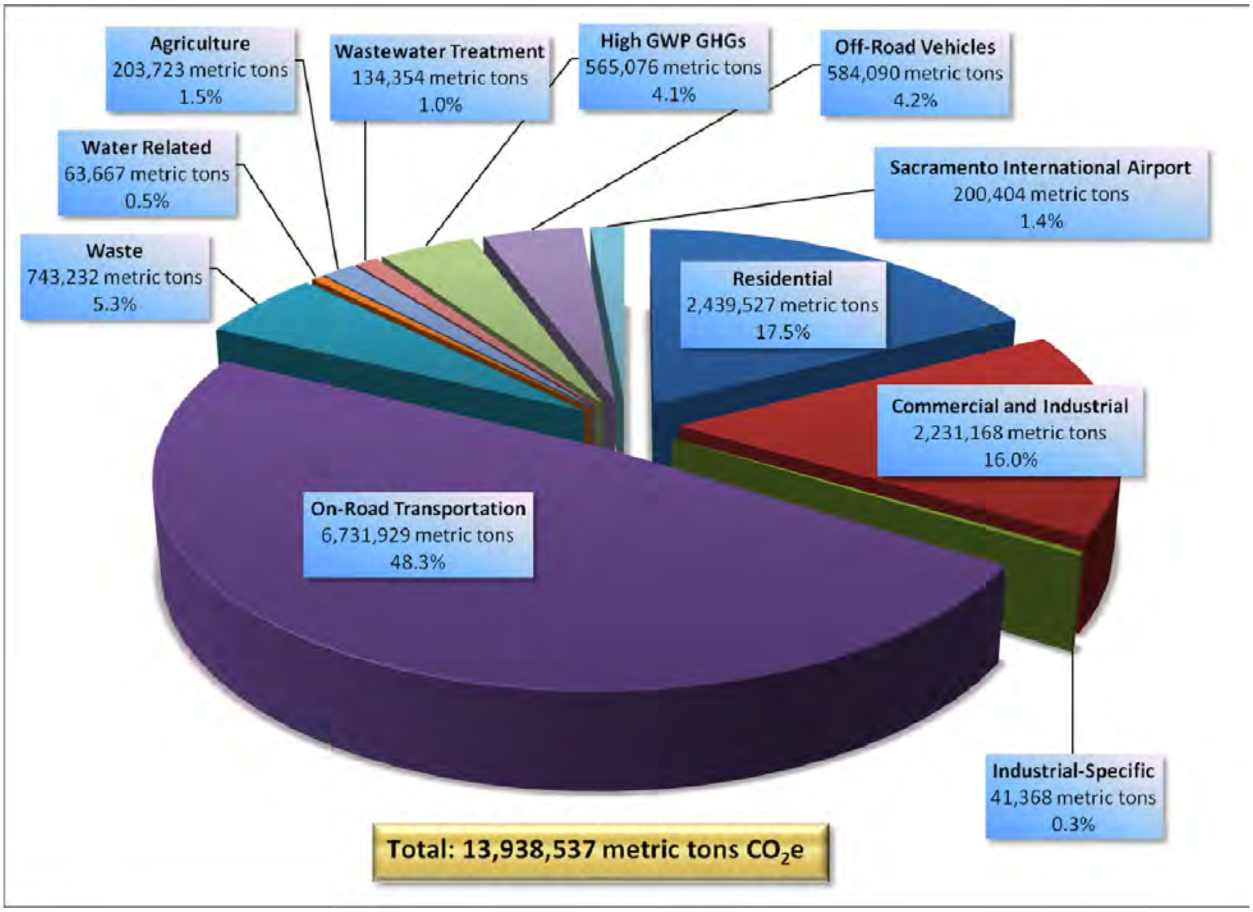
Table 10-1 quantifies the contributions of each sector to total 2005 emissions for Sacramento County. Figure 10-1 illustrates each sector's contribution to total emissions. On-road transportation accounted for 48.3% of overall emissions and is the largest contributing sector to overall emissions.

Table 10-1. 2005 GHG Emissions for Sacramento County[1]

Sector	CO_2e (metric tons)	Percent
Residential	2,439,527	17.5
Commercial and Industrial	2,231,168	16.0
Industrial Specific	41,369	0.3
On-Road Transportation	6,731,929	48.3
Off-Road Vehicle Use	584,090	4.2
Waste	743,232	5.3
Wastewater Treatment	134,354	1.0
Water-Related	63,667	0.5
Agriculture	203,723	1.5
High GWP GHGs	565,076	4.1
Sacramento International Airport	200,404	1.4
Total	**13,938,537**	**100.0**

[1] Calculated using CACP software (Appendix A). The total may not be the exact sum of emissions due to rounding.

Figure 10-1. Sacramento County-Wide GHG Emissions for 2005 (metric tons CO_2e)



Total GHG emissions in 2005 for Sacramento County amounted to 13,938,537 metric tons of CO_2e. Figure 10-2 and 10-3 show the contribution of each fuel type and emissions source to overall GHG emissions. Electricity, natural gas, gasoline, and diesel are the largest overall contributors to GHG emissions in Sacramento County.

Figure 10-2. Sacramento County GHG Emissions for 2005 by Source (metric tons CO_2e)

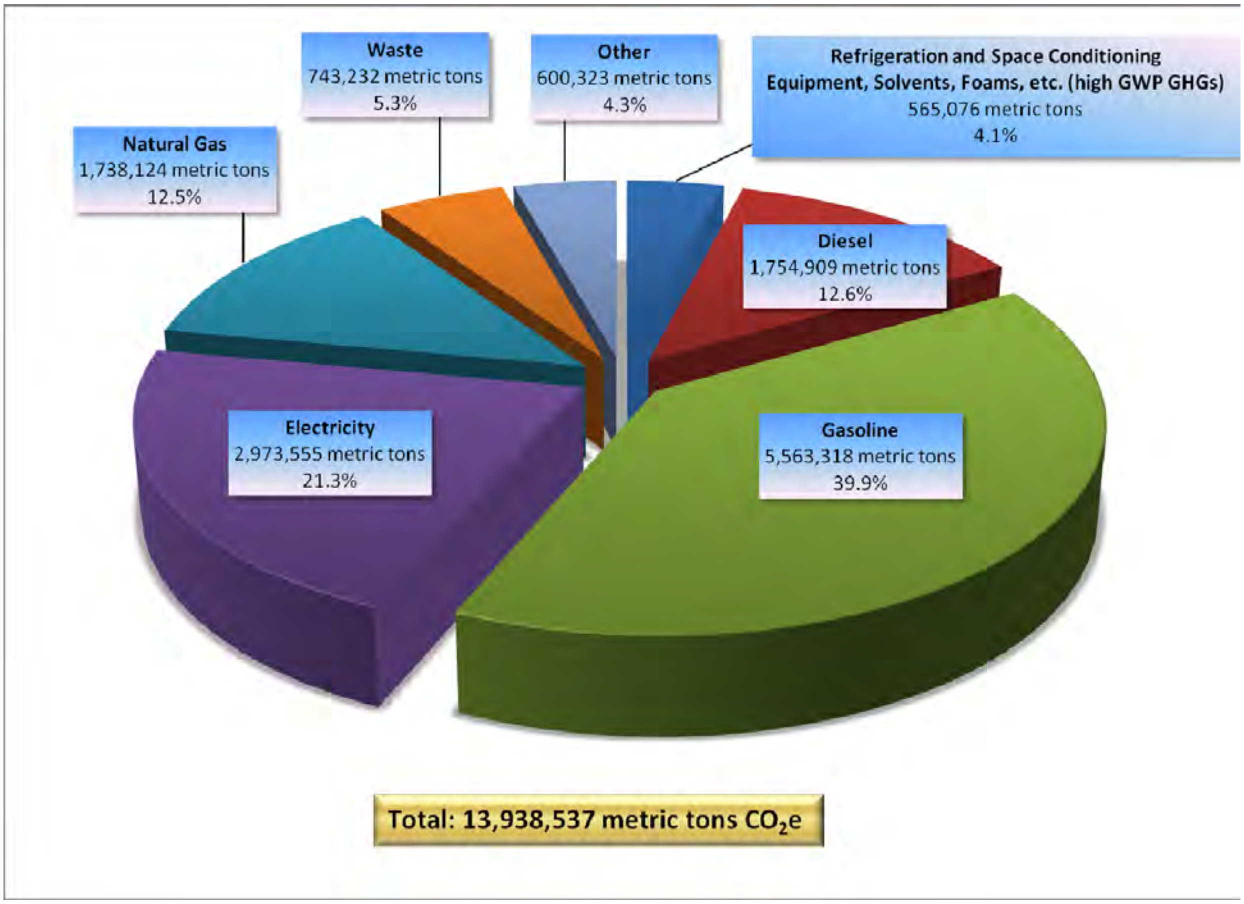
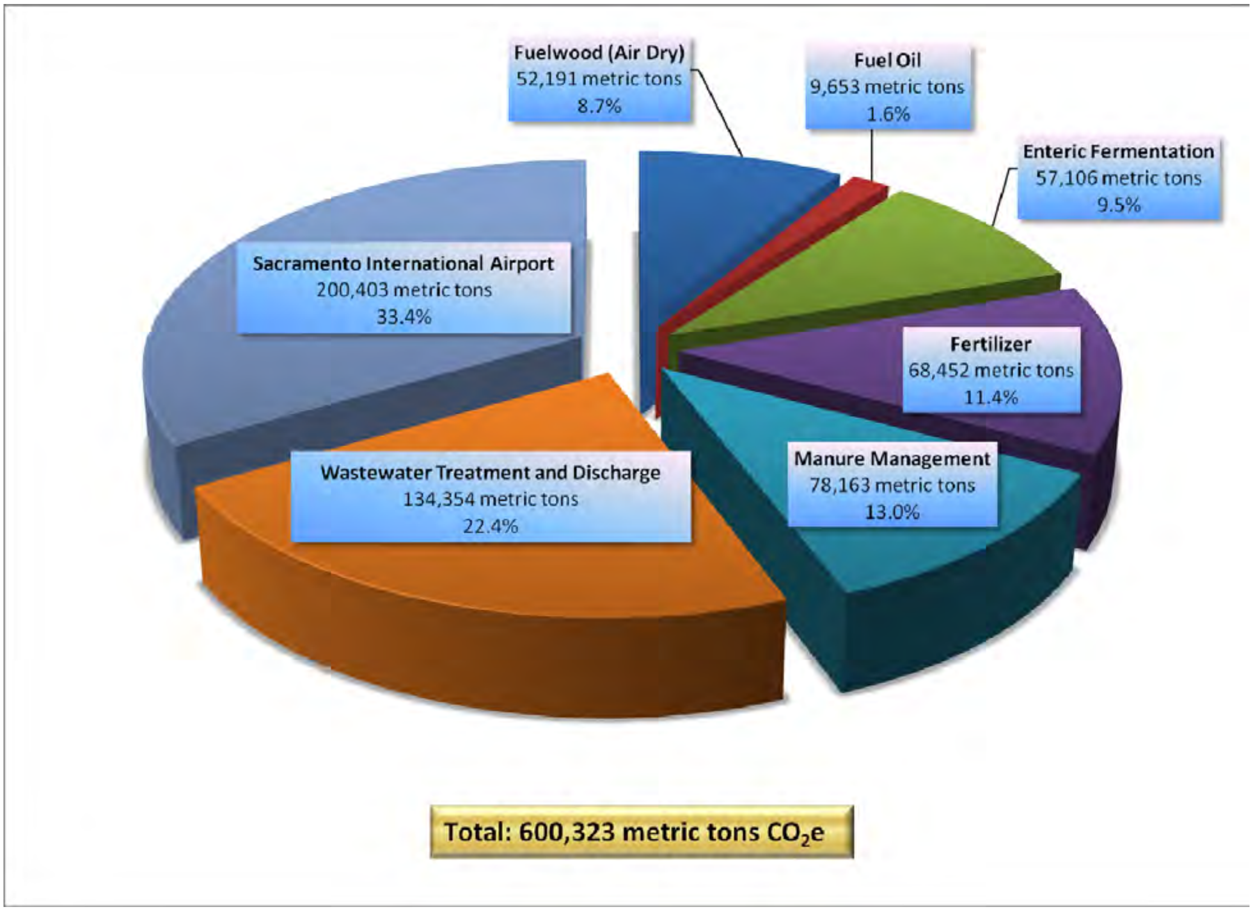


Figure 10-3. Sacramento County GHG Emissions for 2005 by Source for "Other" Emissions (metric tons CO_2e)



Sacramento County 2005 per capita GHG emissions are 10.0 metric tons per capita per year. Figure ES-5 compares 2005 per capita emissions for the cities, Sacramento County, and Unincorporated Sacramento County. City-wide emissions range from 20,382 (Isleton) to 6,556,875 (Unincorporated Sacramento County) metric tons of CO_2e, and per capita emissions range from 6.4 (Elk Grove) to 11.7 (Unincorporated Sacramento County) metric tons of CO_2e.

The sum of GHG emissions from each city is 13,890,792 metric tons of CO_2e, which does not equal Sacramento County emissions precisely. The 0.3% difference is due to two major factors: 1) additional industrial fuel use for Sacramento County provided by the SMAQMD was not separated by city and represents an extra 10,608 metric tons of CO_2e; 2) aggregated waste stream profile from the CIWMB, the weighted CH_4 capture percentage used for Sacramento County waste generation, and varying reporting years for waste profile data provided by the CIWMB, representing an extra 36,888 metric tons of CO_2e. See Appendix B for further discussion.

A discussion of Sacramento County GHG emissions for each major sector is provided below. For detailed analysis of emissions inventory methodologies, see Appendix B.

Residential Emissions

As shown in Table 10-1, residential GHG emissions for Sacramento County in 2005 amounted to 2,439,527 metric tons of CO_2e, which represents 17.5% of total emissions.

Residential-sector GHG emissions mainly result from household use of electricity and natural gas. Residential emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E. Residential GHG emissions also include CH_4 and N_2O emissions residential wood burning in Sacramento County residences. GHG emissions from residential wood burning were quantified using data from the SMAQMD (SMAQMD 2007).

Emissions were quantified using CACP emission factors. Wood-burning contributions to GHG emissions were included because the SMAQMD introduced a wood stove change-out incentive program in Sacramento County that may reduce GHG emissions from wood burning (SMAQMD 2007).

Residential use of self-generated energy through the consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified due to a lack of available data. It is expected that the GHG emissions from these sources are negligible. High GWP gases partially originate from the residential sector but are included in a separate category below. See Appendix B for a detailed description of calculations and methodology.

Commercial and Industrial Emissions

The commercial and industrial sector are combined because both SMUD and PG&E aggregate energy use data from these two sectors into their “commercial” sector. As shown in Table 10-1, commercial and industrial GHG emissions for Sacramento County in 2005 amounted to 2,231,168 metric tons of CO_2e, which represents 16.0% of total emissions in 2005. This sector of GHG emissions mainly result from consumption of electricity and natural gas by commercial and industrial buildings. Commercial and industrial GHG emissions were calculated from electricity and natural gas consumption data provided by SMUD and PG&E.

Energy generated through the commercial and industrial consumption of kerosene, propane, fuel oil, individual diesel generators, and bottled natural gas could not be quantified. Appendix B describes in detail the methodology used to quantify these emissions.

Industrial Specific Emissions

Industrial-sector GHG emissions mainly result from consumption of electricity and natural gas by industrial buildings. As discussed above, most GHG emissions from the industrial sector are included in the commercial and industrial category. The following data represents industrial activity only.

Major industrial sources in the City of Sacramento include the SMUD power plants, UC Davis Medical Center, and the Sacramento Cogeneration and Power Authority. The majority of industrial emissions are related to energy generation, and are accounted for in the emission factors for electricity supplied by SMUD and PG&E.

Approximately 41,369 metric tons of CO_2e were emitted as a result of industrial operations in Sacramento County in 2005. Industrial energy and fuel consumption was provided by SMUD and the SMAQMD (Bruso pers. comm., Quinn pers. comm.).

According to the utilities, natural gas combustion data from the SMAQMD was included in PG&E’s commercial plus industrial category. Fuel combustion related to power plants is accounted for in the electricity emission factors used in this inventory for each sector (Ave pers. comm., Bartholomy pers. comm.). Total GHG emissions from non–power plant industrial fuel use reported by the SMAQMD are 89,808 metric tons of CO_2e, and total GHG emissions from all industrial fuel use reported by the SMAQMD are 1,188,276 metric tons CO_2e. If emissions from non–power plant fuel use were subtracted from the commercial and industrial sector and added to the industrial-specific sector, industrial emissions would represent 0.9% of total emissions (versus 0.3%). See Appendix B for detailed discussion of industrial sources.

Companies that fall within the industrial sector may, by law, choose not to disclose energy use. In that case, energy consumed by the industrial sector may be included in the commercial sector to maintain confidentiality. See Appendix B for a detailed description of commercial and industrial emissions.

On-Road Transportation Emissions

GHG emissions from on-road transportation for Sacramento County in 2005 amounted to 6,731,929 metric tons of CO_2e, which represents 48.3% of total emissions. Emissions from on-road vehicle use, including heavy-duty trucks and buses, were quantified using average annual VMT for Sacramento County in 2005. VMT data for 2005 was obtained from the Caltrans HPMS 2005 Public Road Data (Caltrans 2006).

A significant portion of highway VMT may be attributed to employee commute trips within the county. Therefore, the county-wide highway VMT was included in the transportation sector. Approximately 47.2% of VMT and associated transportation GHG emissions within Sacramento County are due to highway travel.

See Appendix B for a detailed description of calculations and methodology.

Off-Road Vehicle Emissions

Exhaust emissions from off-road vehicle use for Sacramento County in 2005 amounted to 584,090 metric tons of CO_2e, which represents 4.2% of overall emissions. Emissions were calculated using the California Air Resources Board OFFROAD 2007 air quality model. OFFROAD 2007 considers emissions from off-road equipment, including recreational boats, recreational vehicles, industrial equipment, construction equipment, and lawn and garden equipment, as well as equipment dealing with airport ground support, military, agriculture, rail operation, and more (California Air Resources Board 2006).

See Appendix B for a detailed description of calculations and methodology.

Waste Emissions

Approximately 1,654,571 tons of waste was landfilled by Sacramento County in 2005; 30% of landfilled waste is due to household (residential) disposal, and 70% of landfilled waste is due to business (commercial/industrial) disposal. The CIWMB estimates that only 50% of all generated waste was landfilled in 2005 because Citrus Heights achieved a diversion rate of 50% for that year (California Integrated Waste Management Board 2008a, 2008b). CH_4 emissions are released to the atmosphere as waste decomposes in the anaerobic environment created by a landfill. CH_4 emissions are released to the atmosphere as waste decomposes in the anaerobic environment created by a landfill. Approximately 654,139 metric tons of CO_2e were emitted as a result of landfilling of waste in 2005. An additional 89,093 metric tons of CO_2e were emitted as a result of methane emissions from waste-in-place at landfills located in Sacramento County (including Dixon Pit, Kiefer, L&D landfill, Elk Grove and Sacramento City). Net waste emissions were 743,232 metric tons of CO_2e.

Waste emissions were calculated using waste stream profile information from the CIWMB, CH_4 control efficiencies for each landfill accepting waste from the city, and legacy waste-in-place information from the Environmental Protection Agency (California Integrated Waste Management Board 2008c, Israel pers. comm., Environmental Protection Agency 1998, 2007).

Appendix B describes in detail the methodology used to quantify these emissions.

Wastewater Treatment Emissions

GHG emissions from domestic wastewater treatment required for Sacramento County in 2005 amounted to 134,354 metric tons of CO_2e, which represents 1.0% of overall emissions. Emissions from this source are included as per capita emissions of CH_4 and N_2O as calculated for the State of California (California Air Resources Board 2008a, 2008b).

Appendix B describes in detail the methodology used to quantify these emissions.

Water-Related Emissions

GHG emissions from electricity and natural gas consumption for water supply and irrigation infrastructure and wastewater collection and treatment facilities required for the City of Sacramento County in 2005 amounted to 63,667 metric tons of CO_2e, which represents 0.5% of overall emissions.

Appendix B describes in detail the methodology used to quantify these emissions.

Agricultural Emissions

Total agricultural emissions for Sacramento County in 2005 were 203,723 metric tons of CO_2e. GHG emissions from enteric fermentation and manure management for cattle and swine, use of fertilizers, and emissions from dairy operations were considered. Agricultural emissions within the county resulted from cattle and swine enteric fermentation (13,168 metric tons of CO_2e), cattle and swine manure management (7,671 metric tons of CO_2e), dairy operations (114,432 metric tons of CO_2e), and from fertilizer application (68,452 metric tons of CO_2e). See Appendix B for a detailed description of calculations and methodology.

High GWP GHG Emissions

Emissions from high GWP GHGs, including chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs) used as substitutes for ozone-depleting substances, for Sacramento County in 2005 amounted to 565,076 metric tons of CO_2e. Emissions calculated based on the California Air Resources Board per capita estimate for California (California Air Resources Board 2007). Appendix B describes in detail the methodology used to quantify these emissions.

Sacramento International Airport Emissions

Sacramento International Airport is located in Unincorporated Sacramento County. Operations at the airport resulted in 200,404 metric tons of CO_2e in 2005 (County of Sacramento Department of Environmental Review and Assessment 2007). Appendix B describes in detail the methodology used to quantify these emissions.

Government Inventory

The government GHG inventory encompasses emissions from sources under the jurisdiction of each government in Sacramento County, including government buildings, vehicle fleet, and employee commute, as well as streetlights and water/wastewater treatment and supply within the boundaries of Sacramento County . Although in some cases different data sources were used to develop the government GHG inventory, this inventory is a subset of the Sacramento County GHG Inventory. The Sacramento County government GHG inventory represents 2% of the total Sacramento County GHG Inventory. Total government GHG emissions by sector are summarized in Table 10-2.

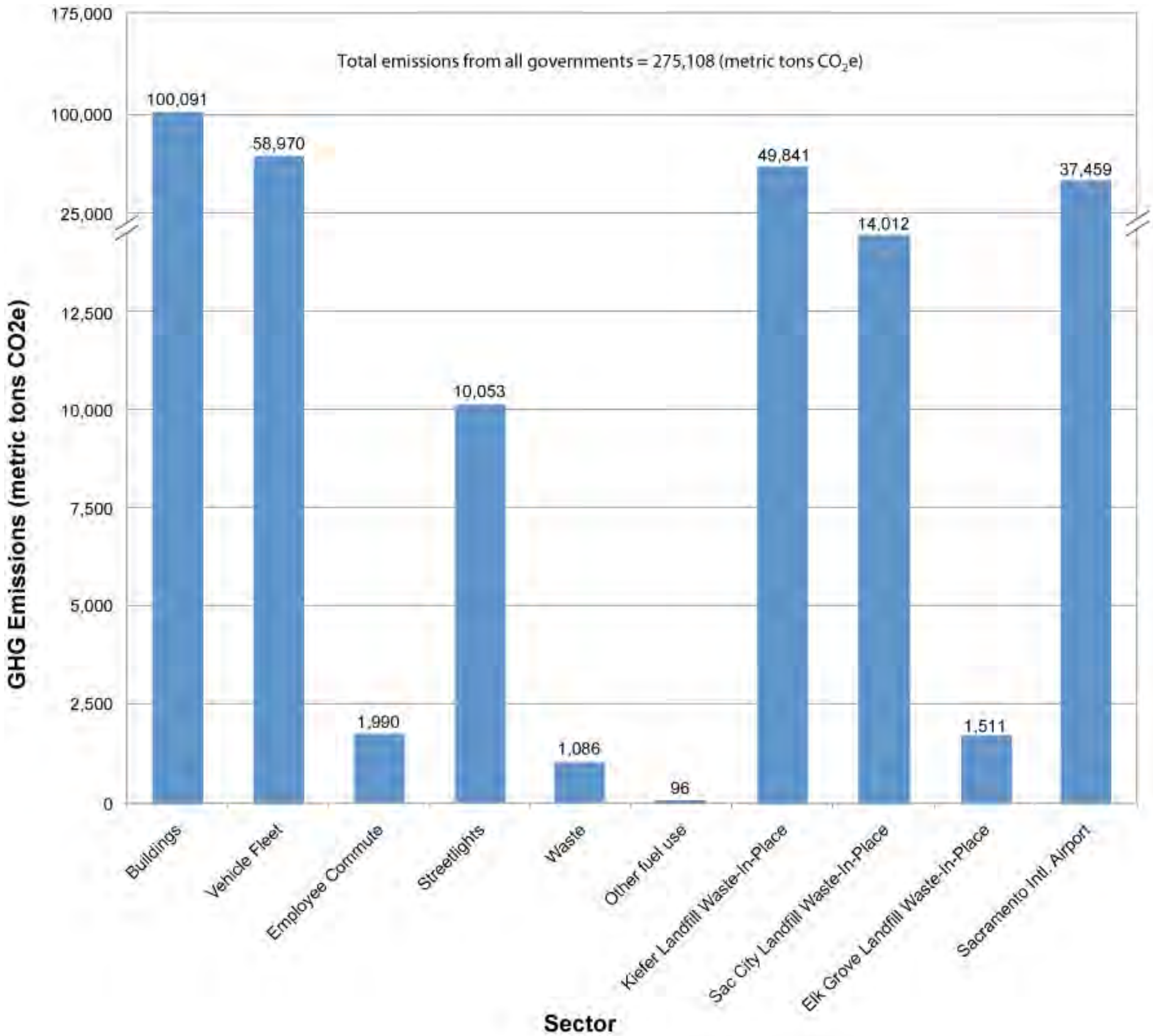
Table 10-2. 2005 Government GHG Emissions for Sacramento County[1]

Sector	CO_2e (metric tons)	Percent
Buildings	100,091	36.4
Vehicle Fleet	58,970	21.4
Employee Commute	1,990	0.7
Streetlights and Traffic Signals	10,053	3.7
Waste	1,086	0.4
Kiefer Landfill Waste-in-Place	49,841	0.03
Sac City Landfill Waste-in-Place	14,012	18.1
Elk Grove Landfill Waste-in-Place	1,511	5.1
Sacramento International Airport	37,459	0.5
Other Fuel Use	96	13.6
Total	**275,108**	**100.0**

[1] Calculated using CACP software.

Figure 10-4 illustrates the contribution of each sector to the total government emissions for Sacramento County in 2005. For detailed analysis of emissions methodologies for the government sector, see Appendix C.

