Amador County

2005 Community-Wide Greenhouse Gas Emissions Inventory

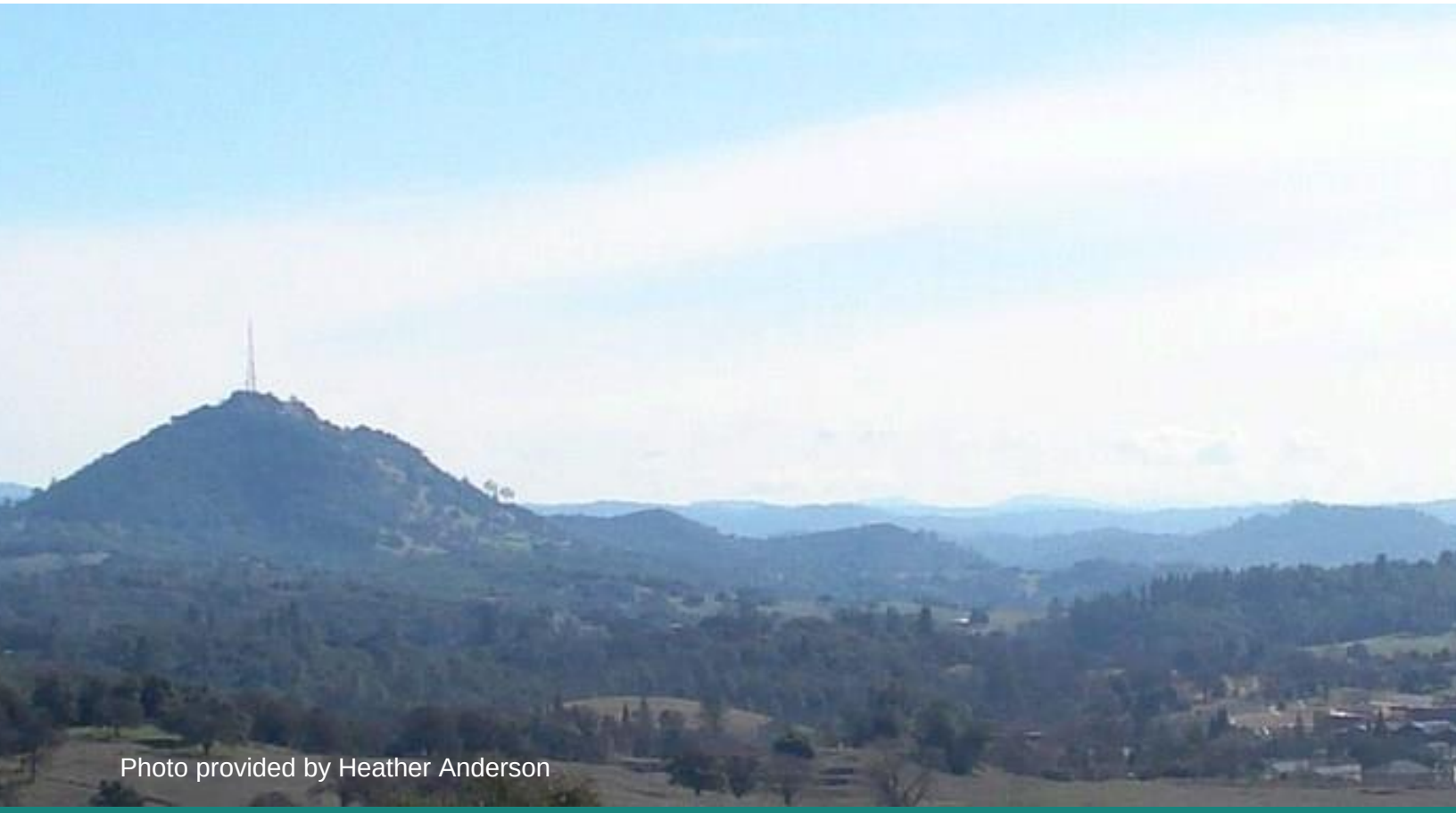


Photo provided by Heather Anderson

Narrative Report

Produced by Sierra Business Council
Supported by Pacific Gas and Electric Company
In Collaboration with Amador County and
ICLEI-Local Governments for Sustainability USA
March 2012