Figure 10-4. Sacramento County Government GHG Emissions for 2005 by Sector (metric tons CO_2e)



Buildings

As shown in Table 10-2, GHG emissions from building energy consumption amounted to 100,091 metric tons of CO_2e, which represents 22.9% of total government emissions. Appendix C describes in detail the methodology used to quantify these emissions.

Vehicle Fleet

Vehicle fleet emissions amounted to 58,970 metric tons of CO_2e in 2005. See Appendix C for a detailed description of calculations and methodology.

Employee Commute

GHG emissions from employee commuting amounted to 1,990 metric tons of CO_2e, which represents 0.5% of total government emissions. Employee commutes were not quantified for Folsom, Isleton, Unincorporated Sacramento County, and the City of Sacramento. Appendix C describes in detail the methodology used to quantify these emissions.

Streetlights and Traffic Signals

As Table 10-2 illustrates, electricity consumption of Sacramento County–owned streetlights amounted to 10,053 metric tons of CO_2e, which represents 2.3% of the total government emissions inventory. Electricity use for Sacramento County streetlights and traffic signals was provided by SMUD (Ave pers. comm.). See Appendix C for a detailed description of calculations and methodology.

Waste

GHG emissions from waste generation specific to government facilities amounted to 1,086 metric tons of CO_2e, which represents 0.2% of total government emissions. Waste generation specific to Rancho Cordova, Sacramento, Folsom, Isleton, and Unincorporated Sacramento County government facilities could not be separated from total estimated Sacramento County waste generation, and it is unclear whether it will be feasible to capture this data in future inventories. All waste landfilled by Sacramento County, including county government waste generation, was included in the Sacramento County GHG inventory. Appendix C describes in detail the methodology used to quantify these emissions.

Kiefer Landfill Waste-in-Place

The Sacramento County government controls Kiefer Landfill. Waste-in-place at Kiefer Landfill in 2005 generated 49,841 metric tons of CO_2e in 2005. Appendix C describes in detail the methodology used to quantify these emissions.

Sacramento City Landfill Waste-in-Place

The Sacramento City government controls the Sacramento City Landfill. Waste-in-place at Sacramento City Landfill in 2005 generated 14,012 metric tons of CO_2e in 2005. Appendix C describes in detail the methodology used to quantify these emissions.

Elk Grove Landfill Waste-in-Place

The Sacramento County government controls the Elk Grove Landfill. Waste-in-place at Elk Grove Landfill in 2005 generated 1,511 metric tons of CO_2e in 2005. Appendix C describes in detail the methodology used to quantify these emissions.

Sacramento International Airport

The Sacramento International Airport is located in Unincorporated Sacramento County and is owned by the Sacramento County government, and is therefore included in the government GHG inventory for Unincorporated Sacramento County (Barry pers. comm.). The county does not have control over aircraft technology (aircraft are regulated by the Federal Aviation Administration nor over the activity or operations of the airlines. Consequently, GHG emissions from aircraft and ground support equipment were not included in the government GHG inventory. GHG emissions from airport on-site roadways, parking facilities, and off-airport roadways associated with the Sacramento International Airport were included in the Sacramento County government emissions inventory. These operations at the airport resulted in 37,459 metric tons of CO_2e in 2005 (County of Sacramento Department of Environmental Review and Assessment 2007). Appendix C describes in detail the methodology used to quantify these emissions.

Summary

GHG emissions for Sacramento County in 2005 amounted to 13,938,537 metric tons of CO_2e. Per capita emissions were 10.0 metric tons per capita per year. The main sources of GHG emissions in the County of Sacramento were transportation (7,316,019 metric tons CO_2e from fuel combustion) and buildings (4,670,695 metric tons CO_2e from electricity and natural gas consumption), representing 53% and 34% of net county-wide emissions respectively[11].

[11] Total emissions for the county are 0.3% more than the sum of emissions from each jurisdiction. This is due to two major factors: 1) additional industrial fuel use for the County of Sacramento provided by the Sacramento Metropolitan Air Quality Management District (SMAQMD) not separated by city; 2) aggregated waste data from the California Integrated Waste Management Board (CIWMB). See Appendix B for further discussion.

Government GHG emissions for Sacramento County amounted to 275,108 metric tons of CO_2e in 2005. The main sources of GHG emissions for government operations were buildings (100,091 metric tons CO_2e from electricity and natural gas consumption) and the vehicle fleet (58,970 metric tons CO_2e from fuel combustion), representing 36% and 21% of net government emissions respectively.

Chapter 11
Recommendations

City and County Data Limitations and Recommendations

Several emissions sources require further review as part of a future inventory update, including: light rail activity, agricultural activities, high GWP GHG emissions, domestic wastewater treatment and discharge, on-road transportation, and off-road equipment. These are sources that were either 1) not disaggregated by city inventory or 2) require county-specific information to improve accuracy. Future updates to the baseline emissions inventory should address the following specific recommendations.

Emissions from light rail activities were quantified but are not allocated by jurisdiction and are not presented in the main inventory due to the utilities' reporting systems and concerns over accurately apportioning emissions across jurisdictions. These light rail emissions, which are not allocated by jurisdiction, are presented in Appendix B. These emissions were instead attributed to county-wide emissions. Access to light rail energy consumption data will require cooperation with Sacramento Regional Transit and allocation of sufficient resources for collection and analysis.

Several source sectors require refinement so as to be more useful to emission reduction planning. These categories include: agricultural activities, high GWP GHG emissions, domestic wastewater treatment and discharge, on-road transportation and off-road equipment. Recommended improvements to these categories primarily include refinement of estimates based on statewide data, and are discussed in detail below.

Emissions from some agricultural activities (i.e., manure management and soil and crop management) were estimated based on available farmland acreage and state-wide average emission factors because area-specific agricultural data for Sacramento County was unavailable.[12] County-specific data on fertilizer consumption, manure management practices, and soil management is needed to improve the emissions methodologies for these activities. This information is not currently collected within Sacramento County and may require cooperation with UC Davis, as well as local surveys of farming and ranchland practices to obtain necessary data for emissions calculations.

[12] See Appendix B for a discussion of agricultural emissions methodology.

Emissions from high GWP GHGs used as replacements for ozone-depleting substances were estimated based on statewide average emission factors because area-specific data for Sacramento County was unavailable. Tracking the purchase and consumption of these substances is required to utilize specific emissions quantification methodologies. This information is not currently collected within Sacramento County and may require cooperation with the ARB and the SCAQMD, as well as local surveys of consumption to obtain necessary data for emissions calculations.

Emissions from domestic wastewater treatment and discharge were also based on per capita statewide averages. Area-specific data on wastewater treatment plants within Sacramento County is required to estimate more precise emissions from these plants. Obtaining this data may be time consuming and cost prohibitive, however, unless reporting procedures are initiated to facilitate this data collection.

The CACP software was used to calculate emissions from on-road vehicles. The CACP default vehicle fleet mix, fuel efficiencies, and emission factors reflect national average information which may differ from vehicle characteristics in Sacramento County. Alternate approaches to calculating emissions from on-road vehicles using the Sacramento County-specific vehicle mix from the ARB's EMFAC model or using vehicle data (including VMT) collected by SACOG could improve the emissions inventory. Because the fleet mix in Sacramento County adheres to California standards, it is likely more efficient than the national average, the emissions calculated using CACP are likely a conservative estimate. Based on rough calculations, we estimate the difference to be less than 5% for the on-road transportation emissions, an approximate 2% difference for the overall county-wide and city-wide emissions.

Emissions from off-road equipment are reported by gas rather than by fuel source. For a more accurate fuel source breakdown of emissions, the future inventories should also quantify off-road emissions by equipment type. This additional data collection and analysis would not change the overall GHG emissions associated with off-road equipment emissions, but it would allow for more accurate accounting of this source. In addition, off-road emissions were apportioned by population to each jurisdiction because off-road activity data is not readily available on a scale smaller than the county. Area-specific data on off-road activity is required to estimate more precise emissions from off-road equipment.

Finally, energy consumption data for wastewater collection and treatment services provided by SRCSD and SASD was disaggregated by jurisdiction using population served; additional energy consumption for irrigation, water supply, and sewage treatment was estimated using NAICS codes. A bottom-up approach to this sector would involve cooperation and data gathering efforts with the many water purveyors' energy consumption and a better understanding of the supply boundaries. Future efforts should consider appropriate jurisdictional boundaries and address data needs accordingly.

Government Limitations and Recommendations

Although considerable efforts were made to accurately account for all significant GHG emissions resulting from government operations, in some cases data was not available. For example, Sacramento, Folsom, Isleton, and Sacramento County governments did not provide employee commute data. For future inventory updates, emissions associated with government employee commute trips can be determined through an employee commute survey. Default emissions estimates were not attempted because of the range in reported emissions for this category from the cities that reported this data (i.e., emissions from these trips represents 5 to 35 percent of the municipal government emissions). The range in the absolute estimated commute emissions for the various cities results from differences in the number of employees and length of commute trips; therefore, emissions from this government sector are difficult to estimate without survey data.

Waste generation data for the Sacramento, Isleton, and county governments was unavailable due to insufficient data. These governments’ waste is aggregated with community waste and recorded as total waste collected. For future efforts, government waste generation data could be collected internally and maintained by a centralized source. In addition because the waste stream profile (i.e., the composition of waste) can vary widely by government facility, specific facility-specific waste stream profiles should be established through the waste services provider or developed by a county/city representative. Waste generation represents 1 to 7 percent of the municipal government emissions for cities which provided waste data.

The LGOP recommends that government operations inventories include fugitive emissions from refrigerants and fire suppression equipment from buildings and facilities as well as vehicles. Because the city and county governments do not track use of refrigerants, fire suppression substances, and other substances that result in high GWP GHG emissions, high GWP GHG emissions from these and other uses in Sacramento County are included in the city-wide inventories and estimated based on per-capita averages provided by the ARB as discussed in the methodology. For future efforts, data regarding HFC-using equipment including HFC storage, purchases, sales, and equipment charging and capacity could be collected internally and maintained by a centralized source within each government.

Appendix A
CACP Detailed Output Report

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential			
Citrus Heights, CA			
Residential			
Electricity	93,472	16.2	1,100,491
Natural Gas	63,684	11.0	1,186,642
Fuelwood (Air Dry)	3,273	0.6	412,101
Subtotal Residential	160,429	27.7	2,699,234
Subtotal Residential	160,429	27.7	2,699,234
Commercial			
Citrus Heights, CA			
Commercial (Non-Water)			
Electricity	50,766	8.8	597,685
Natural Gas	11,787	2.0	219,640
Subtotal Commercial (Non-Water)	62,553	10.8	817,325
Irrigation Systems			
Electricity	78	0.0	913
Subtotal Irrigation Systems	78	0.0	913
Sewage Treatment Facilities			
Electricity	2,422	0.4	28,518
Natural Gas	6	0.0	111
Subtotal Sewage Treatment Facilities	2,428	0.4	28,629
Water Supply			
Electricity	824	0.1	9,702
Subtotal Water Supply	824	0.1	9,702
Subtotal Commercial	65,883	11.4	856,569

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Industrial			
Citrus Heights, CA			
Wastewater Treatment and Collection fuel combustion			
Stationary Gasoline	68	0.0	947
Stationary Diesel	127	0.0	1,512
Subtotal Wastewater Treatment and Collection fuel combustion		0.0	2,460
Subtotal Industrial	195	0.0	2,460
Transportation			
Citrus Heights, CA			
Transportation			
Gasoline	200,006	34.6	2,739,969
Diesel	47,457	8.2	565,119
Subtotal Transportation	247,463	42.8	3,305,088
Subtotal Transportation	247,463	42.8	3,305,088
Waste			
Citrus Heights, CA			
Community Waste			*Disposal Method - Managed Landfill*
Paper Products	16,385	2.8	
Food Waste	5,455	0.9	
Plant Debris	1,430	0.2	
Wood/Textiles	408	0.1	
Subtotal Community Waste	23,679	4.1	
Subtotal Waste	23,679	4.1	

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Other			
Citrus Heights, CA			
Domestic Wastewater Treatment and Discharge			
Nitrous Oxide	2,570	0.4	
Methane	5,855	1.0	
Subtotal Domestic Wastewater Treatment and Discharge		1.5	
High GWP GHGs			
Carbon Dioxide	35,433	6.1	
Subtotal High GWP GHGs	35,433	6.1	
Offroad Emissions			
Carbon Dioxide	35,382	6.1	
Nitrous Oxide	914	0.2	
Methane	331	0.1	
Subtotal Offroad Emissions	36,627	6.3	
Subtotal Other	80,485	13.9	
Total	578,133	100.0	6,863,350

Citrus Heights

Community Greenhouse Gas Emissions in 2005

Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential	160,429	27.7	2,699,234
Commercial	65,883	11.4	856,569
Industrial	195	0.0	2,460
Transportation	247,463	42.8	3,305,088
Waste	23,679	4.1	
Other	80,485	13.9	
Total	578,133	100.0	6,863,350

This report has been generated for Citrus Heights, CA using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Government Greenhouse Gas Emissions in 2007
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings				
Citrus Heights, CA				
Government Facilities				
Electricity	551	18.9	5,633	0
Natural Gas	115	4.0	2,148	0
Subtotal Government Facilities	666	22.9	7,782	0
Subtotal Buildings	666	22.9	7,782	0
Vehicle Fleet				
Citrus Heights, CA				
Fullsize Government Vehicles				
Gasoline	130	4.5	1,788	0
Subtotal Fullsize Government Vehicles	130	4.5	1,788	0
Heavy Truck				
Gasoline	2	0.1	27	0
Subtotal Heavy Truck	2	0.1	27	0
Light Pickup Government Vehicles				
Gasoline	18	0.6	254	0
Subtotal Light Pickup Government Vehicles	18	0.6	254	0
Midsize Government Vehicles				
Gasoline	3	0.1	39	0
Subtotal Midsize Government Vehicles	3	0.1	39	0
Motorcycle Government Vehicles				
Gasoline	4	0.1	61	0
Subtotal Motorcycle Government Vehicles	4	0.1	61	0

Government Greenhouse Gas Emissions in 2007
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Van Government Vehicles				
Gasoline	1	0.0	11	0
Subtotal Van Government Vehicles	1	0.0	11	0
Subtotal Vehicle Fleet	158	5.4	2,178	0
Employee Commute				
Citrus Heights, CA				
Employee Commute				
Gasoline	1,044	35.8	14,371	
Subtotal Employee Commute	1,044	35.8	14,371	
Subtotal Employee Commute	1,044	35.8	14,371	
Streetlights				
Citrus Heights, CA				
Street Lights				
Electricity	950	32.6	9,716	0
Subtotal Street Lights	950	32.6	9,716	0
Traffic Signals				
Electricity	54	1.9	553	0
Subtotal Traffic Signals	54	1.9	553	0
Subtotal Streetlights	1,004	34.5	10,269	0
Waste				
Citrus Heights, CA				
Government Trash			*Disposal Method - Managed Landfill*	
Paper Products	19	0.7		0
Food Waste	6	0.2		0
Plant Debris	1	0.0		0

Government Greenhouse Gas Emissions in 2007
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Wood/Textiles	1	0.0		0
Subtotal Government Trash	28	1.0		0
Subtotal Waste	28	1.0		0
Other				
Citrus Heights, CA				
Diesel Generator				
Carbon Dioxide	15	0.5		
Subtotal Diesel Generator	15	0.5		
Subtotal Other	15	0.5		
Total	2,915	100.0	34,600	0

Citrus Heights

Government Greenhouse Gas Emissions in 2007
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings	666	22.9	7,782	0
Vehicle Fleet	158	5.4	2,178	0
Employee Commute	1,044	35.8	14,371	
Streetlights	1,004	34.5	10,269	0
Waste	28	1.0		0
Other	15	0.5		
Total	2,915	100.0	34,600	0

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential			
Sacramento County, CA			
Wood Burning Emissions 2005			
Fuelwood (Air Dry)	52,191	0.4	6,572,060
Subtotal Wood Burning Emissions 2005	52,191	0.4	6,572,060
Sacramento, CA			
Residential (PGE)			
Electricity	3,494	0.0	51,325
Natural Gas	1,068,794	7.7	19,915,198
Subtotal Residential (PGE)	1,072,287	7.7	19,966,523
Residential (SMUD)			
Electricity	1,315,048	9.4	15,482,643
Subtotal Residential (SMUD)	1,315,048	9.4	15,482,643
Subtotal Residential	2,439,527	17.5	42,021,227
Commercial			
Sacramento County, CA			
Commercial (Non-Water; PGE)			
Electricity	4,117	0.0	60,482
Natural Gas	636,438	4.6	11,858,969
Subtotal Commercial (Non-Water; PGE)	640,555	4.6	11,919,451
Commercial (Non-Water; SMUD)			
Electricity	1,590,614	11.4	18,726,999
Subtotal Commercial (Non-Water; SMUD)	1,590,614	11.4	18,726,999
Irrigation Systems (SMUD)			
Electricity	1,957	0.0	23,038
Subtotal Irrigation Systems (SMUD)	1,957	0.0	23,038

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Sewage Treatment Facilities (PG&E)			
Electricity	19	0.0	278
Natural Gas	1,176	0.0	21,906
Subtotal Sewage Treatment Facilities (PG&E)	1,195	0.0	22,184
Sewage Treatment Facilities (SMUD)			
Electricity	34,430	0.2	405,363
Subtotal Sewage Treatment Facilities (SMUD)	34,430	0.2	405,363
Water Supply (SMUD)			
Electricity	23,877	0.2	281,112
Subtotal Water Supply (SMUD)	23,877	0.2	281,112
Subtotal Commercial	2,292,627	16.4	31,378,147
Industrial			
Sacramento County, CA			
Asphalt Plant			
Light Fuel Oil	5,136	0.0	123,442
Subtotal Asphalt Plant	5,136	0.0	123,442
Boiler			
Heavy Fuel Oil	47	0.0	603
Light Fuel Oil	1,124	0.0	27,012
Natural Gas	956	0.0	20,402
Biomethane	402	0.0	206,250
Subtotal Boiler	2,529	0.0	254,267
IC Engine Diesel			
Light Fuel Oil	2,943	0.0	40,448
Subtotal IC Engine Diesel	2,943	0.0	40,448

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
PGE			
Natural Gas	30,760	0.2	573,170
Subtotal PGE	30,760	0.2	573,170
Wastewater Treatment and Collection fuel combustion			
Stationary Gasoline	768	0.0	10,667
Stationary Diesel	1,440	0.0	17,155
Subtotal Wastewater Treatment and Collection fuel combustion		0.0	27,822
Subtotal Industrial	43,577	0.3	1,019,148
Transportation			
Sacramento County, CA			
Community On-road 2005			
Gasoline	5,440,915	39.0	74,537,587
Diesel	1,291,014	9.3	15,373,375
Subtotal Community On-road 2005	6,731,929	48.3	89,910,962
Subtotal Transportation	6,731,929	48.3	89,910,962
Waste			
Sacramento County, CA			
Waste			*Disposal Method - Managed Landfill*
Paper Products	432,710	3.1	
Food Waste	141,159	1.0	
Plant Debris	53,183	0.4	
Wood/Textiles	27,087	0.2	
Subtotal Waste	654,139	4.7	
Subtotal Waste	654,139	4.7	

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Other			
Sacramento County, CA			
Dairies			
Nitrous Oxide	1,378	0.0	
Methane	113,054	0.8	
Subtotal Dairies	114,432	0.8	
Dixon Pit			
Methane	735	0.0	
Subtotal Dixon Pit	735	0.0	
Elk Grove Landfill			
Methane	1,511	0.0	
Subtotal Elk Grove Landfill	1,511	0.0	
Enteric Fermentation			
Methane	13,168	0.1	
Subtotal Enteric Fermentation	13,168	0.1	
High GWP Gases 2005			
Carbon Dioxide	565,076	4.1	
Subtotal High GWP Gases 2005	565,076	4.1	
Kiefer Landfill			
Methane	49,841	0.4	
Subtotal Kiefer Landfill	49,841	0.4	
L&D Landfill			
Methane	22,994	0.2	
Subtotal L&D Landfill	22,994	0.2	
Manure Management			
Nitrous Oxide	5,287	0.0	

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Methane	2,383	0.0	
Subtotal Manure Management	7,671	0.1	
N2O from fertilizer			
Nitrous Oxide	68,452	0.5	
Subtotal N2O from fertilizer	68,452	0.5	
Offroad Emissions 2005			
Carbon Dioxide	564,257	4.0	
Nitrous Oxide	14,554	0.1	
Methane	5,279	0.0	
Subtotal Offroad Emissions 2005	584,090	4.2	
Sac City Landfill			
Methane	14,011	0.1	
Subtotal Sac City Landfill	14,011	0.1	
Sacramento International Airport			
Carbon Dioxide	196,895	1.4	
Nitrous Oxide	3,230	0.0	
Methane	278	0.0	
Subtotal Sacramento International Airport	200,404	1.4	
Wastewater Treatement and Discharge			
Nitrous Oxide	40,985	0.3	
Methane	93,369	0.7	
Subtotal Wastewater Treatement and Discharge	1,354	1.0	
Subtotal Other	1,776,739	12.7	
Total	13,938,537	100.0	164,329,483

Sacramento County

Community Greenhouse Gas Emissions in 2005

Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential	2,439,527	17.5	42,021,227
Commercial	2,292,627	16.4	31,378,147
Industrial	43,577	0.3	1,019,148
Transportation	6,731,929	48.3	89,910,962
Waste	654,139	4.7	
Other	1,776,739	12.7	
Total	13,938,537	100.0	164,329,483

This report has been generated for Sacramento County, CA using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential			
Sacramento, California			
Aggregate Residential			
Electricity	126,044	15.0	1,483,974
Natural Gas	103,797	12.3	1,934,093
Subtotal Aggregate Residential	229,841	27.3	3,418,066
Wood Burning			
Fuelwood (Air Dry)	4,930	0.6	620,762
Subtotal Wood Burning	4,930	0.6	620,762
Subtotal Residential	234,771	27.9	4,038,828
Commercial			
Sacramento, California			
Commercial (Non-Water)			
Electricity	76,188	9.0	896,995
Natural Gas	25,420	3.0	473,651
Subtotal Commercial (Non-Water)	101,607	12.1	1,370,647
Irrigation Systems			
Electricity	114	0.0	1,341
Subtotal Irrigation Systems	114	0.0	1,341
Sewage Treatment Facilities			
Electricity	2,069	0.2	24,359
Natural Gas	5	0.0	95
Subtotal Sewage Treatment Facilities	2,074	0.2	24,454
Water Supply			
Electricity	2,016	0.2	23,732
Subtotal Water Supply	2,016	0.2	23,732
Subtotal Commercial	105,811	12.6	1,420,173

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Industrial			
Sacramento, California			
Wastewater Treatment and Collection fuel combustion			
Stationary Gasoline	58	0.0	809
Stationary Diesel	108	0.0	1,292
Subtotal Wastewater Treatment and Collection fuel combustion		0.0	2,101
Subtotal Industrial	167	0.0	2,101
Transportation			
Sacramento, California			
Aggregate Transportation			
Gasoline	273,184	32.4	3,742,473
Diesel	64,821	7.7	771,885
Subtotal Aggregate Transportation	338,005	40.1	4,514,358
Subtotal Transportation	338,005	40.1	4,514,358
Waste			
Sacramento, California			
Aggregate Solid Waste			*Disposal Method - Managed Landfill*
Paper Products	25,140	3.0	
Food Waste	8,323	1.0	
Plant Debris	3,119	0.4	
Wood/Textiles	1,521	0.2	
Subtotal Aggregate Solid Waste	38,104	4.5	
Subtotal Waste	38,104	4.5	

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Other			
Sacramento, California			
Agriculture: Cattle/Swine Enteric Fermentation			
Methane	136	0.0	
Subtotal Agriculture: Cattle/Swine Enteric Fermentation		0.0	
Agriculture: Cattle/Swine Manure Mangement			
Nitrous Oxide	55	0.0	
Methane	25	0.0	
Subtotal Agriculture: Cattle/Swine Manure Mangement		0.0	
Dixon Pit			
Methane	735	0.1	
Subtotal Dixon Pit	735	0.1	
Domestic Wastewater and Discharge			
Nitrous Oxide	3,872	0.5	
Methane	8,819	1.0	
Subtotal Domestic Wastewater and Discharge	12,691	1.5	
Elk Grove Landfill			
Methane	1,511	0.2	
Subtotal Elk Grove Landfill	1,511	0.2	
High GWP GHGs			
Carbon Dioxide	53,374	6.3	
Subtotal High GWP GHGs	53,374	6.3	
N2O from Nitrogen applied in fertilizer			
Nitrous Oxide	2,416	0.3	
Subtotal N2O from Nitrogen applied in fertilizer	2,416	0.3	

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Offroad equipment			
Carbon Dioxide	53,297	6.3	
Nitrous Oxide	1,375	0.2	
Methane	499	0.1	
Subtotal Offroad equipment	55,171	6.5	
Subtotal Other	126,113	15.0	
Total	842,971	100.0	9,975,461

Elk Grove

Community Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential	234,771	27.9	4,038,828
Commercial	105,811	12.6	1,420,173
Industrial	167	0.0	2,101
Transportation	338,005	40.1	4,514,358
Waste	38,104	4.5	
Other	126,113	15.0	
Total	842,971	100.0	9,975,461

Government Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings				
Sacramento, California				
PG&E				
Natural Gas	69	0.8	1,294	0
Subtotal PG&E	69	0.8	1,294	0
SMUD				
Electricity	444	5.1	5,233	0
Subtotal SMUD	444	5.1	5,233	0
Subtotal Buildings	514	5.9	6,527	0
Vehicle Fleet				
Sacramento, California				
City Fleet				
Gasoline	1,254	14.5	17,204	0
Subtotal City Fleet	1,254	14.5	17,204	0
E-Tran Buses				
Diesel	2,428	28.0	28,927	0
Subtotal E-Tran Buses	2,428	28.0	28,927	0
Street Sweeping				
Diesel	58	0.7	689	0
Subtotal Street Sweeping	58	0.7	689	0
Waste Fleet				
Diesel	3,679	42.5	43,837	0
Subtotal Waste Fleet	3,679	42.5	43,837	0
Subtotal Vehicle Fleet	7,418	85.6	90,656	0

Government Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Employee Commute				
Sacramento, California				
Commute				
Gasoline	406	4.7	5,591	
Diesel	55	0.6	655	
Subtotal Commute	461	5.3	6,245	
Subtotal Employee Commute	461	5.3	6,245	
Streetlights				
Sacramento, California				
Streetlights				
Electricity	3	0.0	36	0
Subtotal Streetlights	3	0.0	36	0
Traffic Signals				
Electricity	70	0.8	828	0
Subtotal Traffic Signals	70	0.8	828	0
Subtotal Streetlights	73	0.8	863	0
Water/Sewage				
Sacramento, California				
Irrigation				
Electricity	0	0.0	0	0
Subtotal Irrigation	0	0.0	0	0
Sewage Treatement				
Electricity	0	0.0	0	0
Subtotal Sewage Treatement	0	0.0	0	0

Government Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Water Supply				
Electricity	0	0.0	0	0
Subtotal Water Supply	0	0.0	0	0
Subtotal Water/Sewage	0	0.0	0	0
Waste				
Sacramento, California				
City Generated Trash			*Disposal Method - Managed Landfill*	
Paper Products	93	1.1		0
Food Waste	29	0.3		0
Plant Debris	11	0.1		0
Wood/Textiles	6	0.1		0
Subtotal City Generated Trash	139	1.6		0
Subtotal Waste	139	1.6		0
Other				
Sacramento, California				
Additional Fuel				
Carbon Dioxide	57	0.7		
Subtotal Additional Fuel	57	0.7		
Subtotal Other	57	0.7		
Total	8,663	100.0	104,292	0

Elk Grove

Government Greenhouse Gas Emissions in 2005

Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings	514	5.9	6,527	0
Vehicle Fleet	7,418	85.6	90,656	0
Employee Commute	461	5.3	6,245	
Streetlights	73	0.8	863	0
Waste	139	1.6		0
Other	57	0.7		
Total	8,663	100.0	104,292	0

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential			
Folsom, CA			
Residential			
Electricity	69,394	11.4	817,003
Natural Gas	59,400	9.8	1,106,817
Fuelwood (Air Dry)	2,616	0.4	329,352
Subtotal Residential	131,409	21.6	2,253,172
Subtotal Residential	131,409	21.6	2,253,172
Commercial			
Folsom, CA			
Commercial (Non-Water)			
Electricity	107,148	17.6	1,261,504
Natural Gas	39,088	6.4	728,334
Subtotal Commercial (Non-Water)	146,236	24.0	1,989,838
Irrigation Systems			
Electricity	202	0.0	2,380
Subtotal Irrigation Systems	202	0.0	2,380
Sewage Treatment Facilities			
Electricity	1,425	0.2	16,782
Natural Gas	14	0.0	269
Subtotal Sewage Treatment Facilities	1,440	0.2	17,051
Water Supply			
Electricity	838	0.1	9,861
Subtotal Water Supply	838	0.1	9,861
Subtotal Commercial	148,716	24.4	2,019,130

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Industrial			
Folsom, CA			
Wastewater Treatment and Collection fuel combustion			
Stationary Gasoline	11	0.0	159
Stationary Diesel	23	0.0	274
Subtotal Wastewater Treatment and Collection fuel combustion		0.0	434
Subtotal Industrial	34	0.0	434
Transportation			
Folsom, CA			
Transportation			
Gasoline	202,049	33.2	2,767,966
Diesel	47,942	7.9	570,893
Subtotal Transportation	249,991	41.0	3,338,859
Subtotal Transportation	249,991	41.0	3,338,859
Waste			
Folsom, CA			
Community Waste			*Disposal Method - Managed Landfill*
Paper Products	9,243	1.5	
Food Waste	3,580	0.6	
Plant Debris	878	0.1	
Wood/Textiles	447	0.1	
Subtotal Community Waste	14,147	2.3	
Subtotal Waste	14,147	2.3	

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Other			
Folsom, CA			
Agriculture			
Nitrous Oxide	97	0.0	
Methane	284	0.0	
Subtotal Agriculture	381	0.1	
Domestic Wastewater Treatment and Discharge			
Nitrous Oxide	2,055	0.3	
Methane	4,679	0.8	
Subtotal Domestic Wastewater Treatment and Discharge		1.1	
High GWP GHGs			
Carbon Dioxide	28,318	4.6	
Subtotal High GWP GHGs	28,318	4.6	
N2O from fertilizer			
Nitrous Oxide	9	0.0	
Subtotal N2O from fertilizer	9	0.0	
Offroad Emissions			
Carbon Dioxide	28,277	4.6	
Nitrous Oxide	728	0.1	
Methane	265	0.0	
Subtotal Offroad Emissions	29,270	4.8	
Subtotal Other	64,712	10.6	
Total	609,010	100.0	7,611,595

Folsom

Community Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential	131,409	21.6	2,253,172
Commercial	148,716	24.4	2,019,130
Industrial	34	0.0	434
Transportation	249,991	41.0	3,338,859
Waste	14,147	2.3	
Other	64,712	10.6	
Total	609,010	100.0	7,611,595

Government Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings				
Folsom, CA				
Government Facilities				
Electricity	3,347	33.6	39,409	0
Natural Gas	887	8.9	16,530	0
Subtotal Government Facilities	4,234	42.5	55,938	0
Subtotal Buildings	4,234	42.5	55,938	0
Vehicle Fleet				
Folsom, CA				
Additional Equipment - Diesel				
Diesel	21	0.2	256	0
Subtotal Additional Equipment - Diesel	21	0.2	256	0
Additional Equipment - Gas				
Gasoline	5	0.1	74	0
Subtotal Additional Equipment - Gas	5	0.1	74	0
Fullsize Government Vehicles				
Gasoline	645	6.5	8,873	0
Subtotal Fullsize Government Vehicles	645	6.5	8,873	0
Government Full Sized Bus				
Diesel	353	3.5	4,208	0
Subtotal Government Full Sized Bus	353	3.5	4,208	0
Government Small Bus				
Gasoline	306	3.1	4,193	0
Subtotal Government Small Bus	306	3.1	4,193	0

Government Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Heavy Truck				
Diesel	1,668	16.8	19,873	0
Subtotal Heavy Truck	1,668	16.8	19,873	0
Light Pickup Government Vehicles				
Gasoline	899	9.0	12,356	0
Subtotal Light Pickup Government Vehicles	899	9.0	12,356	0
Midsize Government Vehicles				
Gasoline	35	0.3	475	0
Subtotal Midsize Government Vehicles	35	0.3	475	0
Van Government Vehicles				
Gasoline	35	0.3	477	0
Subtotal Van Government Vehicles	35	0.3	477	0
Subtotal Vehicle Fleet	3,967	39.8	50,786	0
Streetlights				
Citrus Heighs, CA				
Street Lights				
Electricity	870	8.7	10,239	0
Subtotal Street Lights	870	8.7	10,239	0
Traffic Signals				
Electricity	146	1.5	1,715	0
Subtotal Traffic Signals	146	1.5	1,715	0
Subtotal Streetlights	1,015	10.2	11,954	0

Government Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Waste				
Citrus Heighs, CA				
Government Waste			*Disposal Method - Managed Landfill*	
Paper Products	505	5.1		0
Food Waste	184	1.9		0
Plant Debris	24	0.2		0
Wood/Textiles	27	0.3		0
Subtotal Government Waste	740	7.4		0
Subtotal Waste	740	7.4		0
Total	9,957	100.0	118,678	0

Folsom

Government Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings	4,234	42.5	55,938	0
Vehicle Fleet	3,967	39.8	50,786	0
Streetlights	1,015	10.2	11,954	0
Waste	740	7.4		0
Total	9,957	100.0	118,678	0

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential			
Sacramento, California			
Aggregate Residential			
Electricity	19,217	11.1	226,252
Natural Gas	15,290	8.9	284,911
Subtotal Aggregate Residential	34,507	20.0	511,163
Wood Burning			
Fuelwood (Air Dry)	866	0.5	108,995
Subtotal Wood Burning	866	0.5	108,995
Subtotal Residential	35,373	20.5	620,158
Commercial			
Sacramento, California			
Commercial: Non-Water			
Electricity	31,769	18.4	374,037
Natural Gas	3,243	1.9	60,437
Subtotal Commercial: Non-Water	35,013	20.3	434,474
Irrigation Systems			
Electricity	40	0.0	470
Subtotal Irrigation Systems	40	0.0	470
Sewage Treatment Facilities			
Electricity	510	0.3	6,010
Subtotal Sewage Treatment Facilities	510	0.3	6,010
Water Supply			
Electricity	860	0.5	10,124
Subtotal Water Supply	860	0.5	10,124
Subtotal Commercial	36,423	21.1	451,078

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	
Transportation				
Sacramento, California				
Aggregate Transportation				
Gasoline	59,648	34.6	817,141	
Diesel	14,153	8.2	168,535	
Subtotal Aggregate Transportation	73,801	42.8	985,676	
Subtotal Transportation	73,801	42.8	985,676	
Waste				
Sacramento, California				
Aggregate Solid Waste				*Disposal Method - Managed Landfill*
Paper Products	3,397	2.0		
Food Waste	1,373	0.8		
Plant Debris	345	0.2		
Wood/Textiles	191	0.1		
Subtotal Aggregate Solid Waste	5,306	3.1		
Subtotal Waste	5,306	3.1		
Other				
Sacramento, California				
Agriculture: Cattle/Swine Enteric Fermentation				
Carbon Dioxide	6	0.0		
Subtotal Agriculture: Cattle/Swine Enteric Fermentation		0.0		
Agriculture: Cattle/Swine Manure Management				
Carbon Dioxide	3	0.0		
Subtotal Agriculture: Cattle/Swine Manure Management		0.0		

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Agriculture: N2O from Fertilizer			
Carbon Dioxide	228	0.1	
Subtotal Agriculture: N2O from Fertilizer	228	0.1	
Domestic Wastewater and Discharge			
Nitrous Oxide	679	0.4	
Methane	1,549	0.9	
Subtotal Domestic Wastewater and Discharge	2,227	1.3	
High GWP GHGs			
Carbon Dioxide	9,372	5.4	
Subtotal High GWP GHGs	9,372	5.4	
Offroad equipment			
Carbon Dioxide	9,358	5.4	
Nitrous Oxide	242	0.1	
Methane	88	0.1	
Subtotal Offroad equipment	9,687	5.6	
Subtotal Other	21,523	12.5	
Total	172,426	100.0	2,056,911

Galt

Community Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential	35,373	20.5	620,158
Commercial	36,423	21.1	451,078
Transportation	73,801	42.8	985,676
Waste	5,306	3.1	
Other	21,525	12.5	
Total	172,428	100.0	2,056,911

This report has been generated for Galt, California using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

2/17/2009 12:48:50 PM

Urbemis 2007 Version 9.2.4

Detail Report for Summer Construction Unmitigated Emissions (Pounds/Day)

File Name: \\TAPESERVER\Groups\LGT-Air&Noise\Air\Sac DERA County GHG\SAC County Full GHG Inventory\Government Inventories\Galt\Galt Government Diesel Equipment.urb924

Project Name: Galt Government Diesel Equipment

Project Location: Sacramento County AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES (Summer Pounds Per Day, Unmitigated)

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Time Slice 1/1/2005-1/1/2005 Active Days: 1	**2.79**	**19.78**	**8.98**	**0.00**	**0.00**	**1.34**	**1.34**	**0.00**	**1.23**	**1.23**	**1,333.84**
Building 01/01/2005-01/01/2005	2.79	19.78	8.98	0.00	0.00	1.34	1.34	0.00	1.23	1.23	1,333.84
Building Off Road Diesel	2.79	19.78	8.98	0.00	0.00	1.34	1.34	0.00	1.23	1.23	1,333.84
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Phase Assumptions

Phase: Building Construction 1/1/2005 - 1/1/2005 - Default Building Construction Description

Off-Road Equipment:

2 Air Compressors (106 hp) operating at a 0.48 load factor for 0.8 hours per day

2 Crawler Tractors (147 hp) operating at a 0.64 load factor for 6.4 hours per day

2 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 3.9 hours per day

Government Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings				
Sacramento, California				
PG&E				
Natural Gas	97	2.1	1,803	19,926
Subtotal PG&E	97	2.1	1,803	19,926
SMUD				
Electricity	2,246	49.4	26,445	0
Subtotal SMUD	2,246	49.4	26,445	0
Subtotal Buildings	2,343	51.5	28,247	19,926
Vehicle Fleet				
Sacramento, California				
City Fleet				
Gasoline	245	5.4	3,371	0
Diesel	19	0.4	226	0
Subtotal City Fleet	264	5.8	3,598	0
Diesel Equipment				
Diesel	61	1.4	732	0
Subtotal Diesel Equipment	61	1.4	732	0
Subtotal Vehicle Fleet	326	7.2	4,330	0
Employee Commute				
Sacramento, California				
Commute				
Gasoline	287	6.3	3,949	
Subtotal Commute	287	6.3	3,949	
Subtotal Employee Commute	287	6.3	3,949	

Government Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Streetlights				
Sacramento, California				
Streetlights				
Electricity	254	5.6	2,996	0
Subtotal Streetlights	254	5.6	2,996	0
Traffic Signals				
Electricity	2	0.0	18	0
Subtotal Traffic Signals	2	0.0	18	0
Subtotal Streetlights	256	5.6	3,014	0
Water/Sewage				
Sacramento, California				
Irrigation				
Electricity	32	0.7	470	0
Subtotal Irrigation	32	0.7	470	0
Sewage Treatement				
Electricity	409	9.0	6,010	0
Subtotal Sewage Treatement	409	9.0	6,010	0
Water Supply				
Electricity	689	15.2	10,124	0
Subtotal Water Supply	689	15.2	10,124	0
Subtotal Water/Sewage	1,130	24.8	16,603	0

Government Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Waste				
Sacramento, California				
City Generated Solid Waste			*Disposal Method - Managed Landfill*	
Paper Products	118	2.6		0
Food Waste	47	1.0		0
Plant Debris	9	0.2		0
Wood/Textiles	7	0.2		0
Subtotal City Generated Solid Waste	182	4.0		0
Subtotal Waste	182	4.0		0
Other				
Sacramento, California				
Additional Fuel Use				
Carbon Dioxide	25	0.6		
Subtotal Additional Fuel Use	25	0.6		
Subtotal Other	25	0.6		
Total	4,549	100.0	56,143	19,926

Galt

Government Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings	2,343	51.5	28,247	19,926
Vehicle Fleet	326	7.2	4,330	0
Employee Commute	287	6.3	3,949	
Streetlights	256	5.6	3,014	0
Water/Sewage	1,130	24.8	16,603	0
Waste	182	4.0		0
Other	25	0.6		
Total	4,549	100.0	56,143	19,926

This report has been generated for Galt, California using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential			
Sacramento, California			
Aggregate Residential			
Electricity	492	2.4	7,232
Natural Gas	775	3.8	14,437
Subtotal Aggregate Residential	1,267	6.2	21,669
Wood Burning			
Fuelwood (Air Dry)	31	0.2	3,856
Subtotal Wood Burning	31	0.2	3,856
Subtotal Residential	1,298	6.4	25,525
Commercial			
Sacramento, California			
Commercial: Non-Water			
Electricity	435	2.1	6,387
Natural Gas	334	1.6	6,229
Subtotal Commercial: Non-Water	769	3.8	12,616
Sewage Treatment Facilities			
Electricity	19	0.1	278
Subtotal Sewage Treatment Facilities	19	0.1	278
Subtotal Commercial	788	3.9	12,894
Transportation			
Sacramento, California			
Aggregate Transportation			
Gasoline	14,033	68.9	192,250
Diesel	3,330	16.3	39,652
Subtotal Aggregate Transportation	17,363	85.2	231,901
Subtotal Transportation	17,363	85.2	231,901

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Waste			
Sacramento, California			
Aggregate Solid Waste			*Disposal Method - Managed Landfill*
Paper Products	104	0.5	
Food Waste	48	0.2	
Plant Debris	10	0.0	
Wood/Textiles	6	0.0	
Subtotal Aggregate Solid Waste	167	0.8	
Subtotal Waste	167	0.8	
Other			
Sacramento, California			
Agriculture: N2O from Fertilizer			
Carbon Dioxide	11	0.1	
Subtotal Agriculture: N2O from Fertilizer	11	0.1	
Domestic Wastewater and Discharge			
Nitrous Oxide	25	0.1	
Methane	55	0.3	
Subtotal Domestic Wastewater and Discharge	80	0.4	
High GWP GHGs			
Carbon Dioxide	332	1.6	
Subtotal High GWP GHGs	332	1.6	
Offroad equipment			
Carbon Dioxide	331	1.6	
Nitrous Oxide	8	0.0	
Methane	3	0.0	
Subtotal Offroad equipment	343	1.7	
Subtotal Other	765	3.8	
Total	20,381	100.0	270,320

Isleton

Community Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential	1,298	6.4	25,525
Commercial	788	3.9	12,894
Transportation	17,363	85.2	231,901
Waste	167	0.8	
Other	765	3.8	
Total	20,381	100.0	270,320

This report has been generated for Isleton, California using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Government Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings				
Sacramento, California				
PG&E				
Electricity	26	63.8	389	0
Natural Gas	15	36.2	280	0
Subtotal PG&E	42	100.0	669	0
Subtotal Buildings	42	100.0	669	0
Total	42	100.0	669	0

Isleton

Government Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings	42	100.0	669	0
Total	42	100.0	669	0

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential			
San Francisco, CA			
Rancho Cordova Residential 2005			
Electricity	53,167	9.5	625,953
Natural Gas	39,035	7.0	727,348
Subtotal Rancho Cordova Residential 2005	92,201	16.5	1,353,301
Wood Burning Emissions 2005			
Fuelwood (Air Dry)	2,123	0.4	267,344
Subtotal Wood Burning Emissions 2005	2,123	0.4	267,344
Subtotal Residential	94,324	16.9	1,620,645
Commercial			
San Francisco, CA			
Commercial (Non-Water)			
Electricity	117,301	21.0	1,381,032
Natural Gas	17,890	3.2	333,343
Subtotal Commercial (Non-Water)	135,190	24.2	1,714,375
Irrigation Systems			
Electricity	38	0.0	451
Subtotal Irrigation Systems	38	0.0	451
Sewage Treatment Facilities			
Electricity	1,526	0.3	17,971
Natural Gas	4	0.0	70
Subtotal Sewage Treatment Facilities	1,530	0.3	18,041
Water Supply			
Electricity	2,130	0.4	25,072
Subtotal Water Supply	2,130	0.4	25,072
Subtotal Commercial	138,888	24.9	1,757,939

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Industrial			
San Francisco, CA			
Wastewater Treatment and Collection fuel combustion			
Stationary Gasoline	43	0.0	597
Stationary Diesel	80	0.0	953
Subtotal Wastewater Treatment and Collection fuel combustion		0.0	1,550
Subtotal Industrial	123	0.0	1,550
Transportation			
San Francisco, CA			
Community On-road 2005			
Gasoline	203,422	36.5	2,786,771
Diesel	48,268	8.7	574,771
Subtotal Community On-road 2005	251,690	45.1	3,361,542
Subtotal Transportation	251,690	45.1	3,361,542
Waste			
San Francisco, CA			
Household and Business Waste 2005			*Disposal Method - Managed Landfill*
Paper Products	13,258	2.4	
Food Waste	4,413	0.8	
Plant Debris	949	0.2	
Wood/Textiles	814	0.1	
Subtotal Household and Business Waste 2005	19,435	3.5	
Subtotal Waste	19,435	3.5	

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Other			
San Francisco, CA			
Domestic Wastewater Treatement and Discharge			
Nitrous Oxide	1,668	0.3	
Methane	3,798	0.7	
Subtotal Domestic Wastewater Treatement and Discharge		1.0	
Enteric Fermentation 2005			
Methane	643	0.1	
Subtotal Enteric Fermentation 2005	643	0.1	
High GWP Gases 2005			
Carbon Dioxide	22,987	4.1	
Subtotal High GWP Gases 2005	22,987	4.1	
Manure Management 2005			
Nitrous Oxide	258	0.0	
Methane	116	0.0	
Subtotal Manure Management 2005	374	0.1	
N2O from Fertilizer			
Nitrous Oxide	251	0.0	
Subtotal N2O from Fertilizer	251	0.0	
Offroad Emissions 2005			
Carbon Dioxide	22,954	4.1	
Nitrous Oxide	593	0.1	
Methane	215	0.0	
Subtotal Offroad Emissions 2005	23,762	4.3	
Subtotal Other	53,483	9.6	
Total	557,943	100.0	6,741,675

Rancho Cordova

Community Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential	94,324	16.9	1,620,645
Commercial	138,888	24.9	1,757,939
Industrial	123	0.0	1,550
Transportation	251,690	45.1	3,361,542
Waste	19,435	3.5	
Other	53,483	9.6	
Total	557,943	100.0	6,741,675

This report has been generated for Rancho Cordova, CA using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Government Greenhouse Gas Emissions in 2007
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings				
San Francisco, CA				
Rancho Cordova				
Electricity	548	51.3	5,605	0
Natural Gas	101	9.5	1,891	0
Subtotal Rancho Cordova	650	60.7	7,497	0
Subtotal Buildings	650	60.7	7,497	0
Vehicle Fleet				
San Francisco, CA				
Rancho Cordova Fleet				
Gasoline	55	5.2	764	0
Subtotal Rancho Cordova Fleet	55	5.2	764	0
Subtotal Vehicle Fleet	55	5.2	764	0
Employee Commute				
San Francisco, CA				
Rancho Cordova Employee Commute				
Gasoline	321	30.0	4,415	
Subtotal Rancho Cordova Employee Commute	321	30.0	4,415	
Subtotal Employee Commute	321	30.0	4,415	
Streetlights				
San Francisco, CA				
Rancho Cordova Traffic Signals				
Electricity	44	4.1	445	0
Subtotal Rancho Cordova Traffic Signals	44	4.1	445	0
Subtotal Streetlights	44	4.1	445	0
Total	1,070	100.0	13,121	0

Rancho Cordova

Government Greenhouse Gas Emissions in 2007

Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings	650	60.7	7,497	0
Vehicle Fleet	55	5.2	764	0
Employee Commute	321	30.0	4,415	
Streetlights	44	4.1	445	0
Total	1,070	100.0	13,121	0

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential			
Sacramento, California			
PG&E			
Electricity	4	0.0	14
Natural Gas	352,586	7.7	6,569,858
Subtotal PG&E	352,590	7.7	6,569,872
SMUD			
Electricity	378,969	8.3	4,461,767
Subtotal SMUD	378,969	8.3	4,461,767
Wood Burning			
Fuelwood (Air Dry)	17,225	0.4	2,168,980
Subtotal Wood Burning	17,225	0.4	2,168,980
Subtotal Residential	748,784	16.4	13,200,619
Commercial			
Sacramento, California			
Commercial (Non-Water; PG&E)			
Electricity	2	0.0	29
Natural Gas	331,618	7.3	6,179,158
Subtotal Commercial (Non-Water; PG&E)	331,621	7.3	6,179,187
Commercial (Non-Water; SMUD)			
Electricity	648,156	14.2	7,631,023
Subtotal Commercial (Non-Water; SMUD)	648,156	14.2	7,631,023
Irrigation Systems			
Electricity	1,297	0.0	15,273
Subtotal Irrigation Systems	1,297	0.0	15,273

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Sewage Treatment Facilities			
Electricity	11,364	0.2	133,793
Natural Gas	1,109	0.0	20,669
Subtotal Sewage Treatment Facilities	12,473	0.3	154,462
Water Supply			
Electricity	11,513	0.3	135,547
Subtotal Water Supply	11,513	0.3	135,547
Subtotal Commercial	1,005,060	22.1	14,115,491
Industrial			
Sacramento, California			
Industrial PG&E			
Natural Gas	28,656	0.6	533,957
Subtotal Industrial PG&E	28,656	0.6	533,957
Wastewater Treatment and Collection (fuel combustion)			
Stationary Gasoline	196	0.0	2,718
Stationary Diesel	371	0.0	4,424
Subtotal Wastewater Treatment and Collection (fuel combustion)		0.0	7,143
Subtotal Industrial	29,223	0.6	541,100
Transportation			
Sacramento, California			
Aggregate Transportation			
Gasoline	1,569,907	34.5	21,506,869
Diesel	372,506	8.2	4,435,791
Subtotal Aggregate Transportation	1,942,412	42.7	25,942,660
Subtotal Transportation	1,942,412	42.7	25,942,660

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Waste			
Sacramento, California			
Aggregate Solid Waste			*Disposal Method - Managed Landfill*
Paper Products	247,060	5.4	
Food Waste	82,339	1.8	
Plant Debris	22,218	0.5	
Wood/Textiles	13,287	0.3	
Subtotal Aggregate Solid Waste	364,904	8.0	
Subtotal Waste	364,904	8.0	
Other			
Sacramento, California			
Agriculture: Cattle/swine Enteric Fermentation			
Methane	71	0.0	
Subtotal Agriculture: Cattle/swine Enteric Fermentation		0.0	
Agriculture: Cattle/swine Manure Management			
Nitrous Oxide	29	0.0	
Methane	13	0.0	
Subtotal Agriculture: Cattle/swine Manure Management		0.0	
Agriculture: N2O from fertilizer			
Nitrous Oxide	1,942	0.0	
Subtotal Agriculture: N2O from fertilizer	1,942	0.0	
Domestic Wastewater Treatment and Discharge			
Nitrous Oxide	13,525	0.3	
Methane	30,815	0.7	
Subtotal Domestic Wastewater Treatment and Discharge		1.0	

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
High GWP GHGs			
Carbon Dioxide	186,492	4.1	
Subtotal High GWP GHGs	186,492	4.1	
L&D Landfill			
Methane	22,994	0.5	
Subtotal L&D Landfill	22,994	0.5	
Offroad Fuel			
Carbon Dioxide	186,222	4.1	
Nitrous Oxide	4,803	0.1	
Methane	1,742	0.0	
Subtotal Offroad Fuel	192,768	4.2	
Sacramento City Landfill			
Methane	14,011	0.3	
Subtotal Sacramento City Landfill	14,011	0.3	
Subtotal Other	462,659	10.2	
Total	4,553,042	100.0	53,799,869

Sacramento

Community Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential	748,792	16.4	13,200,619
Commercial	1,005,060	22.1	14,115,491
Industrial	29,223	0.6	541,100
Transportation	1,942,412	42.7	25,942,660
Waste	364,904	8.0	
Other	462,659	10.2	
Total	4,553,051	100.0	53,799,869