Credits and Acknowledgements

Amador County

Amador County Board of Supervisors
Amador County Planning Department:
- Susan Grijalva, Planning Director
- Heather Anderson, Planner
- Cara Agustin, Planner
- Nathan Lishman, Planner
- Heidi Jacobs, Senior Administrative Assistant

Sierra Business Council

Nicholas Martin, Program Manager
Emma Ingebretsen, Staff Manager
Scott Legg, Lead Author

Pacific Gas and Electric Company (PG&E)

Lisa McNally, Senior Program Manager

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

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

ICLEI-Local Governments for Sustainability USA

Amruta Sudhalkar, Program Officer
Eli Yewdall, Program Officer

This report was prepared for Amador County by the Sierra Business Council in partnership with PG&E and ICLEI. The authors would like to thank Amador County staff for providing much of the insight and local information necessary for the completion of this report. The authors would also like to recognize PG&E for their administrative support of the inventory, made possible through the use of Public Goods Charge funding, as well as thank ICLEI for providing training and technical support.

Table of Contents

Tables and Figures i
List of Tables i
List of Figures ii
Executive Summary 1
Key Findings 1
Next Steps 1
Introduction 2
Climate Change Background 2
Regional and Local Impacts 2
California Policy 3
ICLEI Local Governments for Sustainability Climate Mitigation Program 3
Pacific Gas and Electric Sponsored Inventory Project 4
Sustainability & Climate Change Mitigation Activities in Amador County 4
Inventory Methodology 5
Understanding a Greenhouse Gas Emissions Inventory 5
Community Emissions Protocol 5
Local Government Operations Protocol 6
Quantifying Greenhouse Gas Emissions 6
Establishing a Base Year 6
Establishing Boundaries 6
Emission Types 6
Quantification Methods 7
CACP 2009 Software 8
Evaluating Emissions 8
Emissions by Scope 8
Information Items 9
Emissions by Sector 9
Community Emissions Inventory Results 10
Emissions by Scope 10
Emissions by Sector 13
Residential 14
Commercial / Industrial 16
Transportation 17
Solid Waste and Wastewater 18
Agriculture 20
Per Capita Emissions 22
Conclusion & Next Steps 22
Setting Emissions Reduction Targets 22

The Long-Term Goal 23
State of California Targets and Guidance 23
Creating an Emissions Reduction Strategy 23
Project Resources 24
Appendices 25
Appendix A - Detailed Community Greenhouse Gas Emissions in 2005 25
Appendix B - Residential Sector Notes 27
Appendix C - Commercial / Industrial Sector Notes 29
Appendix D - Transportation Sector Notes 31
Appendix E - Solid Waste 34
Appendix F – Wastewater Sector Notes 36
Appendix G – Agriculture Sector Notes 38

Tables and Figures

List of Tables

#	Title
1	Greenhouse Gases
2	Basic Emissions Calculations
3	Community Sectors
4	Scopes and Sectors Included in Amador County Community Inventory
5	Community GHG Emissions per Sector per Scope (metric tons of CO_2e)
6	Community Scope 1 GHG Emissions (metric tons CO_2e)
7	Community Scope 2 GHG Emissions (metric tons CO_2e)
8	Community GHG Emissions by Sector (metric tons CO_2e)
9	Greenhouse Gas Emissions per Household
10	Residential Emissions by Source
11	Commercial / Industrial Emissions by Source
12	Commercial / Industrial Point Source Emissions (2005)
13	Transportation Emissions by Type
14	Waste and Wastewater Emissions by Category
15	Agriculture Emissions by Source
16	Amador County 2005 Greenhouse Gas Emissions per Capita

List of Figures

#	Figure Title
ES-1	Community GHG Emissions by Sector
1	ICLEI's Five Milestones of Identifying and Reducing GHG Emissions
2	Government Operations Inventory as a subset of Community Inventory
3	Community GHG Emissions by Scope
4	Community Scope 1 GHG Emissions
5	Community Scope 2 GHG Emissions
6	Community GHG Emissions by Sector
7	Residential Emissions by Source
8	Commercial / Industrial Emissions by Source
9	Transportation Emissions by Type
10	Solid Waste and Wastewater Emissions by Category
11	Agriculture Emissions by Process