This report has been generated for Sacramento, California using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Government Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings				
Sacramento, California				
Leased Space (SMUD)				
Electricity	1,165	1.5	13,713	0
Subtotal Leased Space (SMUD)	1,165	1.5	13,713	0
PG&E				
Electricity	56	0.1	659	0
Natural Gas	6,355	8.1	118,413	0
Subtotal PG&E	6,411	8.2	119,072	0
Propane				
Propane	216	0.3	3,507	0
Subtotal Propane	216	0.3	3,507	0
SMUD				
Electricity	27,982	35.6	329,440	0
Subtotal SMUD	27,982	35.6	329,440	0
Subtotal Buildings	35,773	45.5	465,732	0
Vehicle Fleet				
Sacramento, California				
Aggregate Fleet				
Gasoline	11,111	14.1	152,454	0
Diesel	9,648	12.3	114,082	0
CNG	1,071	1.4	33	0
Diesel (ULSD)	97	0.1	1,525	0
Subtotal Aggregate Fleet	21,927	27.9	268,094	0
Subtotal Vehicle Fleet	21,927	27.9	268,094	0

Government Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Streetlights				
Sacramento, California				
Streetlights				
Electricity	5,807	7.4	68,367	0
Subtotal Streetlights	5,807	7.4	68,367	0
Traffic Signals				
Electricity	1,065	1.4	12,538	0
Subtotal Traffic Signals	1,065	1.4	12,538	0
Subtotal Streetlights	6,872	8.7	80,905	0
Water/Sewage				
Sacramento, California				
Irrigation				
Electricity	0	0.0	0	0
Subtotal Irrigation	0	0.0	0	0
Sewage Treatement Facilities				
Electricity	0	0.0	0	0
Subtotal Sewage Treatement Facilities	0	0.0	0	0
Water Supply				
Electricity	0	0.0	0	0
Subtotal Water Supply	0	0.0	0	0
Subtotal Water/Sewage	0	0.0	0	0

Government Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Other				
Sacramento, California				
Waste-in-Place from Sac City Landfill				
Methane	14,011	17.8		
Subtotal Waste-in-Place from Sac City Landfill	14,011	17.8		
Subtotal Other	14,011	17.8		
Total	78,584	100.0	814,731	0

Sacramento

Government Greenhouse Gas Emissions in 2005

Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings	35,773	45.5	465,732	0
Vehicle Fleet	21,927	27.9	268,094	0
Streetlights	6,872	8.7	80,905	0
Other	14,011	17.8		
Total	78,584	100.0	814,731	0

This report has been generated for Sacramento, California using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential			
Sacramento, California			
PG&E Residential Energy Usage			
Electricity	3,000	0.0	44,079
Natural Gas	434,227	6.6	8,091,093
Subtotal PG&E Residential Energy Usage	437,227	6.7	8,135,172
SMUD Residential Energy Usage			
Electricity	574,786	8.8	6,767,205
Fuelwood (Air Dry)	21,129	0.3	2,660,670
Subtotal SMUD Residential Energy Usage	595,915	9.1	9,427,875
Subtotal Residential	1,033,142	15.8	17,563,047
Commercial			
Sacramento, California			
Commercial (Non-water; PG&E)			
Electricity	3,680	0.1	54,066
Natural Gas	207,058	3.2	3,858,188
Subtotal Commercial (Non-water; PG&E)	210,739	3.2	3,912,254
Commercial (Non-water; SMUD)			
Electricity	559,286	8.5	6,584,721
Subtotal Commercial (Non-water; SMUD)	559,286	8.5	6,584,721
Irrigation Systems			
Electricity	188	0.0	2,212
Subtotal Irrigation Systems	188	0.0	2,212
Sewage Treatment Facilities			
Electricity	15,113	0.2	177,930
Natural Gas	37	0.0	693
Subtotal Sewage Treatment Facilities	15,150	0.2	178,623

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Water Supply			
Electricity	5,697	0.1	67,074
Subtotal Water Supply	5,697	0.1	67,074
Subtotal Commercial	791,059	12.1	10,744,884
Industrial			
Sacramento, California			
Aggregate Industrial			
Natural Gas	2,104	0.0	39,212
Subtotal Aggregate Industrial	2,104	0.0	39,212
Wastewater Treatment and Collection fuel combustion			
Stationary Gasoline	391	0.0	5,436
Stationary Diesel	730	0.0	8,699
Subtotal Wastewater Treatment and Collection fuel combustion		0.0	14,135
Subtotal Industrial	3,226	0.0	53,347
Transportation			
Sacramento, California			
Aggregate VMT Onroad Vehicles			
Gasoline	2,918,451	44.5	39,981,188
Diesel	692,486	10.6	8,246,119
Subtotal Aggregate VMT Onroad Vehicles	3,610,937	55.1	48,227,307
Subtotal Transportation	3,610,937	55.1	48,227,307

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)

Waste

Sacramento, California

All other Waste			*Disposal Method - Managed Landfill*
Paper Products	74	0.0	
Food Waste	25	0.0	
Plant Debris	6	0.0	
Wood/Textiles	2	0.0	
Subtotal All other Waste	106	0.0	
Anderson Solid Waste Disposal Site: Shasta County			*Disposal Method - Managed Landfill*
Paper Products	847	0.0	
Food Waste	282	0.0	
Plant Debris	63	0.0	
Wood/Textiles	21	0.0	
Subtotal Anderson Solid Waste Disposal Site: Shasta County		0.0	
Exported Waste: Out of State			*Disposal Method - Managed Landfill*
Paper Products	3,483	0.1	
Food Waste	1,160	0.0	
Plant Debris	259	0.0	
Wood/Textiles	87	0.0	
Subtotal Exported Waste: Out of State	4,988	0.1	
Forward, Inc: San Joaquin County			*Disposal Method - Managed Landfill*
Paper Products	23,390	0.4	
Food Waste	7,787	0.1	
Plant Debris	1,740	0.0	
Wood/Textiles	583	0.0	
Subtotal Forward, Inc: San Joaquin County	33,499	0.5	

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Kiefer Landfill Disposal: Sacramento County (unincorporated)			*Disposal Method - Managed Landfill*
Paper Products	64,839	1.0	
Food Waste	21,587	0.3	
Plant Debris	4,823	0.1	
Wood/Textiles	1,615	0.0	
Subtotal Kiefer Landfill Disposal: Sacramento County (unincorporated)		1.4	
L and D Landfill Co: Sacramento County (incorporated)			*Disposal Method - Managed Landfill*
Paper Products	10,949	0.2	
Food Waste	3,645	0.1	
Plant Debris	810	0.0	
Wood/Textiles	272	0.0	
Subtotal L and D Landfill Co: Sacramento County (incorporated)		0.2	
North County Landfill: San Joaquin County			*Disposal Method - Managed Landfill*
Paper Products	338	0.0	
Food Waste	112	0.0	
Plant Debris	25	0.0	
Wood/Textiles	8	0.0	
Subtotal North County Landfill: San Joaquin County	4	0.0	
Potrero Hills Landfill: Solano County			*Disposal Method - Managed Landfill*
Paper Products	1,058	0.0	
Food Waste	352	0.0	
Plant Debris	79	0.0	
Wood/Textiles	26	0.0	
Subtotal Potrero Hills Landfill: Solano County	1,515	0.0	
Western Regional Landfill: Placer County			*Disposal Method - Managed Landfill*
Paper Products	189	0.0	
Food Waste	63	0.0	
Plant Debris	14	0.0	

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Wood/Textiles	5	0.0	
Subtotal Western Regional Landfill: Placer County	771	0.0	
Yolo County Central Landfill: Yolo County			*Disposal Method - Managed Landfill*
Paper Products	623	0.0	
Food Waste	207	0.0	
Plant Debris	46	0.0	
Wood/Textiles	16	0.0	
Subtotal Yolo County Central Landfill: Yolo County	893	0.0	
Subtotal Waste	151,509	2.3	

Other

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Sacramento, California			
Aggregate Off Road Emissions			
Carbon Dioxide	228,437	3.5	
Nitrous Oxide	5,892	0.1	
Methane	2,137	0.0	
Subtotal Aggregate Off Road Emissions	236,466	3.6	
Dairy Emissions			
Nitrous Oxide	1,378	0.0	
Methane	113,054	1.7	
Subtotal Dairy Emissions	114,432	1.7	
Enteric Fermentation			
Methane	12,073	0.2	
Subtotal Enteric Fermentation	12,073	0.2	
High GWP GHGs			
Carbon Dioxide	228,768	3.5	
Subtotal High GWP GHGs	228,768	3.5	

Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Kiefer waste-in-place			
Methane	49,841	0.8	
Subtotal Kiefer waste-in-place	49,841	0.8	
Manure Management			
Nitrous Oxide	4,847	0.1	
Methane	2,185	0.0	
Subtotal Manure Management	7,033	0.1	
N2O from Nitrogen applied in fertilizer			
Nitrous Oxide	63,594	1.0	
Subtotal N2O from Nitrogen applied in fertilizer	63,594	1.0	
Sacramento International Airport			
Carbon Dioxide	196,895	3.0	
Nitrous Oxide	3,230	0.0	
Methane	278	0.0	
Subtotal Sacramento International Airport	200,404	3.1	
Wastewater Treatement and Discharge			
Nitrous Oxide	16,591	0.3	
Methane	37,800	0.6	
Subtotal Wastewater Treatement and Discharge	54,391	0.8	
Subtotal Other	967,001	14.7	
Total	6,556,874	100.0	76,588,585

Sacramento Unincorporated County

Community Greenhouse Gas Emissions in 2005

Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential	1,033,142	15.8	17,563,047
Commercial	791,059	12.1	10,744,884
Industrial	3,226	0.0	53,347
Transportation	3,610,937	55.1	48,227,307
Waste	151,509	2.3	
Other	967,001	14.7	
Total	6,556,874	100.0	76,588,585

This report has been generated for Sacramento Unincorporated County, California using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Government Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings				
Sacramento, California				
Executive Airport				
Electricity	345	0.2	4,057	122,447
Natural Gas	89	0.1	1,663	16,100
Subtotal Executive Airport	434	0.3	5,721	138,546
International Airport (SMF)				
Electricity	9,279	5.4	109,241	3,296,782
Natural Gas	3,735	2.2	69,588	673,607
Subtotal International Airport (SMF)	13,013	7.6	178,828	3,970,389
Leased Buildings-General Services				
Electricity	6,648	3.9	78,274	2,362,241
Natural Gas	1,224	0.7	22,802	220,723
Subtotal Leased Buildings-General Services	7,872	4.6	101,076	2,582,964
Leased Buildings-General Services, No Utilities				
Electricity	1,916	1.1	22,560	680,842
Subtotal Leased Buildings-General Services, No Utilities		1.1	22,560	680,842
Mather Airport (MHR)				
Electricity	292	0.2	3,436	103,686
Subtotal Mather Airport (MHR)	292	0.2	3,436	103,686
McClellan Airport (MCC)				
Natural Gas	5	0.0	90	869
Subtotal McClellan Airport (MCC)	5	0.0	90	869
OCIT Remote				
Electricity	223	0.1	2,622	79,139
Subtotal OCIT Remote	223	0.1	2,622	79,139

Government Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Owned Buildings-General Services				
Electricity	18,090	10.6	212,981	6,427,554
Stationary Diesel	53	0.0	633	13,754
Natural Gas	8,771	5.1	163,428	1,581,984
Propane	42	0.0	687	14,352
Subtotal Owned Buildings-General Services	26,956	15.8	377,729	8,037,644
Parks				
Electricity	324	0.2	3,818	115,232
Natural Gas	41	0.0	773	7,481
Subtotal Parks	366	0.2	4,591	122,713
Public Works				
Electricity	4,904	2.9	57,741	1,742,560
Subtotal Public Works	4,904	2.9	57,741	1,742,560
Subtotal Buildings	55,981	32.8	754,394	17,459,351
Vehicle Fleet				
Sacramento, California				
Aggregate County Vehicle Fleet Fuel Consumption				
Gasoline	14,608	8.6	200,455	4,117,530
Diesel	10,527	6.2	125,337	2,722,167
CNG	3	0.0	115	1,000,217
Subtotal Aggregate County Vehicle Fleet Fuel Consumption		14.7	325,907	7,839,915
Subtotal Vehicle Fleet	25,138	14.7	325,907	7,839,915

Government Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Streetlights				
Sacramento, California				
traffic signals/street lights				
Electricity	888	0.5	10,456	315,538
Subtotal traffic signals/street lights	888	0.5	10,456	315,538
Subtotal Streetlights	888	0.5	10,456	315,538
Water/Sewage				
Sacramento, California				
Aggregate Energy Consumption for Waste Water Collection and Treatment				
Electricity	0	0.0	0	3,744,942
Stationary Diesel	0	0.0	0	202,321
Natural Gas	0	0.0	0	8,179
Stationary Gasoline 2	0	0.0	0	126,161
Subtotal Aggregate Energy Consumption for Waste Water Collection and Treatment			0	4,081,603
Aggregate Energy Consumption for Water Treatment and Supply				
Electricity	0	0.0	0	1,710,663
Natural Gas	0	0.0	0	20,602
Subtotal Aggregate Energy Consumption for Water Treatment and Supply	0	0.0	0	1,731,265
Subtotal Water/Sewage	0	0.0	0	5,812,868
Other				
Sacramento, California				
Sacramento International Airport				
Carbon Dioxide	36,036	21.1		
Nitrous Oxide	1,339	0.8		
Methane	84	0.0		
Subtotal Sacramento International Airport	37,460	21.9		

Government Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Waste-in-place: Elk Grove Landfill				
Methane	1,511	0.9		
Subtotal Waste-in-place: Elk Grove Landfill	1,511	0.9		
Waste-in-place: Kiefer				
Methane	49,841	29.2		
Subtotal Waste-in-place: Kiefer	49,841	29.2		
Subtotal Other	88,812	52.0		
Total	170,819	100.0	1,090,756	31,427,672

Sacramento Unincorporated County

Government Greenhouse Gas Emissions in 2005

Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings	55,981	32.8	754,394	17,459,351
Vehicle Fleet	25,138	14.7	325,907	7,839,915
Streetlights	888	0.5	10,456	315,538
Water/Sewage	0	0.0	0	5,812,868
Other	88,812	52.0		
Total	170,819	100.0	1,090,756	31,427,672

This report has been generated for Sacramento Unincorporated County, California using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Appendix B

City-Wide GHG Emissions Methodology

Appendix B

City-Wide GHG Emissions Methodology

Summary

Appendix B discusses the approach and methodology used to assess GHG emissions from each sector of city-wide emissions for each city in the County of Sacramento. The cities are defined by their geographical boundaries. GHG emissions occurring within each city's geographical boundary are reported in that city's inventory, including emissions attributed to government operations.

Some sectors of city-wide emissions are based on population data provided by the California Department of Finance for the year 2005. Where only aggregate or per capita emissions data are available, emissions were apportioned based on population. Table B-1 presents the population for each jurisdiction in Sacramento County for the year 2005.

Table B-1. 2005 Population for Each Jurisdiction in Sacramento County

City/Jurisdiction	Population	Percent
Citrus Heights	86,988	6.27
Elk Grove	131,033	9.45
Folsom	69,521	5.01
Galt	23,007	1.66
Isleton	814	0.06
Rancho Cordova	56,432	4.07
Sacramento	457,837	33.00
Unincorporated Sacramento County	561,625	40.48
Sacramento County Total	**1,387,257**	**100.00**

Source: California Department of Finance 2008.

The CACP fuel CO_2 emission factors were updated to reflect the most recent and accurate research to date, as presented in The Climate Registry General Reporting Protocol Version 1.1 (The Climate Registry 2008). These emission factors affect most sectors in the city-wide inventories. Table B-2 presents the original and revised fuel CO_2 emission factors.

Table B-2. Fuel CO_2 Emission Factor Updates

Fuel	Unit	CACP CO_2 Emission Factor	The Climate Registry CO_2 Emission Factor
Natural Gas	kg /std. cu. ft.	0.057	0.0546
Propane	kg/gallon	6.122	5.74
Diesel	kg/gallon	9.511	10.15
Motor Gasoline	kg /gallon	9.393	8.81
Stationary Diesel	kg/gallon	9.511	10.15
Stationary Gasoline	kg/gallon	9.393	8.81
Compressed Natural Gas (CNG)	kg/ std. cu. ft.	0.126	0.0546
Liquified Petroleum Gas (LPG)	kg/gallon	6.122	5.79
Digester Gas[1]	lbs /1,000 cu. ft.	–	104.654
Landfill Gas[1]	lbs /1,000 cu. ft.	0.0	0.0

[1] Digester gas and landfill gas emission factors from the Bay Area Air Quality Management District 2006 GHG inventory. CH_4 and N_2O emission factors for digester gas of 0.02997 and 0.0003 lb/1,000 cu. ft. respectively and for landfill gas of 0.210503 and 0.000236 lb/1,000 cu. ft. respectively were entered into the CACP software; these factors were only used for the Sacramento County inventory industrial sector. CO_2 from landfill gas is biogenic and is not included in the inventory (Intergovernmental Panel on Climate Change 2006a).

Sources: The Climate Registry 2008. (Tables 12.1 and 13.1); Bay Area Air Quality Management District 2006 (Table B).

Residential Emissions

This section discusses the approach and methodology used to assess GHG emissions from residential sources in the County of Sacramento.

Electricity and Natural Gas

Electricity and natural gas consumption for the residential sector of each city in Sacramento County in 2005 was provided by the Sacramento Municipal Utilities District (SMUD) and The Pacific Gas and Electric Company (PG&E) (Ave pers. comm.; Bruso pers. comm.). Energy use data for the unincorporated areas were also supplied by SMUD and PG&E (Gill pers. comm.; Forney pers. comm.).The aggregate electricity and natural gas consumption data was entered into the CACP software, which uses default emissions factors for the state of California to calculate greenhouse gas emissions.

Both SMUD and PG&E report area-specific CO_2 emissions factors to the California Climate Action Registry (CCAR) of 616.07 and 489.2 pounds per megawatt hours (lbs/MWh) respectively. The default CO_2 electricity emissions factors in the CACP software were replaced with these emissions factors (California Climate Action Registry 2007a, 2007b) and the default CACP CO_2 natural gas emissions factor was replaced with 0.0546 lbs/ft^3 (shown in Table B-2) (The Climate Registry 2008). CH_4 and N_2O electricity and natural gas emission factors were not changed.

Wood and Other Solid-Fuel Burning

CH_4 and N_2O emissions from the burning of wood and pellets in homes was calculated using the Sacramento Metropolitan Air Quality Management District (SMAQMD) *Final Staff Report on Rule 421: Mandatory Episodic Curtailment of Wood and Other Solid Fuel Burning* (Sacramento Metropolitan Air Quality Management District 2007). The report estimated the number of residences in Sacramento County with fireplaces, wood stoves, wood burning inserts, and pellet stoves in 2007. The maximum estimated number of fireplaces, stoves, and pellet stoves were used in calculations to represent a worst-case scenario for greenhouse gas emissions (Table B-4).

The report also quantified the number of cords of wood and pounds of pellets burned each year per fireplace, stove, or pellet stove. A heat fuel comparison calculator published by the Energy Information Administration (EIA) was used to convert pellet and wood use into Btus (Energy Information Administration 2007). Table B-3 lists electricity, natural gas, and wood/pellets consumption and associated GHG emissions for the residential sector of each city in Sacramento County in 2005.

The total annual Btu of heat generated through burning of wood and pellets was then apportioned according to population in each city and the unincorporated area using California Department of Finance population data for the County shown in Table B-1 (California Department of Finance 2008).This data was then entered into the CACP software, which generated estimated CO_2e emissions for 2005 residential use of wood and pellets totaling 2,439,526 metric tons of CO_2e for the County of Sacramento.

Table B-3. 2005 Residential Energy Use and Associated GHG Emissions

City/Jurisdiction	SMUD Electricity (kWh)	PG&E Electricity (kWh)	Natural Gas[1] (therms)	Wood/Pellets (million Btu)	GHG Emissions (metric tons CO_2e)
Citrus Heights	322,443,748	–	11,866,422	412,101	160,429
Elk Grove	434,804,341	–	19,340,925	620,762	234,771
Folsom	239,381,909	–	11,068,167	329,352	131,409
Galt	66,291,790	–	2,849,108	108,995	35,373
Isleton	–	2,118,929	144,369	3,856	1,298
Rancho Cordova	183,404,161	–	7,273,480	267,344	94,324
Sacramento	1,307,297,649	4,044	65,698,581	2,168,980	748,792
Unincorporated Sacramento County [2]	1,982,790,947	12,915,291	80,910,929	2,660,670	1,033,142
Sacramento County	**4,536,414,545**	**15,038,264**	**199,151,981**	**6,572,060**	**2,439,526**

Natural gas is supplied by PG&E.

Electricity use data provided by SMUD for Sacramento County also includes Arden Arcade (303,378,900 kWh); this data was included in the Unincorporated Sacramento County GHG Inventory because Arden Arcade was an unincorporated community in 2005.

Sources: California Climate Action Registry 2007a, 2007b; The Climate Registry 2008; Ave pers. comm.; Bruso pers. comm.; Sacramento Metropolitan Air Quality Management District 2007; California Department of Finance 2008.

Table B-4. Wood Burning in Sacramento County

Type	Number of Residences	Wood Usage	Million Btu
Fireplace	139,000	0.92 cords/yr	2,813,360
Wood Stove	78,100	1.5 cords/yr	2,577,300
Wood Burning Insert	26,000	1.5 cords/yr	858,000
Pellet Stove	9,800	4,000 lb pellets/yr	323,400
Total			**6,572,060**

Note: Btu calculations based on heat contents of 22 million Btu/cord for wood and 16.5 million Btu/ton of pellets

Source: Sacramento Metropolitan Air Quality Management District 2007.

It is worth noting here that the U.S. Environmental Protection Agency (EPA), considers biofuels such as wood carbon neutral. Although these fuels emit CO_2, in the long run the CO_2 emitted from biomass consumption does not increase atmospheric CO_2 concentrations if the biogenic carbon emitted is offset by the growth of new biomass (U.S. Environmental Protection Agency 2008).

Commercial and Industrial Emissions

This section discusses the approach and methodology used to assess GHG emissions from commercial and industrial sources in Sacramento County. The commercial and industrial sectors are combined because both SMUD and PG&E aggregate energy use data from these two sectors into their commercial sector. SMUD does not have an industrial category: all industrial sources are included in SMUD's commercial category (Gill pers. comm.). PG&E's 15/15 rule protects customer confidentiality by aggregating energy usage into categories[1]. Industrial natural gas consumption is included in the commercial category when this rule is triggered (Cheeseman pers. comm.). Consequently, GHG emissions from energy usage in the industrial sector is accounted for in this inventory, but are not separated out. In addition, light rail electricity use is included in this sector.

Some industrial-specific data was available for the City of Sacramento and Sacramento County. These data and associated GHG emissions are discussed in the next section (Industrial-Specific Emissions). These emissions do not account for all industrial sources due to SMUD and PG&E's aggregation of consumption data discussed above.

Electricity and natural gas consumption for the commercial sector of each city in Sacramento County in 2005 was provided by SMUD and PG&E (Ave pers. comm.; Bruso pers. comm.). Table B-5 lists the electricity and natural gas consumption for each city in the commercial sector of Sacramento County in 2005.

According to SMUD, the Commercial and Industrial sector includes water-related electricity and natural gas consumption[2], but is not easily broken out. Energy use associated with water-related activities was collected separately and is discussed below (see Table B-19). To avoid double-counting, water-related electricity and natural gas consumption was subtracted from the Commercial and Industrial sector and placed in a separate category.

[1] The 15/15 Rule was adopted by the CPUC in the Direct Access Proceeding (CPUC Decision 97-10-031) to protect customer confidentiality. The 15/15 rule requires that any aggregated information provided by the Utilities must be made up of at least 15 customers and a single customer's load must be less than 15 percent of an assigned category. If the number of customers in the complied data is below 15, or if a single customer's load is more than 15 percent of the total data, categories must be combined before the information is released. The Rule further requires that if the 15/15 Rule is triggered for a second time after the data has been screened once already using the 15/15 Rule, the customer be dropped from the information provided. In addition to the 15/15 Rule, the CPUC further determined that no information about customers with demands above 500 kW should be included in the distributed information.

[2] Water-related emissions include indirect emissions for water supply and irrigation infrastructure and wastewater collection and treatment facilities.

Table B-5. 2005 Commercial and Industrial[1] Energy Use and Associated GHG Emissions

City/Jurisdiction	SMUD Electricity (kWh)	PG&E Electricity (kWh)	Natural Gas[2] (therms)	GHG Emissions (metric tons CO_2e)
Citrus Heights	175,121,791	–	2,196,291	62,553
Elk Grove	262,819,673	–	4,736,514	101,607
Folsom	369,620,692	–	7,283,341	146,236
Galt	109,592,861	–	604,370	35,013
Isleton	–	1,871,372	62,288	769
Rancho Cordova	404,642,501	–	3,333,425	135,190
Sacramento	2,235,889,750	8,457	61,791,582	979,777
Unincorporated Sacramento County [3]	1,929,323,364	15,841,392	38,581,878	770,025
Sacramento County	**5,487,010,632**	**17,721,221**	**118,589,689**	**2,231,170**

Note: The data presented above includes water-related energy consumption (Ave pers. comm.). Water-related energy consumption is presented in a separate section (see Table B-19). To avoid double-counting, water-related electricity and natural gas consumption was subtracted from the above data.

[1] Specific industrial usage data was not available from SMUD or PG&E.

[2] Natural gas is supplied by PG&E.

[3] Electricity use data provided by SMUD for Sacramento County also includes Arden Arcade (347,353,173 kWh); this data was included in the Unincorporated Sacramento County Inventory because Arden Arcade was an unincorporated community in 2005.

Sources: California Climate Action Registry 2007a, 2007b; The Climate Registry 2008; Ave pers. comm.; Bruso pers. comm.

The aggregate electricity and natural gas consumption was entered into the CACP software, which calculated GHG emissions related to commercial and industrial energy use. Changes to the default CACP emission factors for electricity and natural gas are addressed in Table B-2. Total GHG emissions from this sector are 2,231,170 metric tons CO_2e.

Industrial-Specific Emissions

This section discusses the approach and methodology used to assess GHG emissions from industrial sources in Sacramento County. As discussed above, most GHG emissions from the industrial sector are included in the Commercial and Industrial category. The following data represents industrial activity only, and is presented for completeness.

Electricity and natural gas consumption for the industrial sector of the city of Sacramento in 2005 was provided by SMUD and PG&E (Ave pers. comm.; Bruso pers. comm.). Table B-6 lists the electricity and natural gas consumption for each city in the industrial sector of Sacramento County in 2005.

Table B-6. 2005 Industrial-Specific Energy Use and Associated GHG Emissions

City/Jurisdiction	SMUD Electricity (kWh)	PG&E Electricity (kWh)	Natural Gas[1] (therms)	GHG Emissions (metric tons CO_2e)
Sacramento	–	–	5,339,573	28,656
Unincorporated Sacramento County	–	–	392,123	2,104
Sacramento County	**–**	**–**	**5,731,696**	**30,760**

[1] Natural gas is supplied by PG&E.