Executive Summary

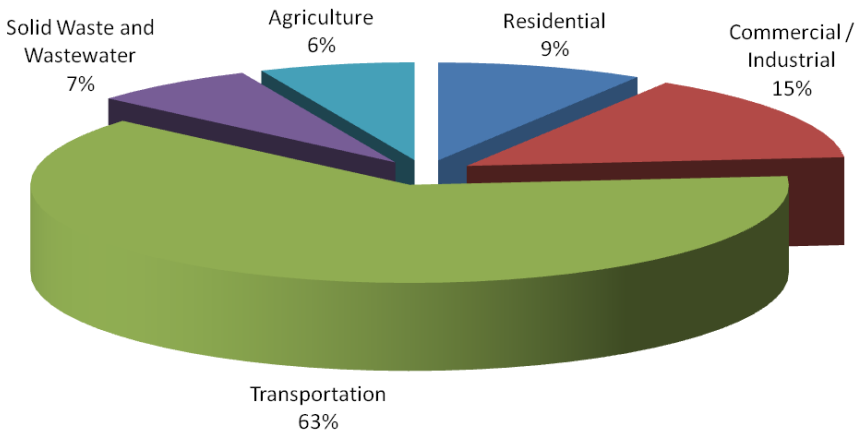
Amador County has multiple opportunities to reduce community GHG emissions. Through implementing GHG emissions reduction strategies, Amador County can help to lower residents' and businesses' energy bills, reduce transportation costs, improve air quality, as well as enhance the efficiency of municipal services such as waste disposal, while reducing costs.

Amador County has begun the climate action planning process, starting with inventorying emissions. Amador County has already completed an inventory of GHG emissions from government operations. This report provides estimates of greenhouse gas emissions resulting from activities in Amador County as a whole in 2005.

Key Findings

As can be seen in Figure ES-1, the largest contributor to community emissions is the Transportation sector with 63% of total emissions. The next largest contributor is the Commercial / Industrial sector with 15% of total emissions. Actions to reduce emissions in both of these sectors will be a key part of a climate action plan. The Residential, Solid Waste & Wastewater, and Agriculture sectors were responsible for the remainder of emissions.

Figure ES-1: Community GHG Emissions by Sector



The Inventory Results section of this report provides a detailed profile of emissions sources within Amador County; information that is key to guiding local reduction efforts. These data will also provide a baseline against which the County will be able to compare future performance and demonstrate progress in reducing emissions.

Next Steps

Amador County is currently in the process of updating the General Plan. The document will outline the County's GHG reduction strategy and a comprehensive climate change adaptation strategy. The General Plan will include goals and policies geared towards minimizing impacts from GHG emissions. These goals and policies may address building design features for energy efficiency; green building through incentives; expansion of recycling and waste minimization efforts; and goals and policies which drive land use patterns to result in a reduction in emissions. Additionally, the General Plan Implementation Measures will include creating a formal climate action plan. Amador County will also support efforts of

Electric Utility companies to develop clean energy from Nuclear Reactors, and hydroelectric energy through the construction of reservoirs.

Introduction

The County of Amador lies east of Sacramento, spanning from east from the Sacramento County line well into the El Dorado National Forest and covers over 605 square miles. It ranges in elevation from 250 ft to over 9,000 and had a 2005 population estimate of 21,706 people in the unincorporated county. Every day, Amador County plays host to a variety of activities necessary for ensuring a properly functioning and robust community. These activities include collecting and treating waste, generating power, utilizing agricultural lands, and providing light and heat for buildings. Activities such as these will either directly or indirectly contribute to the addition of carbon dioxide and other greenhouse gases (GHGs) into the environment. This report presents the findings and methodology of a community-wide greenhouse gas emissions inventory for Amador County in 2005.