Sources: California Climate Action Registry 2007a, 2007b; The Climate Registry 2008; Ave pers. comm.; Bruso pers. comm.; Quinn pers. comm..

Additional industrial fuel use for the County of Sacramento was supplied by the SMAQMD (Quinn pers. comm.). This fuel use represents large stationary point sources such as power plants, boilers, incinerators, and internal-combustion engines. Smaller industrial sources were not reported by SMAQMD. Fuel includes natural gas, digester gas, liquefied petroleum gas (LPG), fuel oil, landfill gas, and diesel. This fuel consumption was included in the Sacramento County Inventory since a breakdown of fuel consumption by city was unavailable. This data is presented in Table B-7 under the heading "Sacramento County Inventory Fuel Combustion." According to the utilities, the natural gas combustion data from SMAQMD was included in PG&E's Commercial and Industrial category.

Fuel combustion related to power plants is accounted for in the electricity emission factors used in this inventory for each sector (Ave pers. comm., Bartholomy pers. comm.). Consequently, fuel combustion for all sources except natural gas and power plants was included in the Sacramento County Industrial sector. Table B-7 presents fuel use data and the associated GHG emissions from industrial sources reported by SMAQMD. Only a portion of this data was entered into the Sacramento County inventory due to the overlaps listed above. This data was not separated by city, so it was only included in the Sacramento County inventory.

Table B-7. 2005 Industrial Fuel Use for Sacramento County and Associated GHG Emissions

Source	Fuel	Quantity	Unit	GHG Emissions (metric tons CO_2e)[1]
Sacramento County Inventory Fuel Combustion				
Asphalt Plant	LPG	882	thousand gal	5,136
Boiler	digester gas	20	million cu. ft.	956
Boiler	fuel oil	4	thousand gal	47
Boiler	landfill gas[2]	197	million cu. ft.	402
Boiler	LPG	193	thousand gal	1,124
IC Engine	Diesel	289	thousand gal	2,943
Sacramento County Subtotal[3]				10,608
Additional Fuel Combustion[4]				
Asphalt Plant	natural gas	151	million cu. ft.	8,267
Boiler	natural gas	1,036	million cu. ft.	56,905
Heater	natural gas	45	million cu. ft.	2,464
Incinerators	natural gas	53	million cu. ft.	2,902
Ovens	natural gas	188	million cu. ft.	10,292
Brick Ovens	natural gas	164	million cu. ft.	8,978
Additional Fuel Combustion Subtotal				89,808
Power Plant Fuel Combustion[5]				
Power Plant Turbine	digester gas	980	million cu. ft.	46,664
Power Plant Turbine	natural gas[2]	18,982	million cu. ft.	1,039,196
Power Plant IC Engine	landfill gas	1,566	million cu. ft.	1,998
Power Plant Fuel Combustion Subtotal				1,087,858
Total				**1,188,276**

[1] See Table B-2 for emission factors.

[2] CO_2 emissions from flaring or landfill gas combustion are of biogenic origin and are not significant (Intergovernmental Panel on Climate Change 2006a). GHG emissions presented here represent CH_4 and N_2O emissions.

[3] Emissions from these sources were only included in the Sacramento County inventory because industrial fuel use by city or jurisdiction was unavailable

[4] This data was not included in the inventory due to overlap with commercial and industrial data. It is presented here for informational purposes.

[5] Fuel combustion related to power plants is accounted for in the electricity emission factors used in this inventory for each sector.

Sources: The Climate Registry 2008; Bay Area Air Quality Management District 2006; Quinn pers. comm.

The aggregate natural gas (see Table B-6) and fuel consumption data (excluding natural gas) for industrial-specific activity was entered into the CACP software in the Industrial category, although a significant portion of industrial data and emissions are included in the Commercial and Industrial category. Changes to the default CACP emission factors for electricity and natural gas are discussed above (see Table B-2).

Total GHG emissions from the industrial-specific sector reported in the Sacramento County inventory are 41,369 metric tons CO_2e (natural gas from Table B-6 plus additional fuel from Table B-7). Total GHG emissions from non–power plant industrial fuel use reported by SMAQMD are 89,808 metric tons CO_2e, and total GHG emissions from all industrial fuel use reported by SMAQMD are 1,188,276 metric tons CO_2e. Power plant turbines account for 92% of net industrial emissions (1,087,858 metric tons CO_2e). Power plant emissions are accounted for in the electricity emission factors used in this inventory for each sector.

Transportation Emissions

This section discusses the approach and methodology used to assess GHG emissions from on-road and off-road transportation in Sacramento. Emissions from the Sacramento International Airport are included in this category.

On-Road Emissions

Greenhouse gas emissions from on-road vehicle use were calculated using the CACP software Transportation Assistant, which breaks out total aggregate vehicle miles travelled (VMT) into default VMT percentages by vehicle type. The software then determines emissions based on a default vehicle population for the base-year inventory. This vehicle population includes the following categories of gasoline vehicles:

- Subcompact/compact, midsize, and full-size autos.
- Light truck/SUV/pickups.
- Motorcycles.

And the following categories of diesel vehicles:

- Subcompact/compact autos.
- Heavy trucks.
- Light truck/SUV/pickups.
- Transit buses.

CACP software fuel economy for each vehicle type is based on state averages from the EIA's Transportation Energy Databook (STAPPA/ALAPCO 2003). The

California Department of Transportation (Caltrans) Highway Performance Monitoring System (HPMS) 2005 public road data estimated 32,145,060 daily VMT (approximately 11.7 million annual VMT; see Table B-8) for Sacramento County as a whole (California Department of Transportation 2006). Based on these inputs, the CACP software yields on-road transportation emissions of 6,731,662 metric tons of CO_2e for Sacramento County in 2005.

The HPMS road data breaks out VMT for each city in the County. This data also lists total VMT for the state highways located within the County. In order to calculate GHG emissions from highway travel for each city, VMT from state highways was apportioned by the number of highway miles located within each city's jurisdictional boundaries. This methodology assumes that each highway mile in the County (regardless of location) sees the same VMT as each other highway mile. This assumption was necessary since more specific highway-related VMT data was unavailable. VMT traveled for surface roads only within each city was added to the estimated highway VMT for each city and entered into the CACP Transportation Assistant software following ICLEI guidance (Zahner pers. comm.). Table B-8 presents city and highway VMT traveled in each city and the associated GHG emissions calculated using the CACP software.

Table B-8. 2005 On-Road VMT from City and Highway Travel and Associated GHG Emissions

City/Jurisdiction	Highway Miles[1]	City VMT (thousand miles)	Highway VMT (thousand miles)[2]	GHG Emissions (metric tons CO_2e)
Citrus Heights	2.8	365,040	66,258	247,463
Elk Grove	7.2	416,874	172,228	338,005
Folsom	6.7	274,236	161,469	249,991
Galt	3.4	46,194	82,432	73,801
Isleton[3]	1.2	924	29,338	17,363
Rancho Cordova	5.1	314,886	123,780	251,690
Sacramento	62.1	1,890,602	1,494,790	1,942,412
Unincorporated Sacramento County	141.4	2,890,778	3,402,652	3,610,937
Additional Travel[4]	–	–	467	268
Sacramento County	**230.0**	**6,199,532**	**5,533,415**	**6,731,929**

[1] Highway miles located within each jurisdiction's boundary.

[2] Apportioned by percentage of overall highway miles in each jurisdiction.

[3] Isleton has 0.06% of the total Sacramento County population but 0.5% of total highway miles within its city limits; this results in relatively high per-capita transportation emissions.

[4] Includes California State Park Service, U.S. Bureau of Reclamation, and U.S. Fish and Wildlife Service.

Source: California Department of Transportation 2006.

Off-Road Emissions

Exhaust emissions for 2005 from off-road vehicles in Sacramento County were calculated using the California Air Resources Board (CARB) OFFROAD 2007 air quality model. OFFROAD 2007 considers emissions from off road equipment including recreational boats and vehicles, industrial equipment, construction equipment, lawn and garden, airport ground support, military, agriculture, rail operation, and more (California Air Resources Board 2006). Emissions were then apportioned by population in the unincorporated area using Department of Finance data for 2005 listed in Table B-1 (California Department of Finance 2008). CO_2, CH_4 and N_2O were quantified for off-road vehicles in the OFFROAD 2007 model. They were entered into the CACP software in the "Other" tab. Off-road GHG emissions were 584,090 metric tons of CO_2e for the entire County in 2005. Table B-9 presents off-road emissions for each city.

Table B-9. 2005 Off-Road GHG Emissions

City/Jurisdiction	GHG Emissions (metric tons CO_2e)
Citrus Heights	36,625
Elk Grove	55,170
Folsom	29,271
Galt	9,687
Isleton	343
Rancho Cordova	23,760
Sacramento	192,767
Unincorporated Sacramento County	236,466
Sacramento County	**584,090**
Source: OFFROAD 2007; California Department of Finance 2008.	

As seen in Table B-10, on-road emissions accounted for 92% of total GHG emissions from the transportation sector and off-road emissions amounted to 8% of total GHG emissions from the transportation sector.

Table B-10. On-Road vs. Off-Road Transportation GHG Emissions for 2005

Source	GHG Emission (metric tons CO_2e)	Percent of Emissions
On-road	6,731,929	92
Off-road	584,090	8
Total	**7,316,019**	**100**
Source: OFFROAD 2007; California Department of Transportation 2006		

Sacramento International Airport Emissions

The Sacramento International Airport is located in the unincorporated area of Sacramento County, and was therefore included in the Unincorporated Sacramento County GHG Inventory. Sacramento County owns and maintains control over the Sacramento International Airport; consequently, GHG emissions from airport on-site roadways, parking facilities, and off-airport roadways associated with the Sacramento International Airport were included in the Sacramento County Government emissions inventory (Barry pers. comm.). Table C-23 in Appendix C presents GHG emissions associated with the airport for 2004, which amount to 200,405 metric tons CO_2e. See Appendix C for further discussion.

Regional Transit/Light Rail Emissions

Electricity consumption and associated GHG emissions related to light rail operation in Sacramento County is included in the Commercial and Industrial sector discussed above. SMUD was unable to separate this data by city or jurisdiction.

Table B-11 presents regional transit electricity consumption and associated GHG emissions for Sacramento County as a whole. GHG emissions related to light rail operation in Sacramento County for 2005 amount to 12,287 metric tons CO_2e, which represent 0.5% of the Commercial and Industrial sector and 0.1% of total County-wide emissions.

Table B-11. 2005 Regional Transit Electricity Consumption and Associated GHG Emissions

Source	Electricity (kWh)	GHG Emissions (metric tons CO_2e)
Regional Transit	42,385,234	12,287
Source: Ave pers. comm.		

Agricultural Emissions

This section discusses the approach and methodology used to assess GHG emissions from agricultural activity in the County of Sacramento. There are four sources of agricultural emissions: emissions from enteric fermentation of cattle and swine, manure management of cattle and swine, enteric fermentation and manure management from dairy cows, and N_2O emissions from fertilizer application. All agriculture emissions were calculated separately from the CACP software using ARB and IPCC methodology (Intergovernmental Panel on Climate Change 2006b; California Air Resources Board 2008a, 2008b, 2008c).

Enteric Fermentation and Manure Management Emissions from Cattle, Swine, and Dairy Cows

Emissions of CH_4 and N_2O can result from livestock production through enteric fermentation and manure management (Intergovernmental Panel on Climate Change 2006b). ARB and IPCC Tier 1 methodology were used to calculate emissions. Data from the California Division of Land Resource Protection Farmland Mapping and Monitoring Program (FMMP) were used to determine grazing land acreage per city within Sacramento County (California Division of Land Resource Protection 2008). Grazing land is located in Elk Grove, Folsom, Galt, Rancho Cordova, Sacramento, and unincorporated Sacramento County.

The Sacramento County 2005 Crop & Livestock Report (County of Sacramento 2006) was used to determine the total number of cattle, swine, and dairy cows within the County. Total emissions from enteric fermentation and manure management resulting from cattle and swine production were calculated for the entire County and apportioned to each city based on the percent of grazing land in each city since specific data on number of livestock within each city was unavailable (92% of all grazing land is in the unincorporated portion of the County). Emissions from enteric fermentation and manure management resulting from dairy cow production were assigned to the unincorporated inventory since all dairies are located outside of city boundaries.

The Sacramento County 2005 Crop & Livestock Report presents the total number of cattle (31,100) and swine (4,836) in the County but does not break out dairy cows. To determine the number of dairy cows, the amount of milk produced in 2005 (163 million kg) was divided by 8,400 kg of milk per head per year, based on Intergovernmental Panel on Climate Change (IPCC) estimates (Intergovernmental Panel on Climate Change 2006b). This yields 19,405 head dairy and 11,695 head cattle.

GHG emissions from enteric fermentation and manure management for each city were calculated using the following equations. The variables used in these equations are presented in Table B-12.

$$CH_4\ Emissions\ from\ Enteric\ Fermentation\ (Cattle\ and\ Swine) = P_g(C * EM_c + S * EM_s)$$

$$CH_4\ Emissions\ from\ Manure\ Management\ (Cattle\ and\ Swine) = P_g(C * MM_c + S * MM_s)$$

$$N_2O\ Emissions\ from\ Manure\ Management\ (Cattle\ and\ Swine) = P_g(C * N_c + S * N_s)$$

$$CH_4\ Emissions\ from\ Enteric\ Fermentation\ (Dairy\ Cows) = D * EM_d$$

$$CH_4\ Emissions\ from\ Manure\ Management\ (Dairy\ Cows) = D * MM_d$$

$$N_2O\ Emissions\ from\ Manure\ Management\ (Dairy\ Cows) = D * N_d$$

Table B-12. Variables and Emissions Factors used to Calculate Agricultural GHG Emissions

Variable	Description	Value	Source
Overall			
P_g	percent grazing land by city	Table B-13	California Division of Land Resource Protection 2008
C	total number of cattle	11,695	County of Sacramento 2006
S	total number of swine	4,836	County of Sacramento 2006
S	total number of dairy cows	19,405	County of Sacramento 2006
Enteric Fermentation			
EM_c	CH_4 per head cattle per year	53 kg	IPCC 2006
EM_s	CH_4 per head swine per year	1.5 kg	ARB 2008a
EM_d	CH_4 per head dairy per year	107.8 kg	ARB 2008a
Manure Management			
MM_c	CH_4 per head cattle per year	2 kg	IPCC 2006
MM_s	CH_4 per head swine per year	18.6 kg	ARB 2008a
MM_d	CH_4 per head dairy per year	169.6 kg	ARB 2008a
N_c	N_2O per head cattle per year	1.45 kg	ARB 2008a
N_s	N_2O per head swine per year	0.018 kg	ARB 2008a
N_d	N_2O per head dairy per year	0.23 kg	ARB 2008a

Sources: California Division of Land Resource Protection 2008; County of Sacramento 2006; Intergovernmental Panel on Climate Change 2006b; California Air Resources Board 2008a.

CH_4 and N_2O emissions were converted to CO_2e using their GWPs of 21 and 310 respectively. Table B-13 presents these emissions for each city.

Table B-13. Sacramento County Grazing Land and GHG Emissions from Enteric Fermentation and Manure Management

			GHG Emissions (metric tons CO_2e)				
			Enteric Fermentation		Manure Management		
City[1]	Grazing Land (acres)	Grazing Land (%)	Cattle & Swine	Dairy Cows	Cattle & Swine	Dairy Cows	Total Emissions
Elk Grove	1,682	1.0	136	–	79	–	215
Folsom	2,980	1.8	241	–	140	–	381
Galt	71	0.0	6	–	3	–	9
Rancho Cordova	7,962	4.9	643	–	374	–	1,017
Sacramento	876	0.5	71	–	41	–	112
Unincorporated Sacramento	149,568	91.7	12,073	43,938	7,033	70,493	135,271
Total	**163,138**	**100.0**	**13,168**	**43,938**	**7,671**	**70,493**	**156,110**

[1] The FMMP does not report grazing land in Isleton or Citrus Heights.

Sources: California Division of Land Resource Protection 2007; Intergovernmental Panel on Climate Change 2006; California Air Resources Board 2008a, 2008b, 2008c; County of Sacramento 2006.

N_2O Emissions from Fertilizers

Emissions of N_2O can result from anthropogenic inputs of nitrogen into soil through fertilizers by way of a direct (directly from the soils to which the nitrogen is added/released) and indirect (following volatilization of NH_3 and NO_X from managed soils) pathway (Intergovernmental Panel on Climate Change 2006b). Both direct and indirect emissions of N_2O were calculated. An average quantity of nitrogen applied in synthetic fertilizer for crops is 140 pounds per acre per year (Miyao pers. comm.).

It was assumed that all crops in Sacramento County use the same rate of fertilizer application, and that all crops use synthetic fertilizer to be conservative (organic fertilizers produce much lower N_2O emissions). Crop acreage by city was determined through the 2004 FMMP report by summing up acreage under the categories labeled Farmland. N_2O emissions from fertilizer application on farmland in each city were calculated using the following equation (California Air Resources Board 2008b, 2008c):

$$Direct\ N_2O\ Emissions = N_f * C * (1 - N_v) * N_n * M$$

$$Indirect\ N_2O\ Emissions = N_f * C * (N_v) * N_n * M$$

where: N_f = nitrogen applied in fertilizer = 140 lbs per acre * acres farmland in each city

C = lbs to gram conversion = 453.59 g/lb

N_v = Nitrogen volatilization = 0.1

N_n = Nitrogen emitted as N_2O = 0.01

M = Molecular weight ratio of N_2O to N_2 = 1.57

Direct and indirect emissions of N_2O for each city with farmland were added together and converted to metric tons of CO_2e. Table B-14 presents farmland acreage and N_2O emissions for each city with farmland.

Table B-14. Direct and Indirect N_2O Emissions from Nitrogen Applied In Fertilizer

City[1]	Farmland (acres)	Farmland (%)	N_2O Emissions (metric tons CO_2e)
Elk Grove	7,811	3.53	2,416
Folsom	28	0.01	9
Galt	743	0.34	230
Isleton	36	0.02	11
Rancho Cordova	813	0.37	251
Sacramento	6,278	2.84	1,942
Unincorporated Sacramento County	205,610	92.90	63,594
Total	**221,319**	**100.00**	**68,452**

[1] The FMMP does not report farmland in Citrus Heights.

Sources: California Department of Conservation, Division of Land Resource Protection 2007; California Air Resources Board 2008b, 2008c; Miyao pers. comm.

Waste Emissions

This section discusses the approach and methodology used to assess GHG emissions from landfills due to waste landfilled by the County of Sacramento. There are two sources of waste emissions included in the inventory: 1) emissions from waste generated and landfilled in 2005, and 2) “waste-in-place” emissions for all waste currently located in landfills within the County.

Landfill Emissions from Waste Generation in 2005

The CACP software was used to calculate GHG emissions from all waste generated and landfilled for the year 2005 for the entire County and each jurisdiction within the County, regardless of the location of the landfills. Waste generation data was compiled from the California Integrated Waste Management Board’s (CIWMB) website. The CIWMB provides waste stream profile information for each city in Sacramento County, including waste by waste type, total disposal, and disposal location. Each landfill receiving waste from the County was researched to determine if CH_4 capture or flaring technology was implemented in 2005. Keifer landfill has both a CH_4-to-energy program and a CH_4 capture efficiency of 85% (Israel pers. comm.). A number of other landfills also have CH_4 capture technology, but individual capture efficiencies were unavailable.

Based on CACP protocol, the default CH_4 capture efficiency of 75% was used to calculate emissions from these landfills (Environmental Protection Agency 1998). Emissions of CO_2 from flared CH_4 are biogenic in origin and IPCC guidelines state that they should not be counted in a GHG inventory (Intergovernmental Panel on Climate Change 2006a). It is good practice to subtract flared $CH_4$from the CH_4 generation potential of landfilled waste. Consequently, even though the quantity of landfill gas flared at Kiefer Landfill was available, GHG emissions from this combustion was not included in the inventory.

The CACP software allows only one CH_4 capture efficiency factor per inventory, so a weighted capture efficiency was calculated for each city as follows for 2005 waste data:

$$M_c = \frac{W_{kc}}{W_{tc}} * 85\% + \frac{W_{fc}}{W_{tc}} * 75\%$$

where: M_c = CH_4 capture efficiency for city c

W_{kc} = waste deposited in Kiefer landfill for city c

W_{tc} = total waste landfilled for city c

W_{fc} = waste deposited in other landfills with CH_4 capture

These capture efficiencies were applied to both the community and government (where available) waste generation data for each city. Waste disposal, waste diversion, waste stream profile, and CH_4 capture efficiencies for each city are presented in Table B-15. Total emissions from waste generation in 2005 are 654,139 metric tons CO_2e.

Table B-15. Waste Disposal, Waste Stream Profile, and CH_4 Capture Efficiencies for Sacramento County In 2005

Category		Citrus Heights	Elk Grove	Folsom	Isleton	Galt	Rancho Cordova	Sacramento	Unincorporated Sacramento County	Sacramento County
Total Disposal (tons)		94,600	107,251	74,635	750	17,344	65,131	684,088	610,772	1,654,571
Diversion Rate (%)		59	59	47	59	52	48	43	59	50
Waste Stream Profile (%)	Paper Products	30.8	31.8	30.4	28.5	29.7	31.8	32.1	30.8	32.1
	Food Waste	18.1	18.6	20.8	23.1	21.2	18.7	18.9	18.1	18.5
	Plant Debris	12.3	12.3	9.0	8.5	9.4	7.1	9.0	7.1	12.3
	Wood Textiles	7.1	6.8	5.2	5.6	5.9	6.9	6.1	2.7	7.1
	Other Waste	30.0	30.5	34.7	34.3	33.9	35.5	34.0	41.3	30.0
Weighted CH_4 Capture (%)		71	62	79	75	66	67	42	71	58
Emissions (metric tons CO_2e)		**23,679**	**38,104**	**14,147**	**167**	**5,306**	**19,435**	**364,904**	**151,509**	**654,139**[1]

[1] The sum of GHG emissions from each city's waste generation does not equal Sacramento County emissions precisely, due to the aggregated waste stream profile from the CIWMB, the weighted CH_4 capture percentage used for Sacramento County waste generation, and varying reporting years for waste profile data provided by the CIWMB.

Source: California Integrated Waste Management Board 2008a, 2008b, 2008c, 2008d¸2008e¸2008f, 2008g, 2008h, 2008i, 2008j; Environmental Protection Agency 1998.

The CIWMB provides different waste data for different years, such as waste profile information for 1999 and total waste disposed for 2005. Data closest to 2005 was used where available, and most recent data was used in other cases. The waste stream percentages shown in Table B-15 represent aggregate household and business disposal provided by the CIWMB. The CIWMB provides data for unincorporated Sacramento County plus Citrus Heights, but does not break out each jurisdiction's waste data. This aggregate waste data was broken down by population to estimate waste from Citrus Heights and unincorporated Sacramento County separately.

The same waste stream profile was applied to each jurisdiction. The sum of GHG emissions from each city's waste generation does not precisely equal Sacramento County emissions due to the aggregated waste stream profile from the CIWMB and the weighted CH_4 capture percentage used for Sacramento County waste generation. This discrepancy is also due in part to varying reporting years for waste profile data provided by the CIWMB.

It was assumed that no GHG sequestration would occur at any landfills to provide a conservative estimate of landfill emissions. Although the CACP software uses positive default sequestration rates for each waste type, it was determined that zero sequestration at landfills provides a more accurate estimate of landfill emissions[3]. See Appendix C for more information on CH_4 emissions from waste generated by government operations and placed in landfills.

Landfill Emissions from Waste-In-Place in 2005

Waste-in-place emissions are based on the accumulated waste in the landfill over the landfill's lifetime, as opposed to the current year's generation of waste. Waste-in-place emissions were calculated for landfills with available waste-in-place and CH_4 capture data located within County borders, including Kiefer (unincorporated), L&D (Sacramento), Sacramento City Landfill (Sacramento), Elk Grove Landfill (Elk Grove), and Dixon Pit landfill (Elk Grove) (Environmental Protection Agency 2007a; County of Sacramento 2009). Methane emissions from waste-in-place were calculated using ARB's Excel tool based on the IPCC's first order decay (FOD) model, according to the guidelines of the Local Government Operations Protocol (ICLEI 2008; California Air Resources Board 2009).

According to the CIWMB, a total of 46 solid waste facilities are located within Sacramento County, most of which are closed (California Integrated Waste Management Board 2009a). These facilities are listed as composting facilities, transfer facilities, solid waste disposal sites, and landfills. Many of these sites are not landfills (Goodrich pers. comm.). Since landfills account for the vast majority

[3] ICLEI recommends eliminating the effect of landfill sequestration for both government operations inventories and community inventories, to be consistent with the principle that local government operations and community inventories should not account for emissions sinks (ICLEI 2009).

of CH_4 emissions from solid waste, these sites would produce negligible CH_4 emissions.

Waste-in-place landfill tonnage for the major landfills listed above was collected from the EPA's Landfill Methane Outreach Program (LMOP) database. Data on these closed landfills was not available in the LMOP database because the landfills do not represent operational or potential landfill gas (LFG) energy projects, have been closed for five or more years, or have less than 1 million tons of waste (Environmental Protection Agency 2007a). It is likely that these landfills are relatively small and are unlikely to emit significant amounts of CH_4 relative to the landfills listed above (Goodrich pers. comm.). In addition, the County of Sacramento has implemented closure maintenance of some of these closed landfills, including heavy clay final covers, monitoring wells, and extraction/flaring. A final cover and gas extraction and flaring system were installed at the Elk Grove Landfill. These controls aid in the mitigation of CH_4 emissions (Tedrow pers. comm.).

The ARB's FOD spreadsheet-based tool for landfill emissions implements the mathematically exact first-order decay model of the 2006 IPCC guidelines. This tool calculates landfill emissions from waste-in-place using a time constant, the methagenic potential of the waste, the year the landfill was opened, and the landfill closure year. Default values for the arid conditions in Sacramento County (less than 25 inches of rain per year) were used for all landfills. It was assumed that the total amount of waste in each landfill was deposited evenly over the landfills' lifetime. Alternative Daily Cover (ADC) tonnages were available for Kiefer and L&D landfills for the years 2000-2005 and were entered into the FOD model (California Integrated Waste Management Board 2009b). Consistent with the LGOP, only methane emissions were counted in the inventory (CO_2 is considered biogenic) (Intergovernmental Panel on Climate Change 2006a).