Climate Change Background

Naturally occurring gases dispersed in the atmosphere determine the Earth's climate by trapping solar radiation. This phenomenon is known as the greenhouse effect. Contributors to greenhouse gas emissions include the burning of fossil fuels for transportation, electricity generation and other purposes. These gases intensify the natural greenhouse effect. Reducing fossil fuel use in the community can have many benefits in addition to reducing gas emissions. More efficient use of energy decreases utility costs for residents and businesses. Retrofitting homes and businesses to be more efficient may create jobs. Reducing fossil fuel use improves air quality.

Regional and Local Impacts

Amador County, as all communities in the Sierra Nevada, faces unique challenges associated with climate change in the region. Potential impacts on water resources include reduced snowpack, delayed snow accumulation, earlier snow melting, and possibly shortages in runoff and water supply driving the need for hydroelectric reservoirs. Local economies in the Sierra Nevada rely so heavily on natural resources for tourism, recreation, forestry, agriculture and other industries, climate change has the potential to affect economic activity in Amador County.

California Policy

California passed the Global Warming Solutions Act (AB 32) in 2006, which charged the California Air Resources Board (CARB) with implementing a comprehensive statewide program to reduce greenhouse gas emissions. AB 32 established the following greenhouse gas emissions reduction targets for the state of California:

- 2000 emissions levels by 2010
- 1990 emissions levels by 2020

Additionally, the passage of SB 375 enhances California's ability to reach its AB 32 goals by promoting good planning with the goal of more sustainable communities. The authors of AB 32 failed to recognize the impacts of the Bill, in Amador County. The mandatory commercial recycling component will increase green house gas emissions as the service providers in Amador County are forced to add additional trucks traveling great distances to collect small quantities of recyclables. Although Amador County is not subject to SB 375, SB 375 requires CARB to develop regional greenhouse gas emission reduction targets for passenger vehicles. CARB is to establish targets for 2020 and 2035 for each region covered by one of the State's 18 metropolitan planning organizations (MPOs). Another policy driver for climate action planning in California is SB 97, which established that GHG emissions and their impacts are appropriate subjects for analysis under the California Environmental Quality Act (CEQA). This law directed the State's Office of Planning and Research (OPR) to develop CEQA guidelines on the mitigation of greenhouse gas emissions for agencies such that they may follow appropriate standards on calculating GHG emissions from projects, determine potential significance, and implement mitigation measures if necessary and feasible. Finally, Executive Order S-3-05, issued by Governor Schwarzenegger, reinforces these goals and sets a schedule for the reporting of both the measured impacts of climate change upon California's natural environment and the emissions reduction efforts undertaken by a myriad of state, regional, and local groups. Executive Order S-3-05 establishes an additional target of 80% below 1990 levels by 2050. Amador County's GHG emissions inventory is intended to enable the county to develop effective GHG reduction policies and programs to meet these targets and track emissions reduction progress.

ICLEI Local Governments for Sustainability Climate Mitigation Program

In response to the problem of climate change, many communities in the United States are taking responsibility for addressing emissions at the local level. Since many of the major sources of greenhouse gas emissions are directly or indirectly controlled through local policies, local governments have a role to play in reducing greenhouse gas emissions within their boundaries. Through proactive measures around land use patterns, transportation demand management, energy efficiency, green building, waste diversion, and more, local governments can reduce emissions in their communities.

ICLEI – Local Governments for Sustainability (herewith known as "ICLEI") is an association for local governments to share knowledge and successful strategies toward increasing local sustainability.[1]

ICLEI provides a framework and methodology for local governments to identify and reduce greenhouse gas emissions, organized along Five Milestones (shown in Figure 1):

1. Conduct an inventory and forecast of local greenhouse gas emissions
2. Establish a greenhouse gas emissions reduction target
3. Develop a climate action plan for achieving the emissions reduction target
4. Implement the climate action plan
5. Monitor and report on progress

This report represents the completion of ICLEI's Climate Mitigation Milestone One and provides a foundation for future work to reduce greenhouse gas emissions in Amador County.

Figure 1: The Five Milestones of identifying and reducing greenhouse gas emissions.

Pacific Gas and Electric Sponsored Inventory Project

This project was made possible by the Pacific Gas and Electric Company (PG&E) Green Communities Program with funding from California utility customers under the auspices of the California Public Utilities Commission. The Green Communities Program assists local governments by providing easy-to-understand information, technical expertise, and financial resources to support local climate action planning. The Green Communities Program is designed to help local governments and communities achieve greenhouse gas reduction goals and to improve air quality, reduce energy costs, and curb greenhouse gas emissions.

Sustainability & Climate Change Mitigation Activities in Amador County

Amador County has already started to implement various programs and efforts to mitigate climate change. Examples of these efforts include:

- The Amador County Integrated Solid Waste Management Agency Waste Reduction and Recycling Guide & "Recycler Ricky" Award.

[1] ICLEI was formerly known as the International Council for Local Environmental Initiatives, but the name has been changed to ICLEI – Local Governments for Sustainability. http://www.iclei.org & http://www.icleiusa.org

- Amador County Eco-procurement policy promoting the purchase of environmentally preferred products to minimize the environmental impacts related to Amador County operations.
- Promote Amador-Tuolumne Community Action Agency's (ATCAA) Home Energy Program which provides low-income residents with energy saving home improvements including weather-stripping, insulation and appliances, and education on reducing energy costs.
- Amador County has lead by example with the solar panels installed at the County Administration Center and aiding in funding for solar at the County Transit Center in Sutter Creek.

Inventory Methodology

Understanding a Greenhouse Gas Emissions Inventory

The first step toward achieving tangible greenhouse gas emission reductions requires identifying baseline levels and sources of emissions in the community. The need for a standardized approach to quantify GHG emissions has proven essential. Standard processes of accounting for emissions have been developed to which our inventory adheres. The International Local Government GHG Emissions Analysis Protocol (IEAP) was used to inventory the County's community emissions. In addition, methods from the Local Government Operations Protocol were used as appropriate for specific sectors.

Amador County (with assistance from Amador Citizens for Energy Conservation) has previously completed an inventory of emissions from government operations. The government operations inventory is a subset of the community inventory; for example, data on commercial energy use by the community includes energy consumed by municipal buildings, and community vehicle-miles-traveled estimates include miles driven by municipal fleet vehicles. The government operations inventory is in this way a subset of the community-scale inventory, as shown in Figure 2.

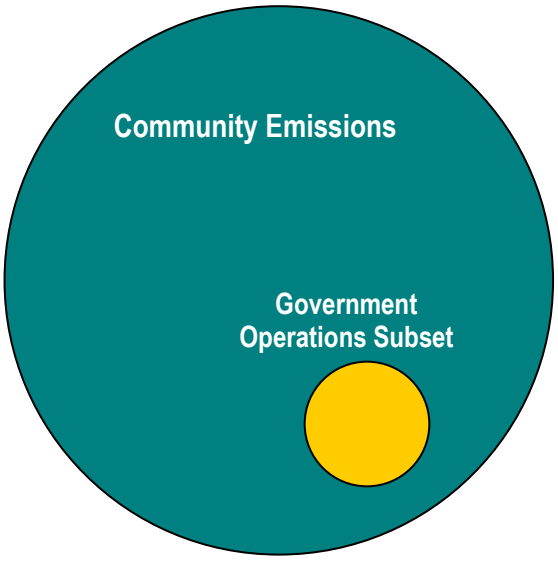


Figure 2: The Government Operations Emissions Inventory as a subset of the Community Emissions Inventory.

Community Emissions Protocol

The IEAP provides guidelines for local governments in quantifying greenhouse gas emissions from the community within their geopolitical boundaries. Staff used this protocol to inventory Amador County's community emissions.

Local Government Operations Protocol

In 2008, ICLEI, the California Air Resources Board (CARB), and the California Climate Action Registry (CCAR) released the LGO Protocol to serve as a national Appendix to the IEAP.[2] The LGO Protocol serves as the national standard for quantifying and reporting greenhouse gas emissions from local government operations. The purpose of the LGO Protocol is to provide the principles, approach, methodology, and procedures needed to develop a local government operations greenhouse gas emissions inventory. The LGO Protocols can also be used for some methods used in community inventories.