Waste-in-place emissions for all five landfills were included in the Sacramento County inventory. Kiefer and Elk Grove Landfill waste-in-place emissions were included in the Unincorporated Sacramento County city-wide and government inventories. L&D landfill emissions were included in the City of Sacramento City-Wide GHG Inventory, but not the government inventory because this landfill is located in Sacramento but is owned by Teichert Land Company.

The Sacramento City landfill waste-in-place emissions were included in the City of Sacramento City-Wide GHG Inventory and government inventories, and Dixon Pit and Elk Grove Landfill emissions were included in the City of Elk Grove City-Wide GHG Inventory but not the City of Elk Grove government inventory because Dixon Pit is owned by West Coast Building–Wrecking, Inc. and Elk Grove landfill is owned by the County of Sacramento. Keifer Landfill has a CH_4 capture efficiency of 85% (Israel pers. comm.).

Sacramento City Landfill, Elk Grove Landfill, and Dixon Pit Landfill have CH_4 flaring, but specific information on their capture efficiency is unavailable (California Integrated Waste Management Board 2001). Consistent with EPA and ICLEI protocol, it was assumed that 75% of CH_4 is captured and flared at these landfills. L&D does not have CH_4 capture or flaring technology. As discussed above, it is good practice to subtract flared CH_4 from the CH_4 generation potential of landfilled waste and not include GHG emissions from this source in an inventory (Intergovernmental Panel on Climate Change 2006a).

Table B-16 presents data input into the CACP software to calculate waste-in-place emissions for landfills located in Sacramento County. Total emissions from waste-in-place for the landfills analyzed in this report are 89,093 metric tons of CO_2e.

Table B-16. Waste-In-Place Data and GHG Emissions for Sacramento County Landfills

Category	Kiefer	Elk Grove Landfill	L&D	Sacramento City	Dixon Pit
Landfill Location	Sacramento County	Elk Grove	City of Sacramento	City of Sacramento	Elk Grove
Landfill Owner	Sacramento County	Sacramento County	Teichert Land Company	City of Sacramento	West Coast Building–Wrecking, Inc.
Waste-in-Place (tons)	23,000,000	465,000	1,453,000	3,900,000	214,800
ADC (tons)[1]	146,009	N/A	59,954	N/A	N/A
Year Opened	1967	1961	1977	1968	N/A
Closure Year	2036	1992	2013	1994	1999
CH_4 Capture Efficiency (%)[1]	85	75	0	75	75
Emissions (metric tons CO_2e)	**49,841**	**1,511**	**22,994**	**14,012**	**735**

[1] ADC tons were only available for Kiefer and L&D landfills for the years 2000-2005; tons presented here are the total ADC for these years (California Integrated Waste Management Board 2009b).

[2] The default CH_4 capture efficiency of 75% was used for the Sacramento City, Elk Grove, and Dixon Pit Landfills (Environmental Protection Agency 1998). L&D does not have CH_4 capture (California Integrated Waste Management Board 2001).

Sources: Environmental Protection Agency 1998; California Integrated Waste Management Board 2001, 2009; California Air Resources Board 2009; Israel pers. comm.; County of Sacramento 2009.

High GWP GHG Emissions

This section discusses the approach and methodology used to assess GHG emissions from High GWP GHG in the County of Sacramento.

CEC estimates California emissions of high GWP gases are largely the result of refrigerants and, to a lesser extent, electric utility transmission and distribution equipment (California Energy Commission 2006a). High GWP GHGs are also emitted during semiconductor manufacturing processes. High GWP GHG emissions in Sacramento County are predominantly associated with refrigerants and transmission lines; there is no semiconductor manufacturing within the County.

Many high GWP GHGs, such as HFCs and CFCs, are used as replacements for ozone-depleting substances in refrigeration and space-conditioning equipment and in solvents and foams. The CEC scaled U.S. emissions for high GWP GHGs from refrigeration equipment, space conditioning, and foams by population in California relative to the United States, and estimates that high GWP GHG emissions for 2004 accounted for 2.9% of total emissions, up from 2.0% in 1990 (California Energy Commission 2006a). CARB estimates that 13.97 million metric tons of CO_2e were emitted from replacements for ozone-depleting substances in 2004 (California Air Resources Board 2007).

The CEC estimates that high GWP GHG emissions are rising in California (California Energy Commission 2006a). For the purposes of this analysis, statewide high GWP GHG emissions trends were mapped from 1990 to 2004 and the resulting trend line (showing an average annual rate of growth of 9.6%) was used to estimate emissions in 2005 at 15.1 million metric tons of CO_2e (California Air Resources Board 2007). The 2005 population in Sacramento County was used to determine per capita emissions of high GWP GHGs (California Department of Finance 2008). The population for each city in 2005 was then used to scale emissions of high GWP GHGs to estimate emissions for each city (see Table B-1).

Table B-17 provides the estimated annual emissions of high GWP GHG emissions of HFCs and PFCs for the year 2005 for each city. Net GHG emissions from high GWP gases are 565,076 metric tons of CO_2e per year.

Table B-17. 2005 High GWP GHG Emissions

City/Jurisdiction	Population (%)	GHG Emissions (metric tons CO_2e)
Citrus Heights	6.27	35,433
Elk Grove	9.45	53,374
Folsom	5.01	28,318
Galt	1.66	9,372
Isleton	0.06	332
Rancho Cordova	4.07	22,987
Sacramento	33.00	186,492
Unincorporated Sacramento County	40.48	228,768
Sacramento County	**100.00**	**565,076**

Source: California Department of Finance 2008; California Air Resources Board 2007a.

Domestic Wastewater Treatment and Discharge Emissions

This section discusses the approach and methodology used to assess direct GHG emissions from domestic wastewater treatment and discharge in Sacramento County.

Wastewater treatment processes can produce emissions of CH_4 and N_2O. Treatment of wastewater from both domestic (municipal sewage) and industrial sources can produce these emissions (U.S. Environmental Protection Agency 2007b). Due to lack of available data on industrial wastewater treatment, only GHG emissions from domestic wastewater were analyzed.

Wastewater from domestic sources is treated to remove soluble organic matter, suspended solids, pathogenic organisms, and chemical contaminants. CH_4 is generated when microorganisms biodegrade soluble organic material in wastewater under anaerobic conditions. N_2O is generated during both nitrification and denitrification of the nitrogen present in wastewater, usually in the form of urea, ammonia, and proteins (U.S. Environmental Protection Agency 2007b).

In 2004, CH_4 emissions in California from domestic wastewater treatment were estimated to be 2.4 million metric tons of CO_2e and N_2O emissions were estimated to be 1 million metric tons of CO_2e (California Air Resources Board 2007). Combined, this source represented 0.7% of net California GHG emissions in 2004.

For the purposes of this analysis, ARB per capita emissions of CH_4 and N_2O from domestic wastewater treatment and discharge for the state of California in 2004 were used to estimate emissions for the County of Sacramento. These emission factors are 3.21 kg CH_4 and 0.0953 kg N_2O per person (California Air Resources Board 2008d, 2008e). These State-wide emission rates were then applied to the population of each city and the County of Sacramento in 2005 to estimate overall city and County emissions (see Table B-1) (State of California, Department of Finance 2007a).

Table B-18 presents the estimated annual emissions of CH_4 and N_2O from domestic wastewater treatment and discharge for the year 2005 for each city. Net GHG emissions from this source are 134,353 metric tons of CO_2e per year.

Table B-18. 2005 Domestic Wastewater Treatment and Discharge Emissions of CH_4 and N_2O

City/Jurisdiction	CH_4 Emissions (metric tons)	N_2O Emissions (metric tons)	GHG Emissions (metric tons CO_2e)
Citrus Heights	278.8	8.3	8,425
Elk Grove	420.0	12.5	12,690
Folsom	222.8	6.6	6,733
Galt	73.7	2.2	2,228
Isleton	2.6	0.1	79
Rancho Cordova	180.9	5.4	5,465
Sacramento	1,467.4	43.6	44,341
Unincorporated Sacramento County	1,800.0	53.5	54,392
Sacramento County	**4,446.2**	**132.2**	**134,353**

Note: emissions based on 2004 California per capita emissions of 3.21 kg CH_4 and 0.0953 kg N_2O per person (California Air Resources Board 2008d, 2008e). See Table B-1 for population data.

Sources: California Department of Finance 2008; California Air Resources Board 2008a, 2008b; U.S. Environmental Protection Agency 2007b.

Water-Related Emissions

Water-related emissions include indirect emissions from electricity consumption and direct emissions from fuel combustion for water supply and irrigation infrastructure and wastewater collection and treatment facilities. The Sacramento Regional County Sanitation District (SCRSD) and the Sacramento Area Sewer District (SASD) provide most wastewater collection and treatment services for Citrus Heights, Elk Grove, Folsom, Rancho Cordova, the City of Sacramento, and Unincorporated Sacramento County. Energy consumption for these services was provided by the Sacramento Municipal Services Agency (MSA) (Fry pers. comm.). Since SCRSD and SASD do not provide wastewater services to the entire county, energy consumption for wastewater treatment for Galt, Isleton, and portions of Folsom and the City of Sacramento was provided by SMUD and PG&E (Ave pers. comm., Cheeseman pers. comm). SMUD and PG&E also provided energy consumption for water supply and irrigation for each city. This data was based on the North American Industry Classification System (NAICS) codes 221311 (water supply), 221312 (irrigation), and 221320 (sewage treatment).

The County and Cities involved in the development of these inventories determined that emissions related to water and wastewater treatment operations should not be included in the government inventories because these operations are not under direct jurisdiction of the governments. Consequently, electricity and natural gas consumption from water/sewage-related activities are accounted for in the city-wide inventories. In addition, more than 20 water purveyors serve

Sacramento County, and data on energy use for each of these purveyors were not readily available.

Table B-19 presents energy use associated with water supply, irrigation, and wastewater collection and treatment for each of the cities in Sacramento County. Table B-19 contains energy consumption data obtained from MSA for SRCSD and SASD wastewater collection and treatment services as well as energy consumption data obtained from PG&E and SMUD for NAICS codes 221311, 221312, and 221320 (Ave pers. comm., Cheeseman pers. comm.). Table B-20 presents fuel consumption data for wastewater collection and treatment for each of the cities in Sacramento County. Total GHG emissions associated with water supply and irrigation infrastructure and wastewater collection and treatment facilities in Sacramento County in 2005 were 63,667 metric tons CO_2e (61,359 metric tons CO_2e from electricity and natural gas and 2,207 metric tons CO_2e from other fuel consumption).

According to SMUD, water-related electricity and natural gas consumption is included in the Commercial and Industrial sector. To avoid double-counting, water-related electricity and natural gas consumption was subtracted from the Commercial and Industrial sector.

Table B-19. 2005 Water Supply and Irrigation Infrastructure and Wastewater Collection and Treatment Facility Energy Consumption and Associated GHG Emissions

	SMUD Electricity (kWh)			PG&E: Sewage Treatment Facilities		
Government	Water Supply[1]	Irrigation Systems[2]	Sewage Treatment Facilities[3,4]	Electricity (kWh)[5]	Natural Gas (therms)[3,6]	GHG Emissions (metric tons CO_2e)
Citrus Heights	2,842,732	267,432	8,355,819	–	1,107	3,330
Elk Grove	6,953,508	392,784	7,137,281	–	945	4,204
Folsom	2,889,410	697,316	4,917,015[7]	–	2,690[8]	2,480
Galt	2,966,301	137,606	1,760,905[5]	–	–	1,410
Isleton	–	–	–	81,477	–	19
Rancho Cordova	7,346,174	132,053	5,265,568	–	697	3,698
Sacramento	39,715,265	4,474,856	39,201,285[7]	–	206,688[9]	25,283
Unincorporated Sacramento County[10]	19,652,559	648,013	52,133,465[11]	–	6,932	21,035
Total	**82,365,949**	**6,750,060**	**118,771,338**	**81,477**	**219,059**	**61,459**

[1] NAICS code 221311.

[2] NAICS code 221312.

[3] Energy consumption for SRCSD and SASD. The Sacramento Regional Wastewater Treatment Facility is located in Elk Grove. The cities of Sacramento and Folsom provide approximately 55% and 99.5% of their own wastewater collection services respectively, although SRCSD provides all of the wastewater treatment services for both cities. Galt and Isleton provide their own wastewater services (Cheeseman pers. comm., Fry pers. comm.).

[4] Actual 2005 electricity consumption apportioned to each city according to the relative percentage of the 2000 census within each city and the population served by SRCSD and SASD in 2005.

[5] NAICS code 221320.

[6] Natural gas usage is apportioned according to the relative percentage of the 2000 census within the city served by SRCSD; SASD did not utilize natural gas in 2005.

[7] Electricity consumption is apportioned according to the relative percentage of the 2000 census within the city and the relative area of the city served by SASD.

[8] 2,015 therms reported by NAICS code 221320 for sewage treatment facilities operating in the City of Folsom. 675 therms reported for SCRSD's service to Folsom.

[9] 201,394 therms (19,730 MCF) provided by Keith Roberts for the City of Sacramento's Department of Utility's two surface water treatment plants, 30 water wells, approximately 30 sanitary sewer lift stations, and approximately 60 storm lift stations (Roberts pers. comm.). 5,294 therms reported for SCRSD's service to the City of Sacramento.

[10] SMUD provided net electricity use data for the following communities: Antelope, Carmichael, Courtland, Elverta, Fair Oaks, Hood, Mather, McClellan, McClellan AFB, North Highlands, Orangeville, Rio Linda, Roseville, Sloughhouse, and Walnut Grove. SMUD did not provide electricity consumption for an Unincorporated County category.

[11] Electricity consumption is apportioned to the unincorporated area of Sacramento County according to the population served by SASD in 2005 less the apportioned population within the cities within the county.

Sources: Ave pers. comm.; Cheeseman pers. comm.; Roberts pers. Comm.; Fry pers. comm.

Table B-20. 2005 Wastewater Collection and Treatment Fuel Consumption and Associated GHG Emissions

Government	Gasoline (gallons)[1]	Diesel (gallons)[1]	GHG Emissions (metric tons CO_2e)
Citrus Heights	7,543	12,394	195
Elk Grove	6,443	10,586	167
Folsom	1,269	2,247	34
Galt	–	–	–
Isleton	–	–	–
Rancho Cordova	4,753	7,810	123
Sacramento	21,642	36,262	567
Unincorporated Sacramento County	43,276	71,298	1,121
Total	**84,926**	**140,597**	**2,207**

[1] Actual 2005 fuel consumption apportioned to each city according to the relative percentage of the 2000 census within each city and the population served by SRCSD and SASD in 2005.

Source: Fry pers. comm.

February 2008 Inventory Report

The GHG Inventory for Sacramento County—Unincorporated Areas (ICF J&S for DERA) relied on different electricity and natural gas data for some sectors. The following section discusses this data and associated GHG emissions for informational purposes only.

Residential, Commercial, and Industrial Emissions

GHG emissions for residential, commercial, and industrial electricity and natural gas consumption in unincorporated Sacramento County were calculated in the February 2008 GHG Inventory for Sacramento County**—**Unincorporated Areas based on different data from SMUD and PG&E than is presented in this report (ICF J&S for DERA). Industrial-specific electricity and natural gas data was supplied by SMUD and PG&E (Forney pers. comm.; Gill pers. comm.). This data was not available for the individual cities or Sacramento County as a whole. For consistency, this data was not included in the inventory. This data is presented in Table B-21 for informational purposes only.

Table B-21 also presents the commercial and residential energy use and associated GHG emissions for unincorporated Sacramento County as reported in the February 2008 inventory. Total emissions from these sectors presented below are 99.9% of the emissions calculated in this report. Table B-21 simply represents a different aggregation of energy and GHG emissions.

Table B-21. 2005 Residential, Commercial, and Industrial Energy Use and Associated GHG Emissions for Unincorporated Sacramento County as Reported in the February 2008 Inventory Report

Sector	SMUD Electricity (kWh)	PG&E Electricity (kWh)	Natural Gas[1] (therms)	GHG Emissions (metric tons CO_2e)[2]
Residential	1,976,222,958	—	82,794,262	1,036,926
Commercial	1,158,884,383	—	22,478,698	456,583
Industrial–Agriculture	6,131,216	—	1,128,648	7,835
Industrial–Electricity	464,322,113	—	—	134,601
Industrial Subtotal	470,453,329	—	1,128,648	142,436
Total[3]	**3,605,560,670**	—	**106,401,608**	**1,635,945**

Note: this data is presented for informational purposes only and was not included in the inventory. Data above merely represents a difference aggregation of the same energy use data used for this inventory.

[1] Natural gas is supplied by PG&E.

[2] See Table B-2 for emission factors.

[3] Total residential, commercial, and industrial GHG emissions for Unincorporated Sacramento County used in this report equal 1,805,271 metric tons of CO_2e, or approximately 10% greater than the emissions presented here.

Sources: California Climate Action Registry 2007a, 2007b; The Climate Registry 2008; Forney pers. comm.; Gill pers. comm.

References

Printed References

Bay Area Air Quality Management District (BAAQMD). 2006. *Source Inventory of Bay Area Greenhouse Gas Emissions*. November. San Francisco, CA.

California Air Resources Board. 2006. *OFFROAD 2007 Software: Off-road Emissions Inventory Program*. December. Sacramento, CA. Available: <http://www.arb.ca.gov/msei/offroad/offroad.htm>.

———. 2007. *Draft California Greenhouse Gas Inventory (millions of metric tons of* CO_2 *equivalent) — By IPCC Category*. Available: <http://www.arb.ca.gov/cc/inventory/data/tables/rpt_Inventory_IPCC_Sum_2007-11-19.pdf>. Accessed: June 1, 2008.

———. 2008a. *Livestock - Manure Management and Enteric Fermentation-Cattle and Swine: 2005* CH_4 *and* N_2O *from Livestock population*. Available: <http://www.arb.ca.gov/cc/inventory/doc/doc_index.php>. Accessed:

———. 2008b. *Direct* N_2O *Emissions from Managed Soils: 2004* N_2O *from Nitrogen applied in fertilizer - Synthetic fertilizers*. Available: <http://www.arb.ca.gov/cc/inventory/doc/docs3/3C4_FertilizerNitrogen_Synthetic fertilizers_N_2O_2004.htm>.

———. 2008c. *Indirect* N_2O *Emissions from Managed Soils: 2004* N_2O *from Nitrogen applied in fertilizer - Synthetic fertilizers*. Available: <http://www.arb.ca.gov/cc/inventory/doc/docs3/3C5_FertilizerNitrogen_Synthetic fertilizers_N_2O_2004.htm>.

———. 2008d. *Domestic Wastewater Treatment and Discharge: 2004 N2O from California Population*. Available: <http://www.arb.ca.gov/cc/inventory/doc/docs4/4D1_Wastewatertreatment_DomesticWasteWater_CaliforniaPopulation_N2O_2004.htm >. Accessed: July 14, 2008.

———. 2008e. *Domestic Wastewater Treatment and Discharge: 2004 CH4 from California Population*. Available: <http://www.arb.ca.gov/cc/inventory/doc/docs4/4D1_Wastewatertreatment_DomesticWasteWater_CaliforniaPopulation_CH4_2004.htm>. Accessed: July 14, 2008.

———. 2009. *Landfill Emissions Tool Version 1.1*. Available: <http://www.arb.ca.gov/cc/protocols/localgov/pubs/pubs.htm>. Accessed: March 27, 2009.

California Climate Action Registry. 2007a. *2005 Sacramento Municipal Utility District Public Report. Carbon dioxide emission factor for electricity delivered*. California Climate Action Registry. Los Angeles, CA.

———. 2007b. *2005 Pacific Gas & Electric Company Public Report. Carbon dioxide emission factor for electricity delivered*. California Climate Action Registry. Los Angeles, CA.

California Department of Conservation, Division of Land Resource Protection. 2007. Farmland Mapping and Monitoring Program. Available: <http://redirect.conservation.ca.gov/DLRP/fmmp/county_info_results.asp>. Accessed: July 7, 2008.

California Department of Finance. 2008. *E-4 Population Estimates for Cities, Counties and the State, 2001–2007, with 2000 Benchmark*. May. Sacramento, CA.

California Department of Transportation. 2006. *2005 California Public Road Data: Statistical Information Derived from the Highway Performance Monitoring System*. September. Available: <http://www.dot.ca.gov/hq/tsip/hpms/hpmslibrary/hpmspdf/2005PRD.pdf>.

California Energy Commission. 2006a. *Inventory of California Green house Gas Emissions and Sinks 1990 to 2004*. (CEC-600-2006-013-SF.) December. Available: <http://www.energy.ca.gov/2006publications/CEC-600-2006-013/CEC-600-2006-013-SF.PDF>.

California Integrated Waste Management Board. 2001. *California Landfill Methane Outreach Program Compilation*. Available: <http://www.ciwmb.ca.gov/LEAcentral/TechServices/EmergingTech/CECData.pdf>. Accessed:

———. 2008a. *California Waste Stream Profiles: Countywide Profile for Sacramento County*. Available: <http://www.ciwmb.ca.gov/Profiles/County/CoProfile1.asp?COID=34>. Accessed: November 23, 2008.

———. 2008b. *Jurisdiction Profile for Sacramento County/City of Citrus Heights Regional Agency*. Available: <http://www.ciwmb.ca.gov/Profiles/Juris/JurProfile1.asp?RG=R&JURID=602&JUR=Sacramento+County%2FCity+of+Citrus+Heights+Regional+Agency>. Accessed: November 23, 2008.

———. 2008c. *Jurisdiction Profile for City of Elk Grove*. Available: <http://www.ciwmb.ca.gov/Profiles/Juris/JurProfile1.asp?RG=C&JURID=613&JUR=Elk+Grove >. Accessed: November 23, 2008.

———. 2008d. *Jurisdiction Profile for City of Folsom*. Available: <http://www.ciwmb.ca.gov/Profiles/Juris/JurProfile1.asp?RG=C&JURID=159&JUR=Folsom >. Accessed: November 23, 2008.

———. 2008e. *Jurisdiction Profile for City of Galt*. Available: <http://www.ciwmb.ca.gov/Profiles/Juris/JurProfile1.asp?RG=C&JURID=172&JUR=Galt>. Accessed: November 23, 2008.

———. 2008f. *Jurisdiction Profile for City of Isleton*. Available: <http://www.ciwmb.ca.gov/Profiles/Juris/JurProfile1.asp?RG=C&JURID=221&JUR=Isleton>. Accessed: November 23, 2008.

———. 2008g. *Jurisdiction Profile for City of Rancho Cordova*. Available: <http://www.ciwmb.ca.gov/Profiles/Juris/JurProfile1.asp?RG=C&JURID=618&JUR=Rancho+Cordova>. Accessed: November 23, 2008.

———. 2008h. *Jurisdiction Profile for City of Sacramento*. Available: <http://www.ciwmb.ca.gov/Profiles/Juris/JurProfile1.asp?RG=C&JURID=418&JUR=Sacramento>. Accessed: November 23, 2008.

———. 2008i. *Disposal Reporting System (DRS): Jurisdiction Disposal and Alternative Daily Cover (ADC) Tons by Facility*. Available: <http://www.ciwmb.ca.gov/LGCentral/DRS/Reports/JurDspFa.asp?VW=JURIS>. Accessed: November 23, 2008.

———. 2008j. *Disposal Reporting System (DRS): Single-year Countywide Origin Detail*. Available: <http://www.ciwmb.ca.gov/LGCentral/Reports/DRS/Origin/WFOrgin.aspx>. Accessed: November 23, 2008.

———. 2009a. *Solid Waste Information System (SWIS): SWIS Sites in Sacramento County*. Available: <http://www.ciwmb.ca.gov/SWIS/SearchList/List?COUNTY=Sacramento>. Accessed: January 2, 2009.

———. 2009b. *Disposal Reporting System (DRS): Facility Reports. ADC Summary for Facility*. Available: < http://www.ciwmb.ca.gov/LGCentral/Reports/DRS/Origin/FacSummary.aspx>. Accessed: June 1, 2009.

County of Sacramento Department of Environmental Review and Assessment (DERA). 2007. *Sacramento International Airport Master Plan: Final Impact Report*. July. Sacramento, CA.

County of Sacramento. 2006. *Sacramento County 2005 Crop and Livestock Report*. Agricultural Commissioner/Director of Weights and Measures. September. Sacramento, CA.

———. 2009. *Municipal Services Agency – Waste Management and Recycling: Elk Grove Landfill Background*. Available: <http://www.sacgreenteam.com/projects/eglandfill2.htm>. Accessed: January 2, 2009.

Energy Information Administration. 2007. *Heating Fuel Comparison Calculator*. Available: <http://www.eia.doe.gov/neic/experts/heatcalc.xls>. Accessed: November 2, 2007.

International Council for Local Environmental Initiatives (ICLEI). 2008. *Local Government Operations Protocol.* September, 2008. Available: <http://www.arb.ca.gov/cc/protocols/localgov/pubs/final_lgo_protocol_2008-09-25.pdf>.

———. 2009. *Frequently Asked Questions (FAQ) about the Draft Local Government GHG Protocol.* Available: <http://www.icleiusa.org/action-center/tools/frequently-asked-questions-faq-about-the-draft-local-government-ghg-protocol/>. Accessed: March 18, 2009.

Intergovernmental Panel on Climate Change. 2006a. *Volume 5: Waste. In: 2006 IPCC Guidelines for National Greenhouse Gas Inventories.* Available: <http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html>. Accessed: January 7, 2009.

———. 2006b. *Volume 4: Agriculture, Forestry, and Other Land Use. In: 2006 IPCC Guidelines for National Greenhouse Gas Inventories.* Available: <http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html>. Accessed: December 29, 2008.

Sacramento Metropolitan Air Quality Management District. 2006. *Wood Stoves and Wood Fireplace Change Out Incentive Program*. November 26. Available: <http://www.airquality.org/woodstove/index.shtml>.

———. 2007. *Staff Report: Rule 421, Mandatory Episodic Curtailment of Wood and Other Solid Fuel Burning*. September 7. Available: <http://www.airquality.org/notices/Rules2007/Rule421StaffReport27Sep2007-Final.pdf>.

The Climate Registry. 2008. *General Reporting Protocol for the Voluntary Reporting Program*. Version 1.1. May. Available: <http://www.theclimateregistry.org/downloads/GRP.pdf>.

U.S. Environmental Protection Agency. 1998. *AP 42, Fifth Edition, Volume I, Chapter 2: Solid Waste Disposal; Section 2.4 Municipal Solid Waste Landfills*. Available: <http://www.epa.gov/ttn/chief/ap42/ch02/final/c02s04.pdf>. Accessed:

———. 2005. *Landfill Gas Emissions Model (LandGEM) Version 3.02 User's Guide*. Available: <http://www.epa.gov/ttncatc1/dir1/landgem-v302-guide.pdf>. Accessed: December 4, 2008.