Quantifying Greenhouse Gas Emissions

Establishing a Base Year

The inventory process requires the selection of a base year with which to compare current emissions. Amador County's community greenhouse gas emissions inventory utilized 2005 as its base year. 2005 is a commonly accepted baseline year in California – it is the reference year in both SB 375 and Executive Order S-3-05. In addition, 2005 is one of the earliest years for which relatively comprehensive data is available and is the base year used in Amador County's government operations inventory.

Establishing Boundaries

Setting an organizational boundary for greenhouse gas emissions accounting and reporting is an important step in the inventory process. Amador County's community inventory assessed emissions resulting from activities within its geopolitical boundary. The IEAP defines geopolitical boundary as that "consisting of the physical area or region over which the local government has jurisdictional authority." Activities that occur within this boundary can be, for the most part, controlled or influenced by Amador County's policies and educational programs. Although the county may have limited influence over the level of emissions from some activities, it is important that every effort be made to compile a complete analysis of all activities that resulted in greenhouse gas emissions. Note that emissions from facilities that are operated by Amador County, but are located outside the county's jurisdictional boundaries were not included in the inventory. Conversely, a government facility operated by another jurisdiction but located within Amador County's jurisdictional boundary was included in the community inventory.

Emission Types

The IEAP and LGOP recommend assessing emissions from six recognized greenhouse gases as listed in Table 1. Emissions of Hydrofluorocarbons, Perfluorocarbons, and Sulfur Hexafluoride were not included in this inventory because of the difficulty in obtaining data on these emissions at a community scale**.** Greenhouse gas emissions are commonly aggregated and reported in terms of equivalent carbon dioxide units, or CO_2e. This standard is based on the Global Warming Potential (GWP) of each gas, which is a measure of the amount of warming a greenhouse gas may

[2] Local Government Operations Protocol (LGOP). http://www.icleiusa.org/programs/climate/ghg-protocol/ghg-protocol

cause, measured against the amount of warming caused by carbon dioxide. Converting all emissions to equivalent carbon dioxide units allows for the consideration of different greenhouse gases in comparable terms. For example, methane is twenty-one times more powerful than carbon dioxide in its warming effect, so one metric ton of methane emission is equal to twenty-one metric tons of carbon dioxide equivalents. See Table 1 for the GWPs of the commonly occurring greenhouse gases.

Table 1: Greenhouse Gases

Greenhouse Gas	Chemical Formula	Global Warming Potential
Carbon Dioxide	**CO_2**	**1**
Methane	**CH_4**	**21**
Nitrous Oxide	**N_2O**	**310**
Hydrofluorocarbons	**Various**	**43-11,700**
Perfluorocarbons	**Various**	**6,500-9,000**
Sulfur Hexafluoride	**SF_6**	**23,900**

Quantification Methods

Greenhouse gas emissions can be quantified in two ways:

- **Measurement-based** methodologies refer to the direct measurement of greenhouse gas emissions (from a monitoring system) emitted from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility.
- **Calculation-based** methodologies calculate emissions using activity data and emission factors. To calculate emissions accordingly, the basic equation below is used: *Activity Data x Emission Factor = Emissions*

All emissions in this inventory were quantified using calculation-based methodologies. Activity data refer to the relevant measurement of energy use or other greenhouse gas-generating processes such as fuel consumption by fuel type, metered annual electricity consumption, and annual vehicle miles traveled. Please see appendices for a detailed listing of the activity data used in composing this inventory.

Known emissions factors were used to convert energy usage or other activity data into associated quantities of emissions. Emissions factors are usually expressed in terms of emissions per unit of activity data (e.g. lbs CO_2/kWh of electricity).

Table 2 demonstrates examples of common emission calculations that use this formula. Please see appendices for details on the emissions factors used in this inventory.