———. 2007a. *Landfill Methane Outreach Program (LMOP)*. Available: <http://www.epa.gov/lmop/proj/index.htm#1>. Accessed: November 23, 2008.

———. 2007b. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005; Chapter 8: Waste*. (EPA 430-R-07-002.) April. Available: <http://epa.gov/climatechange/emissions/downloads/08_Waste.pdf >. Accessed: January 8, 2008.

Personal Communications

Ave, Kathleen. Project Manager: Advanced, Renewable & Distributed Generation Technologies. Sacramento Municipal Utility District, Sacramento, CA. July 15 and 16, 2008— email correspondence with Brian Schuster, ICF Jones & Stokes.

Barry, Toni. Principal Environmental Analyst. County of Sacramento Department of Environmental Review and Assessment, Sacramento, CA. December 9, 2008— telephone conversation.

Bartholomy, Obadiah. Project Manager: Advanced, Renewable & Distributed Generation Technologies. Sacramento Municipal Utility District, Sacramento, CA. November 31, 2008— telephone conversation with Brian Schuster, Shannon Hatcher, and Rebecca Rosen, ICF Jones & Stokes.

Bruso, Xantha. Climate Protection Policy Specialist : Environmental Policy Dept.. Pacific Gas & Electric Co., San Francisco, CA. August 6, 2008— email correspondence with Brian Schuster and Lisa Lowry, ICF Jones & Stokes.

Cheeseman, Corey. Program Manager. Customer Energy Efficiency, Pacific Gas and Electric Company, San Francisco, CA. December 4, 2008—email correspondence with Rebecca Rosen, ICF Jones & Stokes.

Forney, Steve. Account Executive. Service and Sales, Pacific Gas and Electric Company, Sacramento, CA. November 1, 2007 and December 17, 2007—email correspondence with Lisa Lowry, ICF Jones & Stokes.

Fry, Vicki. Associate Civil Engineer. Water Quality Division, Policy and Planning, Sacramento County Municipal Services Agency, Sacramento, CA. May 18, 2009—email correspondence with Brian Schuster, ICF Jones & Stokes.

Gill, Jan. Principal Load Research Analyst. Customer Strategy Division, Sacramento Municipal Utility District, Sacramento, CA. October 18, 2007, December 12, 2007, and Januray 7 2009—email correspondence and telephone conversations with Lisa Lowry and Brian Schuster, ICF Jones & Stokes.

Goodrich, Keith. Principal Civil Engineer. Sacramento County Department of Waste Management & Recycling (DWMR). Sacramento, CA. January 7, 2009—email correspondence with Brian Schuster, ICF Jones & Stokes.

Israel, Tim. Associate Engineer. County of Sacramento Municipal Services Agency. Sacramento, CA. November 28, 2007-telephone conversation with Lisa Lowry, ICF Jones & Stokes.

Miyao, Gene. Farm Advisor, Vegetable Crops, Yolo, Solano & Sacramento counties. University of California Cooperative Extension. Woodland, CA. December 19 and 22, 2008– email correspondence with Lindsay Christensen, ICF Jones & Stokes.

Quinn, Hao. Air Quality Engineer. Sacramento Metropolitan Air Quality Management District, Sacramento, CA. November 6, 2008—email correspondence with Rebecca Rosen, ICF Jones & Stokes.

Tedrow, Matt. Operations Manager, North Area Recovery Station. Sacramento County Department of Waste Management & Recycling. Sacramento, CA. January 6, 2009—email correspondence with Brian Schuster, ICF Jones & Stokes.

Zahner, Ayrin. Program Associate. International Council for Local Environmental Initiatives, Oakland, CA. July 1, 2008— email correspondence with Brian Schuster, ICF Jones & Stokes.

Appendix C

Government GHG Emissions Methodology

Appendix C
Government GHG Emissions Methodology

Summary

Appendix C discusses the approach and methodology used to assess GHG emissions from each sector of government for the County of Sacramento.

The Clean Air and Climate Protection (CACP) fuel CO_2 emissions factors were updated to reflect the most recent and accurate research to date, as presented in the Climate Registry General Reporting Protocol Version 1.1 (The Climate Registry 2008). These emission factors affect most sectors in the government inventories. Table B-2 in Appendix B presents the original and revised fuel CO_2 emission factors.

CCAR GHG inventories for Sacramento County (2006) and the City of Sacramento (2005) are available on CCAR's website (California Climate Action Registry 2009). Data from these CCAR reports were used for the Sacramento County and City of Sacramento government inventories. For government operations beyond the scope of the CCAR report, data was collected from the governments themselves (Barry pers. comm., Roberts pers. comm.). Electricity and natural gas consumption for the remaining incorporated governments was supplied by SMUD and PG&E (Ave pers. comm., Bruso pers. comm.).

The GHG inventories certified by CCAR include only activity and associated emissions directly managed by the associated government (in this case, the City of Sacramento and unincorporated Sacramento County). According to Dan Mendonsa, Energy Program Manager for the County, only emissions from facilities under direct control and responsibility of the County were included in the inventory (Mendonsa pers. comm.). Facilities serving the entire County, such as the Sacramento County Regional Sanitation District (SCRSD) and Sacramento Metro Fire, are not under direct control of the County. Consequently, GHG emissions from their operations were not reported as County emissions.

The inventory reports have undergone a comprehensive verification and auditing process. For these reasons, data supplied by the CCAR-verified reports were used for the City of Sacramento and County government inventories. Although the County CCAR report inventories emissions for the year 2006, this data is a good proxy for 2005 emissions since County operations have likely not grown more than 1% (Mendonsa pers. comm.).

The City of Citrus Heights and Rancho Cordova provided data regarding their government operations for the year 2007. Both cities have grown substantially between 2005 and 2007 and believe that a baseline GHG inventory for the year 2005 would inaccurately reflect the scale of their operations. Consequently, this analysis presents activity data and associated emissions for the year 2007 for these two cities.

In an effort to determine GHG emissions related to the government operations of Citrus Heights and Rancho Cordova for the year 2005, Citrus Heights' emissions for 2007 in each sector were scaled back based on the change in governmental budget from fiscal year 2004/2005 to 2006/2007, and Rancho Cordova's emissions for 2007 in each sector were scaled back based on the change in the city's population from 2005 to 2007. Citrus Heights total operational expenses increased 10.6% during this time period, and Rancho Cordova's population increased 8.1% from 56,432 (on 1/1/2006) to 60,975 (on 1/1/2008) (Kempenaar pers. comm., California Department of Finance 2008). It was assumed that total operating expenses would be a reasonable proxy for determining GHG emissions for Citrus Heights, so 2007 emissions were multiplied by 90.4%. It was determined that population growth would more accurately reflect the scale of operations and related GHG emissions for Rancho Cordova in 2005, so 2007 emissions were multiplied by 92.5%. The following equations describe the calculation of the scaling factors:

$$\boldsymbol{Citrus\ Heights}\text{: } 2005\ GHG\ emissions = \frac{100\%}{110.6\%} * 2007\ GHG\ emissions$$
$$= 90.4\% * 2007\ GHG\ emissions$$

$$\boldsymbol{Rancho\ Cordova}\text{: } 2005\ GHG\ emissions = \frac{56{,}432}{60{,}975} * 2007\ GHG\ emissions$$
$$= 92.5\% * 2007\ GHG\ emissions$$

Data for 2005 in some sectors was available from SMUD and PG&E, including electricity and natural gas consumption for buildings and streetlights. This data was not used because it likely does not reflect actual energy use by Citrus Heights or Rancho Cordova in 2005 including all contracted services. Discussion of the scaling methodology is presented below in the appropriate sectors.

Buildings

Electricity and natural gas consumption for buildings was primarily supplied by SMUD and PG&E (Ave. pers. comm., Bruso pers. comm.). Some energy and fuel use data was supplied by the individual cities or from certified CCAR reports when more accurate information was available. Table C-1 lists energy consumption for buildings and associated GHG emissions by city as it was input into the CACP program. Total GHG emissions associated with government operated buildings in Sacramento County for 2005 were 100,177 metric tons CO_2e.

Table C-1. 2005 Government Building Energy and Fuel Use and Associated GHG Emissions

Government	Electricity (kWh)	Natural Gas (therms)	Diesel[1] (gallons)	Propane[1] (gallons)	GHG Emissions (metric tons CO_2e)
Citrus Heights[2]	1,492,156	19,420	1,344	–	603
Elk Grove[3]	1,533,321	12,938	5,646	–	514
Folsom	11,546,708	165,297	–	–	4,234
Galt	7,748,269	18,026	2,451	28	2,343
Isleton[4]	113,975	2,800	–	–	42
Rancho Cordova[5]	1,520,023	17,503	–	–	602
Sacramento (SMUD)[6]	96,525,817	–	–	37,587	28,198
Sacramento (PG&E)[7]	193,000	1,184,133	–	–	6,411
Sacramento (Leased)[8]	4,017,890	–	–	–	1,165
Unincorporated Sacramento County[9]	144,956,142	2,653,434	5,190	7,360	55,981
Total	**269,647,301**	**4,073,551**	**14,631**	**44,975**	**100,091**

Note: electricity and natural gas data were supplied by PG&E and SMUD unless otherwise noted (Ave. pers. comm., Bruso pers. comm.).

1 Diesel and propane from generators, equipment, and other stationary sources.

2 Energy consumption for 2007 (see Table C-2) was scaled back based on fiscal year budget growth (10.6% increase). Calculation: 2007 energy use * 90.4% = 2005 energy use. According to SMUD and PG&E, Citrus Heights city accounts used 1,364,487 kWh and 17,583 therms in 2005.

3 Propane consumption provided by Jessica Shalamunec (Shalamunec pers. comm.).

4 Electricity for Isleton is supplied by PG&E (Bruso pers. comm.).

5 Energy consumption for 2007 (see Table C-2) was scaled back based on population growth (8.1% increase). Calculation: 2007 energy use * 92.5% = 2005 energy use. According to SMUD and PG&E, Rancho Cordova city accounts used 500,034 kWh and 982 therms in 2005.

6 Data supplied by CCAR (Roberts pers. comm.). CCAR did not separate streetlights and traffic signals from net electricity consumption. Electricity consumption for streetlights and traffic signals was supplied by SMUD (Ave pers. comm.) and subtracted from the net consumption reported by CCAR of 120,231,000 kWh. See Table C-3.

7 Data supplied by CCAR (Roberts pers. comm.).

8 Represents data for the year 2006 supplied by CCAR (Mendonsa pers. comm.); See Table C-3.

Sources: Ave pers. comm., Bruso pers. comm., Kempenaar pers. comm., Shalamunec pers. comm., Roberts pers. comm., Mendonsa pers. comm.

Electricity, natural gas, and fuel consumption for buildings owned and operated by the Citrus Heights and Rancho Cordova city governments for the year 2007 is presented in Table C-2. Both cities have grown substantially between 2005 and 2007, and felt that a baseline GHG inventory for the year 2005 would inaccurately reflect the scale of their operations.

Table C-2. 2007 Citrus Heights and Rancho Cordova Government Building Energy and Fuel Use and Associated GHG Emissions

Government	Electricity (kWh)	Natural Gas (therms)	Diesel (gallons)	GHG Emissions (metric tons CO_2e)
Citrus Heights[1]	1,650,615	21,482	1,487	666
Rancho Cordova	1,642,391	18,912	–	650

[1] Diesel fuel calculated as follows: 300-400 kWh generator operating 1 hr. per week (Kempenaar pers. comm.) at 28.6 gallons per hour = 1,487 gallons (assumed 400 kWh operating at full load for a conservative estimate of fuel) (Diesel Service and Supply 2007).

Sources: Ave pers. comm., Kempenaar, pers. comm., McCormick pers. comm.

Streetlights and Traffic Signals

Electricity consumption for streetlights and traffic signals was primarily supplied by SMUD and PG&E (Ave pers. comm., Bruso pers. comm.). Some energy and fuel use data was supplied by the individual cities when more accurate information was available. Table C-3 lists energy consumption for streetlights and traffic signals and associated GHG emissions by city as it was input into the CACP program. Consumption presented below does not include district accounts (i.e. SMUD-owned streetlights). Total GHG emissions associated with streetlights and traffic signals in Sacramento County for 2005 were 10,053 metric tons CO_2e.

Table C-3. 2005 Government Streetlights and Traffic Signal Electricity Consumption and Associated GHG Emissions

	Streetlights[1]		Traffic Signals		
Government	Electricity (kWh)	# of Streetlights	Electricity (kWh)	# of Traffic signals	GHG Emissions (metric tons CO_2e)
Citrus Heights[2]	2,573,541	–	146,488	–	908
Elk Grove[3]	10,419	10,711	242,480	104	73
Folsom	3,000,053	6,860	502,395	80	1,015
Galt[4]	887,752	1,391	5,398	4	256
Isleton	–	–	–	–	–
Rancho Cordova[5]	–	–	120,633	–	41
Sacramento	20,031,485	39,000	3,673,698	562	6,872
Unincorporated Sacramento County[6]	3,063,476	–	–	–	888
Total	**29,566,726**	–	**4,691,092**	–	**10,053**

Note: electricity data was supplied by SMUD unless otherwise noted (Ave pers. comm.).

[1] Does not include district accounts (i.e. SMUD-owned streetlights). These accounts are included in the city-wide inventories in the commercial + industrial sector

[2] Energy consumption for 2007 (see Table C-4) was scaled back based on fiscal year budget growth (10.6% increase). Calculation: 2007 energy use * 90.4% = 2005 energy use. According to SMUD and PG&E, Citrus Heights city accounts used 47,832 kWh for streetlights and 141,049 kWh for 52 traffic signals in 2005.

[3] Number of streetlights supplied by Jessica Shalamunec (Shalamunec pers. comm.).

[4] Traffic signal electricity consumption and number of streetlights supplied by Sandra Kiriu (Kiriu pers. comm.).

[5] Energy consumption for 2007 (see Table C-4) was scaled back based on population growth (8.1% increase). Calculation: 2007 energy use * 92.5% = 2005 energy use. Streetlights in Rancho Cordova operated by Sacramento County (McCormick pers. comm.). According to SMUD and PG&E, Rancho Cordova city accounts used 202,192 kWh for 43 traffic signals in 2005.

[6] Represents data for the year 2006 supplied by CCAR and includes streetlights and traffic signals (Mendonsa pers. comm.).

Sources: Ave pers. comm., Shalamunec pers. comm., Kiriu pers. comm., McCormick pers. comm., Mendonsa pers. comm.

Electricity consumption for streetlights and traffic signals in Citrus Heights and Rancho Cordova for the year 2007 is presented in Table C-4. Both cities have grown substantially between 2005 and 2007, and felt that a baseline GHG inventory for the year 2005 would inaccurately reflect the scale of their operations.

Table C-4. 2007 Citrus Heights and Rancho Cordova Streetlights and Traffic Signal Electricity Consumption and Associated GHG Emissions

Government	Streetlights: Electricity (kWh)	Streetlights: # of Streetlights	Traffic Signals: Electricity (kWh)	Traffic Signals: # of Traffic signals	GHG Emissions (metric tons CO_2e)
Citrus Heights	2,846,837	–	162,044	59	1,004
Rancho Cordova[1]	–	–	130,344	53	44

[1] Streetlights in Rancho Cordova operated by Sacramento County (McCormick pers. comm.).
Sources: Ave pers. comm., McCormick pers. comm.

All electricity, natural gas and other fuel consumption for building and streetlight operations owned by Sacramento County government in the incorporated and unincorporated areas for 2006 was provided by Dan Mendonsa, the County energy program manager (Mendosa pers. comm.). Although the County CCAR report inventories emissions for the year 2006, this data is a good proxy for 2005 emissions since County operations have likely not grown more than 1% (Mendonsa pers. comm.).

Table C-5 lists energy consumption for the unincorporated government as it was input into the CACP program. Total GHG emissions associated with government-operated buildings in unincorporated Sacramento County for 2006 were 55,981 metric tons CO_2e. Total GHG emissions associated with streetlights and traffic signals were 888 metric tons CO_2e.

Table C-5. 2006 Unincorporated Sacramento County Government Energy Consumption

Building Inputs	Electricity (kWh)	Natural Gas (therms)	Diesel (gallons)	Propane (gallons)
Executive Airport (SAC)	1,188,802	16,632	0	0
International Airport (SMF)	32,007,597	695,875	0	0
Mather Airport (MHR)	1,006,656	0	0	0
McClellan Airport (MCC)	0	898	0	0
Leased General Services Buildings	22,934,381	228,020	0	0
Leased General Services Buildings-Utilities Included	6,610,114	0	0	0
Owned General Services Buildings	62,403,440	1,634,281	5,190	7,360
Remote Office of Communication and Inform. Tech (OCIT)	768,337	0	0	0
Parks	1,118,756	77,728	0	0
Public Works	16,918,059	0	0	0
Streetlights/traffic signals	3,063,476	0	0	0
Total	**148,019,618**	**2,653,434**	**5,190**	**7,360**

Source: Mendonsa pers. comm.

Vehicle Fleet

Vehicle fleet data was supplied by each of the cities except Isleton and entered into the CACP software. This sector includes vehicles owned by city/County governments, which can include Sheriff vehicles, garbage trucks, police and fire. Some cities contract these fleets and consequently do not fall under the operational control boundaries for municipal governments as described above. The following sections describe the data received from each city. Citrus Heights and Rancho Cordova vehicle fleet data was provided for the year 2007. Scaling factors based on their budgets were used to estimate vehicle fleet emissions for 2005. Total GHG emissions from vehicle fleets in Sacramento County for 2005 were 58,970 metric tons CO_2e. Table C-6 presents GHG emissions from vehicle fleets.

Table C-6. 2005 Sacramento County Vehicle Fleet VMT, Fuel Consumption, and Associated GHG Emissions

City/Jurisdiction	VMT	Gasoline Consumption (gallons)	Diesel Consumption (gallons)	Compressed Natural Gas (gallons)	Purinox Consumption (gallons)	GHG Emissions (metric tons CO_2e)
Citrus Heights[1]	173,142	15,678	–	–	–	143
Elk Grove	1,305,238	136,968	364,926	–	–	7,418
Folsom	2,819,531	206,778	199,461	–	–	3,967
Galt[2]	431,466	–	6,000	–	–	325
Isleton	–	–	–	–	–	–
Rancho Cordova[2]	–	5,628	–	–	–	51
Sacramento	–	1,213,779	934,994	240,102	12,461	21,927
Unincorporated Sacramento County	–	1,595,942	1,027,233	844,778	–	25,138
Total	**4,729,377**	**3,174,773**	**2,526,614**	**1,084,880**	**12,461**	**58,969**

[1] Scaled back from 2007 based on budget.

[2] Diesel fuel was estimated for diesel construction equipment. Fuel consumption for remainder of city fleet was not available. GHG emissions are based on VMT data and default fuel efficiencies in the CACP software.

[3] Scaled back from 2007 based on population growth.

Sources: Kempenaar, pers. comm., Shalamunec pers. comm., Kiriu pers. comm., McCormick pers. comm.

Citrus Heights

Citrus Heights vehicle fleet data for the year 2007 was supplied by Casey Kempenaar, Associate Planner for the City of Citrus Heights (Kempenaar pers. comm.). 2005 data was unavailable. The city fleet vehicles were divided into the vehicle type categories listed in Table C-7, which were provided by the CACP program. This information was then entered into the CACP software to produce resulting GHG emissions from the vehicle fleet. Total GHG emissions from the Citrus Heights vehicle fleet in 2007 were 158 metric tons CO_2e.

Table C-7. 2007 Citrus Heights Vehicle Fleet VMT and Fuel Consumption

Vehicle Type	VMT	Gasoline Consumption (gallons)
Full-Size Auto	145,670	14,235
Mid-Size Auto	5,268	307
Heavy Truck	1,483	213
Light Truck/SUV/Pickup	20,993	2,020
Motorcycle	16,931	483
Vanpool Van	1,184	85
Total	**191,529**	**17,343**

Source: Kempenaar pers. comm.

GHG emissions from the Citrus Heights vehicle fleet data for the year 2007 were scaled back based on budget to estimate vehicle fleet emissions for the year 2005. Citrus Heights total expenses increased 10.6% during this time period (Kempenaar pers. comm.). Table C-8 presents 2007 and estimated 2005 GHG emissions from the Citrus Heights vehicle fleet.

Table C-8. 2007 and Estimated 2005 Citrus Heights Vehicle Fleet GHG Emissions

2007 Emissions (metric tons CO_2e)	Scaling Factor[1]	2005 Emissions (metric tons CO_2e)
158	0.904	143

[1] Based on budget; calculation: 1/1.106

Source: Kempenaar pers. comm.

Elk Grove

Elk Grove vehicle fleet data for the year 2005 was supplied by Jessica Shalamunec, Planning Manager for the City of Elk Grove (Shalamunec pers. comm.). Vehicle fleet data was supplied by fleet type, not by vehicle type. The city fleet vehicles were divided into the vehicle type categories listed in Table C-9, which were provided by the CACP program. This information was then entered into the CACP software to produce resulting GHG emissions from the vehicle fleet. Total GHG emissions from the Citrus Heights vehicle fleet in 2005 were 7,418 metric tons CO_2e.

Table C-9. 2005 Elk Grove Vehicle Fleet VMT and Fuel Consumption

Vehicle Type	Fleet Type	VMT	Gasoline Consumption (gallons)	Diesel Consumption (gallons)
Mid-Size Auto	City Fleet	–	136,968	–
Heavy Truck	Waste Fleet	–	–	359,280
Motorcycle	Street Sweepers	7,684	–	5,646
Transit Bus	E-Tran Fleet[1]	1,297,554	–	–
Total	**–**	**1,305,238**	**136,968**	**364,926**

[1] VMT for the E-Tran fleet was entered into the CACP software; data on fuel consumption was unavailable.

Source: Shalamunec pers. comm.

Folsom

Folsom vehicle fleet data for the year 2005 was supplied by Evert W. Palmer, Assistant City Manager for the City of Folsom (Evert pers. comm.). The city fleet vehicles were divided into the vehicle type categories listed in Table C-10, which were provided by the CACP program. This information was then entered into the CACP software to produce resulting GHG emissions from the vehicle fleet. Total GHG emissions from the Folsom vehicle fleet in 2005 were 3,967 metric tons CO_2e.

Table C-10. 2005 Folsom Vehicle Fleet VMT and Fuel Consumption

Vehicle Type	Number of Vehicles	VMT	Gasoline Consumption (gallons)	Diesel Consumption (gallons)
Full-Size Auto	75	818,885	70,646	–
Mid-Size Auto	16	66,786	3,782	–
Sub-Compact/Compact Auto	0	0	0	–
Heavy Truck	72	557,946	–	162,874
Light Truck/SUV/Pickup	138	935,300	98,372	–
Motorcycle	0	0	0	–
Passenger Vehicle	9	215,231	33,387	–
Additional Equipment	18	9,279	591	2,096
Transit Bus	9	216,104	–	34,491
Total	**337**	**2,819,531**	**206,778**	**199,461**

Source: Palmer pers. comm.

Galt

Galt vehicle fleet data for the year 2005 was supplied by Sandra Kiriu, Principal Planner for the City of Galt Planning Department (Kiriu pers. comm.). Galt supplied VMT data, but not fuel consumption data. GHG emissions are based on VMT data and default fuel efficiencies in the CACP software. Additional diesel equipment including air compressors, backhoes, tractors, etc. was reported by total number of hours operational. It was assumed that 2 backhoes (CASE), 2 crawler tractor (John Deere and Ag-Chem), and 2 air compressors, comprised this diesel fleet. This data was entered into the URBEMIS 2007 (version 9.2.4) air emissions model to determine the CO_2 emissions from these vehicles which were 60.5 metric tons CO_2, or about 6,000 gallons of diesel fuel (URBEMIS 2007). The city fleet vehicles were divided into the vehicle type categories listed in Table C-11, which were provided by the CACP program. This information was then entered into the CACP software to produce resulting GHG emissions from the vehicle fleet. Total GHG emissions from the Galt vehicle fleet in 2005 were 325 metric tons CO_2e.

Table C-11. 2005 Galt Vehicle Fleet VMT

Vehicle Type	Number of Vehicles	VMT (diesel vehicles)	VMT (gasoline vehicles)
Full-Size Auto	21	–	196,986
Mid-Size Auto	1	–	4,331
Heavy Truck	6	10,159	–
Light Truck/SUV/Pickup	36	–	215,868
Vanpool Van	1	–	4,122
Motorcycle[1]	2	–	–
Other Vehicle[2]	7	–	–
Total	**74**	**10,159**	**421,307**

[1] VMT unknown; motorcycles not used to a significant degree

[2] Includes diesel construction equipment. VMT and fuel consumption unavailable. Total hours of operation = 1,113. Total CO_2 = 66.7 tons (60.5 metric tons). (URBEMIS 2007). Estimated fuel use = 6,000 gallons diesel.

Source: Kiriu pers. comm., URBEMIS 2007.

Isleton

Isleton vehicle fleet data was unavailable.

Rancho Cordova

Rancho Cordova vehicle fleet data for the year 2007 was supplied by Michael McCormick, PMC (McCormick pers. comm.). 2005 data was unavailable. The city fleet vehicles were divided into the vehicle type categories listed in Table C-12, which were provided by the CACP program. This information was then entered into the CACP software to produce resulting GHG emissions from the vehicle fleet. Total GHG emissions from the Rancho Cordova vehicle fleet in 2007 were 55 metric tons CO_2e.

Table C-12. 2007 Rancho Cordova Vehicle Fleet Fuel Consumption

Vehicle Type	Number of Vehicles	Gasoline Consumption (gallons)
Full-Size Auto	1	318
Light Truck/SUV/Pickup	13	5,763
Total	**14**	**6,081**
Source: McCormick pers. comm.		

GHG emissions from the Rancho Cordova vehicle fleet data for the year 2007 were scaled back based on population growth to estimate vehicle fleet emissions for the year 2005. Rancho Cordova population increased 8.1% during this time period (McCormick pers. comm.). Table C-13 presents 2007 and estimated 2005 GHG emissions from the Rancho Cordova vehicle fleet.

Table C-13. 2007 and Estimated 2005 Rancho Cordova Vehicle Fleet GHG Emissions

2007 Emissions (metric tons CO_2e)	Scaling Factor[1]	2005 Emissions (metric tons CO_2e)
55	0.925	51
[1] Based on budget; calculation: 56,432/60,975		
Source: McCormick pers. comm.		

Sacramento

Sacramento vehicle fleet data for the year 2005 was supplied by Keith Roberts, City Energy Manager for the City of Sacramento General Services (Roberts pers. comm.). Vehicle fleet data was supplied by net fuel combustion; no data on the vehicle fleet profile or VMT was available. This data was reported in Sacramento's 2005 CCAR report. The city fleet vehicles were divided into the vehicle type categories listed in Table C-14, which were provided by the CACP program. This information was then entered into the CACP software to produce resulting GHG emissions from the vehicle fleet. The total number of vehicles in the 2005 vehicle fleet is 2,400. Total GHG emissions from the Sacramento vehicle fleet in 2005 were 21,927 metric tons CO_2e.

Table C-14. 2005 Sacramento Vehicle Fleet Fuel Consumption

Vehicle Type	Gasoline Consumption (gallons)	Diesel Consumption (gallons)	Compressed Natural Gas (gallons)	Purinox Consumption (gallons)
Full-Size Auto	–	–	–	–
Mid-Size Auto	1,213,779	–	–	–
Heavy Truck	–	–	240,102	12,461
Light Truck/SUV/Pickup	–	934,994	–	–
Total	**1,213,779**	**934,994**	**240,102**	**12,461**

Source: Roberts pers. comm.

Sacramento County

County vehicle fleet information for 2006 was provided by Dan Mendonsa, the Energy Program Manager for the Sacramento County (Mendosa pers. comm.). The county fleet vehicles were divided into the vehicle type categories listed in Table C-15, which were provided by the CACP program. This information was then entered into the CACP software to produce resulting GHG emissions from the vehicle fleet. County owned vehicles include Sheriff, garbage trucks, and other government-related vehicles. Vehicle fuel costs were $2.58 per gallon of gasoline, $2.65 per gallon of diesel, and $1.18 per gallon of compressed natural gas (Mendonsa pers. comm.).

In some cases, fuel consumption was unavailable for a vehicle type and was left out of the inventory. This lack of data represents a relatively small data gap that may be filled when more vehicle fleet fuel data becomes available. Missing fuel consumption may account for up to 5% of emissions from the County vehicle fleet. Total GHG emissions from the Sacramento County vehicle fleet in 2006 were 25,416 metric tons CO_2e.

Table C-15. 2006 County Vehicle Fleet Fuel Consumption

Vehicle Type	Gasoline Consumption (gallons)	Diesel Consumption (gallons)	Compressed Natural Gas (gallons)
Full-Size Auto	569,668	–	–
Mid-Size Auto	–	–	–
Sub-Compact/Compact Auto	254,792	–	–
Heavy Truck	–	899,500	844,778
Light Truck/SUV/Pickup	771,482	106,213	–
Motorcycle[1]	–	–	–
Passenger Vehicle	–	–	–
Vanpool Van	–	–	–
Transit Bus	–	21,520	–
Total	**1,595,942**	**1,027,233**	**844,778**

[1] Fuel consumption not available.
Source: Mendonsa pers. comm.

Employee Commute

Employee commute data was provided by Citrus Heights (for 2007), Elk Grove, Galt, and Rancho Cordova (for 2007) (Kempenaar, pers. comm., Shalamunec pers. comm., Kiriu pers. comm., McCormick pers. comm.). Employee commute data was not provided by Folsom, Isleton, Sacramento, or unincorporated Sacramento County. Employee commute data supplied by each city was entered into the CACP software. The following sections describe the data received from each city. Total GHG emissions from employee commute in Sacramento County for 2005 were1,990 metric tons CO_2e. Table C-16 presents GHG emissions from employee commutes.

Table C-16. 2005 Sacramento County Employee Commute VMT and Associated GHG Emissions

City/Jurisdiction	Net Commute VMT	GHG Emissions (metric tons CO_2e)
Citrus Heights[1]	1,961,609	944
Elk Grove	857,722	461
Folsom	–	–
Galt	585,057	287
Isleton	–	–
Rancho Cordova[2]	509,951	297
Sacramento	–	–
Unincorporated Sacramento County	–	–
Total	**3,914,339**	**1,990**

[1] Scaled back from 2007 based on budget.
[2] Scaled back from 2007 based on population growth.
Sources: Kempenaar pers. comm., Shalamunec pers. comm., Kiriu pers. comm., McCormick pers. comm.

Employee commute VMT and associated GHG emissions for Citrus Heights and Rancho Cordova city governments for the year 2007 are presented in Table C-17. Both cities have grown substantially between 2005 and 2007, and felt that a baseline GHG inventory for the year 2005 would inaccurately reflect the scale of their operations.

Table C-17. 2007 Citrus Heights and Rancho Cordova Employee Commute VMT and Associated GHG Emissions

Government	VMT	GHG Emissions (metric tons CO_2e)
Citrus Heights	2,169,922	1,044
Rancho Cordova	551,004	321

Sources: Kempenaar pers. comm., McCormick pers. comm.

Citrus Heights

Citrus Heights employee commute data for the year 2007 was supplied by Casey Kempenaar, Associate Planner for the City of Citrus Heights (Kempenaar pers. comm.). 2005 data were unavailable. There were 231 employees working for Citrus Heights in 2007 with an average one-way commute distance of 19.57 miles, yielding a total of 2,169,922 miles. It was assumed that commuters travel an average of 240 days per year (48 work weeks) and that all employees drove full-size gasoline-fueled automobiles for CACP entry purposes (Full-Size Auto category). Total GHG emissions from the Citrus Heights employee commute in 2007 were 1,044 metric tons CO_2e. Table C-16 presents GHG emissions from employee commutes.

GHG emissions from the Citrus Heights employee commute for the year 2007 were scaled back based on budget to estimate employee commute emissions for the year 2005. Citrus Heights total expenses increased 10.6% during this time period (Kempenaar pers. comm.). Table C-18 presents 2007 and estimated 2005 GHG emissions from Citrus Heights employee commute.

Table C-18. 2007 and Estimated 2005 Citrus Heights Employee Commute GHG Emissions

2007 Emissions (metric tons CO_2e)	Scaling Factor[1]	2005 Emissions (metric tons CO_2e)
1,044	.904	944

[1] Based on budget; calculation: 1/1.106

Source: Kempenaar pers. comm.

Elk Grove

Elk Grove employee commute data were supplied by Jessica Shalamunec (Shalamunec pers. comm.). There were 257 employees working for Elk Grove in 2005 with 80% driving alone, 10% carpooling, 3% biking, and 7% using mass transit. The average daily commute distance was 7.9 miles for employees who drove alone and 6.8 miles for users of alternative modes of transportation. It was assumed that distances were one way, that commuters travel an average of 240 days per year, that carpools were 2 people per vehicle, and that mass transit constitutes diesel buses. This yields 779,635 miles traveled by single drivers, 48,727 miles traveled by carpools, and 29,360 miles traveled by transit vehicles. It was assumed that all employees drove full-size gasoline-fueled automobiles for CACP entry purposes (Full-Size Auto category).

The total number of miles traveled in 2005 is 857,722. Total GHG emissions from the Elk Grove employee commute in 2005 were 461 metric tons CO_2e. Table C-16 presents GHG emissions from employee commutes.

Galt

Galt employee commute data were supplied by Sandra Kiriu (Kiriu pers. comm.) based on a commute survey with a 73% response rate. There were 173 employees working for Galt in 2005 with 61% commuting less than 10 miles, 22% commuting 10–30 miles, 11% commuting 31–50 miles, and 6% commuting more than 50 miles round trip. It was assumed that the average distances of these trips were 5, 20, 30, and 50 miles, respectively, and that commuters travel an average of 240 days per year. The total number of miles traveled in 2005, assuming the remaining 27% of Galt's workforce follow the same commuting pattern, is 611,267. It was assumed that all employees drove full-size gasoline-fueled automobiles (CACP Full-Size Auto category). Without considering any form of alternative transportation, GHG emissions from the Galt employee commute in 2005 were 300 metric tons CO_2e.

The commute survey indicated that about 6% of employees carpool, 3% take mass transit, and 8% walk or bike to work 3 days per week on average. In order to determine the miles offset by alternate transportation, miles traveled by employees who carpool and walk or bike to work were estimated based on the average commute distance provided above (walk/bike miles were assumed to occur for commute distances less than 10 miles). Total miles offset were 26,263. Consequently, net commute VMT, factoring in alternative transportation for 2005, are 585,057, and total GHG emissions are 287 metric tons CO_2e.

Total GHG emissions from Galt employee commute in 2005 were 287 metric tons CO_2e. Table C-16 presents GHG emissions from employee commutes.

Rancho Cordova

Rancho Cordova employee commute data for the year 2007 was supplied by Michael McCormick (McCormick pers. comm.) based on a commute survey with a 71% response rate, or 52 out of 73 employees. 2005 data was unavailable. 75% of employees worked 5 days a week, with some working less and some working more, so it was assumed that 85% of employees worked 5 days a week. It was assumed that commuters travel an average of 240 days per year. The average one-way commute distance was 18.5 miles, and because 94% of employees drove gasoline fueled vehicles, it was assumed that 100% of commuters used gasoline. These assumptions yield a total of 551,004 VMT for employee commute.

Total GHG emissions from Rancho Cordova employee commute in 2007 were 321 metric tons CO_2e. Table C-19 presents the Rancho Cordova employee commute vehicle mix and Table C-16 presents GHG emissions from employee commutes.

Table C-19. 2007 Rancho Cordova Employee Commute Fleet Mix and VMT

Vehicle Type	Vehicle Fleet Percentage	VMT[1]
Full-Size Auto	5.9	32,509
Mid-Size Auto	21.6	119,017
Sub-Compact/Compact Auto	19.6	107,997
Heavy Truck	3.9	21,489
Light Truck/SUV/Pickup	47.0	258,972
Other vehicles	2.0	11,020
Total	**100.0**	**551,004**

[1] Based on 551,004 total miles. Assumed all gasoline.
Source: McCormick pers. comm.

GHG emissions from the Rancho Cordova employee commute data for the year 2007 were scaled back based on population growth to estimate employee commute emissions for the year 2005. Rancho Cordova population increased 83.4% during this time period (McCormick pers. comm.). Table C-20 presents 2007 and estimated 2005 GHG emissions from the Rancho Cordova employee commute.

Table C-20. 2007 and Estimated 2005 Rancho Cordova Employee Commute GHG Emissions

2007 Emissions (metric tons CO_2e)	Scaling Factor[1]	2005 Emissions (metric tons CO_2e)
321	0.925	297

[1] Based on population growth; calculation: 56,432/60,975

Source: McCormick pers. comm.

Waste Emissions

This section discusses the approach and methodology used to assess GHG emissions from landfills due to waste generated by government operations and placed in landfills. There are two sources of waste emissions included in the inventory: 1) emissions from waste generated and landfilled in 2005, and 2) “waste-in-place” emissions for all waste currently located in landfills within the County.

Landfill Emissions from Waste Generation in 2005

The CACP software was used to calculate GHG emissions from all waste generated by government operations and placed in landfills for each city and the County in 2005. Waste generation data was provided by Citrus Heights (for 2007), Elk Grove, Folsom, and Galt (Kempenaar, pers. comm., Shalamunec pers. comm., Palmer pers. comm., Kiriu pers. comm.). Waste generation data was not provided by Isleton, Rancho Cordova, Sacramento, and unincorporated Sacramento County. Each landfill receiving waste from the County was researched to determine if CH_4 capture or flaring technology was implemented in 2005. See Appendix B for more detailed discussion of flaring and CH_4 capture.

For city-landfilled waste, the waste stream profile is the community business waste profile for each city reported by the CIWMB. For cities providing a breakdown of government waste, it was assumed that recycling was 100% paper. Compost and green waste was assumed to be 100% food waste or plant debris. Emissions associated with recycling, compost, and green waste were not estimated since the CACP software does not have the option to report tonnage recycled. In addition, the Local Government Operations Protocol recommends that local inventories not account for emissions sinks such as carbon sequestration at landfills (i.e. from composting) . This assumption may result in an overestimate of methane emissions from landfills since composting can be an emissions sink (Intergovernmental Panel on Climate Change 2006a; ICLEI 2008, 2009). The waste disposal technology used for these calculations was managed landfill, and GHG sequestration at the landfills was set to zero, based on guidance in the Local Government Operations Protocol [1]. See Appendix B for more information on methane emissions from waste generation.

Table C-21 presents waste generation and waste stream profile information for waste landfilled by government operations. Total GHG emissions associated with waste generation from government operations in Sacramento County in 2005 were 1,086 metric tons CO_2e.

[1] ICLEI recommends eliminating the effect of landfill sequestration for both government operations inventories and community inventories, to be consistent with the principle that local government operations and community inventories should not account for emissions sinks (ICLEI 2009).

Table C-21. 2005 Government Waste Disposal and Waste Stream Profile

Category		Citrus Heights[1]	Elk Grove	Folsom	Galt	Isleton	Rancho Cordova	Sacramento	Unincorporated Sacramento County
Trash Disposal (tons)		96	340	3,719	582	–	–	–	–
Trash Waste Stream Profile Trash (%)[2]	Paper Products	32.2	33.1	33.3	30.7	29.3	32.7	34.4	32.2
	Food Waste	17.3	18.2	21.5	21.7	25.7	18.4	18.3	17.3
	Plant Debris	6.4	12.1	4.9	7.7	4.7	5.9	6.9	6.4
	Wood Textiles	8.5	7.7	6.4	6.8	7.1	7.5	7.2	8.5
	Other Waste	35.6	28.9	33.9	33.1	33.2	35.5	33.2	35.6
Diverted Waste Disposal (tons)[3]	Recycling	7.3	250	1,448	158	–	–	–	–
	Compost	19.9	–	–	610	–	–	–	–
	Green waste	–	40	–	–	–	–	–	–
Weighted Methane Capture (%)[4]		71	62	79	75	66	67	42	71
Emissions (metric tons CO_2e)		**25**	**139**	**740**	**182**	–	–	–	–

[1] Disposal scaled back from 2007 based on budget. 106 tons of waste was generated in 2007.
[2] Waste stream profile is the community business waste profile for each city reported by the CIWMB.
[3] Emissions from diverted waste was not estimated since the CACP software does not have the option to report tonnage recycled. In addition, the Local Government Operations Protocol recommends that local inventories not account for emissions sinks (ICLEI 2009). Diverted waste for Citrus Heights is for 2007.
[4] CH_4 capture efficiencies are discussed in Appendix B.
Source: California Integrated Waste Management Board 2007, 2008a, 2008b, 2008c, 2008d¸2008e¸2008f, 2008g, 2008h; Kempenaar, pers. comm.; Shalamunec pers. comm.; Palmer pers. comm.; Kiriu pers. comm.; Environmental Protection Agency 1998.

GHG emissions related to waste generation by Citrus Heights governmental operations for the year 2007 were scaled back based on budget to estimate waste emissions for the year 2005. Citrus Heights total expenses increased 10.6% during this time period. It was assumed that total operating expenses would be a reasonable proxy for determining GHG emissions, so 2007 emissions were multiplied by 90.4% (1/1.106). The waste stream profile, CH_4capture efficiency, and diverted waste percentages were assumed to be the same for both years. Table C-22 presents 2007 and estimated 2005 waste-related GHG emissions from Citrus Heights governmental operations.

Table C-22. 2007 Citrus Heights Government Waste Disposal

Government	2007 Emissions (metric tons CO_2e)	Scaling Factor	2005 Emissions (metric tons CO_2e)
Citrus Heights	28	0.904	25
Source: Kempenaar pers. comm.			

Landfill Emissions from Waste-In-Place in 2005

Waste-in-place emissions are based on the accumulated waste in the landfill over the landfill's lifetime, as opposed to the current year's generation of waste. Waste-in-place emissions were calculated for landfills owned and operated by municipal governments, with available waste-in-place and CH_4 capture data including Kiefer (Sacramento County), Sacramento City Landfill (City of Sacramento), and Elk Grove Landfill (Sacramento County) (Environmental Protection Agency 2007; County of Sacramento 2009). Methane emissions from waste-in-place were calculated using ARB's Excel tool based on the IPCC's first order decay (FOD) model, as recommended by the Local Government Operations Protocol (ICLEI 2008; California Air Resources Board 2009). Landfill emissions from waste-in-place are discussed in Appendix B.

Table B-16 presents data input into the ARB FOD tool to calculate waste-in-place emissions for landfills owned and operated by municipal governments. Emissions from Kiefer Landfill, Sacramento City Landfill, and Elk Grove Landfill are 49,841, 14,012, and 1,511 metric tons CO_2e, respectively. These emissions were included in the appropriate government inventories.

Sacramento International Airport Emissions

The Sacramento International Airport is located in the unincorporated area of Sacramento County and is owned by Sacramento County, and is therefore included in the government inventory for the unincorporated County (Barry pers. comm.). Sacramento County does not have control over aircraft technology (aircraft are regulated by the Federal Aviation Administration [FAA]) nor over the activity or operations of the airlines. Consequently, GHG emissions from aircraft and ground support equipment were not included in the government

GHG inventory. GHG emissions from airport on-site roadways, parking facilities, and off-airport roadways associated with the Sacramento International Airport were included in the Sacramento County Government emissions inventory.

This data was obtained from the Sacramento DERA Final Impact Report on the Sacramento International Airport Master Plan (County of Sacramento Department of Environmental Review and Assessment 2007). Because no major changes to airport or airline operations occurred between 2004 and 2005, the 2004 emissions estimates were included in the 2005 inventory without any adjustment for 2005 activity (Barry pers. comm.). Table C-23 presents GHG emissions associated with the airport, which amount to 200,405 metric tons CO_2e. As discussed above, emissions allocated to the Sacramento County government inventory amount to 37,459 metric tons CO_2e.

Table C-23. 2004 Operational GHG Emissions from the Sacramento International Airport[1]

Source	N_2O (tons)	CH_4 (tons)	CO_2 (tons)	Total Emissions (metric tons CO_2e)[2]
Sources not included in Government Inventory[3]				
Aircraft	6.53	10.15	177,307	162,880
Ground Support Equipment	0.20	0.002	10	65
Subtotal	***6.73***	***10.152***	***177,317***	***162,945***
Sources included in Government Inventory				
Onsite Roadways	4.35	4.106	38,460	36,192
Parking Facilities	0.38	0.302	1,020	1,038
Off-Airport Roadways	0.03	0.025	243	229
Stationary Sources[4]	0.00	0.000	0	0
Subtotal	***4.76***	***4.433***	***39,723***	***37,459***
Total	**11.49**	**14.590**	**217,040**	**200,405**

[1] Table RC-4 (pg. 22-37) from the County of Sacramento DERA Sacramento International Airport Master Plan: Final Impact Report (2007).

[2] Calculated using the conversion of 0.90718474 metric ton per short ton, and the GWP of 310, 21, and 1 for N_2O, CH_4, and CO_2 respectively.

[3] These emissions were included in the City-Wide inventory.

[4] No stationary sources were reported.

Source: County of Sacramento Department of Environmental Review and Assessment 2007.

References

Printed References

California Air Resources Board. 2009. *Landfill Emissions Tool Version 1.1*. Available: <http://www.arb.ca.gov/cc/protocols/localgov/pubs/pubs.htm>. Accessed: March 27, 2009.

California Climate Action Registry. 2009. *Climate Action Registry Reporting Online Tool*. Available: <https://www.climateregistry.org/CARROT/public/reports.aspx>. Accessed: November 23, 2008.

California Integrated Waste Management Board. 2007. *Diversion Study Guide, Appendix I: Conversion Factor Sources*. Available: <http://www.ciwmb.ca.gov/LgLibrary/DSG/ApndxI.htm#Conversion>. Accessed: Januarys 9, 2008.

———. 2008a. *Jurisdiction Profile for Sacramento County/City of Citrus Heights Regional Agency*. Available: <http://www.ciwmb.ca.gov/Profiles/Juris/JurProfile1.asp?RG=R&JURID=602&JUR=Sacramento+County%2FCity+of+Citrus+Heights+Regional+Agency>. Accessed: November 23, 2008.

———. 2008b. *Jurisdiction Profile for City of Elk Grove*. Available: <http://www.ciwmb.ca.gov/Profiles/Juris/JurProfile1.asp?RG=C&JURID=613&JUR=Elk+Grove >. Accessed: November 23, 2008.

———. 2008c. *Jurisdiction Profile for City of Folsom*. Available: <http://www.ciwmb.ca.gov/Profiles/Juris/JurProfile1.asp?RG=C&JURID=159&JUR=Folsom >. Accessed: November 23, 2008.

———. 2008d. *Jurisdiction Profile for City of Galt*. Available: <http://www.ciwmb.ca.gov/Profiles/Juris/JurProfile1.asp?RG=C&JURID=172&JUR=Galt>. Accessed: November 23, 2008.

———. 2008e. *Jurisdiction Profile for City of Isleton*. Available: <http://www.ciwmb.ca.gov/Profiles/Juris/JurProfile1.asp?RG=C&JURID=221&JUR=Isleton>. Accessed: November 23, 2008.

———. 2008f. *Jurisdiction Profile for City of Rancho Cordova*. Available: <http://www.ciwmb.ca.gov/Profiles/Juris/JurProfile1.asp?RG=C&JURID=618&JUR=Rancho+Cordova>. Accessed: November 23, 2008.

———. 2008g. *Jurisdiction Profile for City of Sacramento*. Available: <http://www.ciwmb.ca.gov/Profiles/Juris/JurProfile1.asp?RG=C&JURID=418&JUR=Sacramento>. Accessed: November 23, 2008.

———. 2008h. *Disposal Reporting System (DRS): Jurisdiction Disposal and Alternative Daily Cover (ADC) Tons by Facility*. Available: <http://www.ciwmb.ca.gov/LGCentral/DRS/Reports/JurDspFa.asp?VW=JURIS>. Accessed: November 23, 2008.

The Climate Registry. 2008. *General Reporting Protocol for the Voluntary Reporting Program*. Version 1.1. May. Available: <http://www.theclimateregistry.org/downloads/GRP.pdf>.

County of Sacramento Department of Environmental Review and Assessment (DERA). 2007. Sacramento International Airport Master Plan: Final Impact Report. July. Sacramento, CA.

County of Sacramento. 2009. *Municipal Services Agency – Waste Management and Recycling: Elk Grove Landfill Background*. Available: <http://www.sacgreenteam.com/projects/eglandfill2.htm>. Accessed: January 2, 2009.

Diesel Service and Supply Inc. 2007. *Approximate Fuel Consumption Chart*. Available: <http://www.dieselserviceandsupply.com/Diesel_Fuel_Consumption.aspx>. Accessed: January 14, 2009.

International Council for Local Environmental Initiatives (ICLEI). 2008. *Local Government Operations Protocol.* September, 2008. Available: <http://www.arb.ca.gov/cc/protocols/localgov/pubs/final_lgo_protocol_2008-09-25.pdf>.

———. 2009. *Frequently Asked Questions (FAQ) about the Draft Local Government GHG Protocol.* Available: <http://www.icleiusa.org/action-center/tools/frequently-asked-questions-faq-about-the-draft-local-government-ghg-protocol/>. Accessed: March 18, 2009.

URBEMIS. 2007. Version 9.2.4 for Windows. Software program for calculating air emissions from land use sources. Rimpo and Associates. 2008. Sacramento, CA.

U.S. Environmental Protection Agency. 1998. *AP 42, Fifth Edition, Volume I, Chapter 2: Solid Waste Disposal; Section 2.4 Municipal Solid Waste Landfills*. Available: <http://www.epa.gov/ttn/chief/ap42/ch02/final/c02s04.pdf>. Accessed:

Personal Communications

Ave, Kathleen. Project Manager: Advanced, Renewable & Distributed Generation Technologies. Sacramento Municipal Utility District,

Sacramento, CA. July 15 and 16, 2008—email correspondence with Brian Schuster, ICF Jones & Stokes.

Barry, Toni. Principal Environmental Analyst. County of Sacramento Department of Environmental Review and Assessment, Sacramento, CA. December 9, 2008— telephone conversation.

Bruso, Xantha. Climate Protection Policy Specialist: Environmental Policy Dept.. Pacific Gas & Electric Co., San Francisco, CA. August 6, 2008— email correspondence with Brian Schuster and Lisa Lowry, ICF Jones & Stokes.

Cheeseman, Corey. Program Manager. Customer Energy Efficiency, Pacific Gas and Electric Company, San Francisco, CA. December 4, 2008—email correspondence with Rebecca Rosen, ICF Jones & Stokes.

Gill, Jan. Principal Load Research Analyst. Customer Strategy Division, Sacramento Municipal Utility District, Sacramento, CA. October 18, 2007, December 12, 2007, and January 7 2009—email correspondence and telephone conversations with Lisa Lowry and Brian Schuster, ICF Jones & Stokes.

Forney, Steve. Account Executive. Service and Sales, Pacific Gas and Electric Company, Sacramento, CA. November 1, 2007 and December 17, 2007—email correspondence with Lisa Lowry, ICF Jones & Stokes.

Fry, Vicki. Associate Civil Engineer. Water Quality Division, Policy and Planning, Sacramento County Municipal Services Agency, Sacramento, CA. May 18, 2009—email correspondence with Brian Schuster, ICF Jones & Stokes.

Kempenaar, Casey. Associate Planner. City of Citrus Heights, Citrus Heights, CA. September 30, 2008—email correspondence with Rebecca Rosen and Brian Schuster, ICF Jones & Stokes.

Kiriu, Sandy. Principal Planner, City of Galt Planning Department. Galt, CA. September 30, 2008—email correspondence with Rebecca Rosen and Brian Schuster, ICF Jones & Stokes.

McCormick, Michael. PMC, Oakland, CA. October 23, 2008—email correspondence with Rebecca Rosen, ICF Jones & Stokes.

Mendonsa, Dan. Energy Program Manager. FPM-FPARE-ISA-County of Sacramento, Sacramento, CA. November 2 and 26, 2007; January 15, 2009—email correspondence and telephone conversations with Lisa Lowry, Brian Schuster, and Shannon Hatcher, ICF Jones & Stokes.

Palmer, Evert W. Assistant City Manager. City of Folsom, Folsom, CA. August 1, 2008—email correspondence with Brian Schuster, ICF Jones & Stokes.

Roberts, Keith. City Energy Manager, General Services. City of Sacramento, Sacramento, CA. June 27 and July 16, 2008—email correspondence with Brian Schuster, ICF Jones & Stokes.

Shalamunec, Jessica. Planning Manager. City of Elk Grove, Elk Grove, CA. September 30, 2008—email correspondence with Rebecca Rosen and Brian Schuster, ICF Jones & Stokes.