Table 2: Basic Emissions Calculations

Activity Data	Emissions Factor	Emissions
Electricity Consumption (kWh)	**CO_2 emitted/kWh**	**CO_2 emitted**
Natural Gas Consumption (therms)	**CO_2 emitted/therm**	**CO_2 emitted**
Gasoline/Diesel Consumption (gallons)	**CO_2 emitted /gallon**	**CO_2 emitted**
Vehicle Miles Traveled	**CH_4, N_2O emitted/mile**	**CH_4, N_20 emitted**

CACP 2009 Software

To facilitate community efforts to measure greenhouse gas emissions as a first step towards reducing them, the Clean Air and Climate Protection 2009 (CACP 2009) software package is utilized. CACP 2009 is designed for compatibility with the LGO Protocol and determines emissions by combining activity data (energy consumption, waste generation, etc.) with verified emission factors.

The CACP software has been and continues to be used by over 600 U.S. local governments to measure their greenhouse gas emissions. However, it is worth noting that although the software provides governments with a sophisticated and useful tool, calculating emissions from activity data with precision is difficult. The model depends upon numerous assumptions and is limited by the quantity as well as quality of available data. With this in mind the model is an approximation of reality rather than an exact value.

Evaluating Emissions

There are several important concepts involved in the analysis of emissions arising from many different sources and chemical/mechanical processes throughout the community. Those not already touched on are explored below.

Emissions by Scope

For both community and government operations, emissions sources are categorized relative to the geopolitical boundary of the community or the operational boundaries of the government. Emissions sources are categorized by Scope 1, Scope 2, or Scope 3. The Scopes framework is used to prevent double counting of emissions for major categories such as electricity use and waste disposal.

The Scopes framework identifies three emissions scopes for community emissions:

- **Scope 1:** All direct emissions from sources located within the geopolitical boundary of the local government.

- **Scope 2:** Indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating, and cooling. Scope 2 emissions occur as a result of activities that take place within the geopolitical boundary of the local government, but that rely upon emissions-producing processes located outside of the government's jurisdiction.
- **Scope 3:** All other indirect or embodied emissions not covered in Scope 2 that occur as a result of activity within the geopolitical boundary.

Scope 1 and Scope 2 sources are the most essential components of a community greenhouse gas analysis as these sources are typically the most significant in scale and are most easily affected by local policy making. In addition to the categories in the Scopes framework, emission sources may also fall in a fourth category called Information Items.

Information Items

Information items are emissions sources that are not included as Scope 1, 2, or 3 emissions in the inventory, but are reported here separately in order to provide a more complete picture of emissions from Amador County.

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

Carbon dioxide emissions from the combustion of biogenic fuels are not included in Scope 1 emissions in accordance with established international principles. Methane and nitrous oxide emissions from biogenic fuels are considered Scope 1 stationary combustion emissions and are included in the stationary combustion sections for the appropriate facilities. These principles indicate that biogenic fuels (e.g., wood, biodiesel), if left to decompose in the natural environment, would release CO_2 into the atmosphere, where it would then enter back into the natural carbon cycle. Therefore, when wood or another biogenic fuel is combusted, the resulting CO_2 emissions are akin to natural emissions and should therefore not be considered as human activity-generated emissions. The CH_4 and N_2O emissions, however, would not have occurred naturally and are therefore included as Scope 1 emissions.

Emissions by Sector

In addition to categorizing emissions by scope, this inventory examines emissions by sector. Many local governments find a sector-based analysis more relevant to policy making and project management, as it assists in formulating sector-specific reduction measures and climate action plan components. Table 3 shows the sectors that are included in this inventory:

Table 3: Community Sectors

Community
Residential
Commercial / Industrial
Transportation
Solid Waste and Wastewater
Agriculture

Community Emissions Inventory Results

Emissions by Scope

The emissions sources by scope and sector included in this inventory are listed in Table 4.

Table 4: Scopes and Sectors Included in Amador County Community Inventory

Sector	Scope 1	Scope 2	Scope 3	Information Items
Residential	Natural Gas, Propane, Heating Oil	Electricity		Biogenic Emissions from Wood Combustion
Commercial / Industrial	Stationary Combustion of Natural Gas, Diesel and Propane	Electricity		
Transportation	Gasoline & Diesel			
Solid Waste and Wastewater	Buena Vista Landfill, Small Historic Dumps, Wastewater Treatment		Future Emissions from 2005 Waste	Biogenic Emissions from Combustion of Landfill Gas
Agriculture	Enteric Fermentation, Manure Management, Fertilizer			

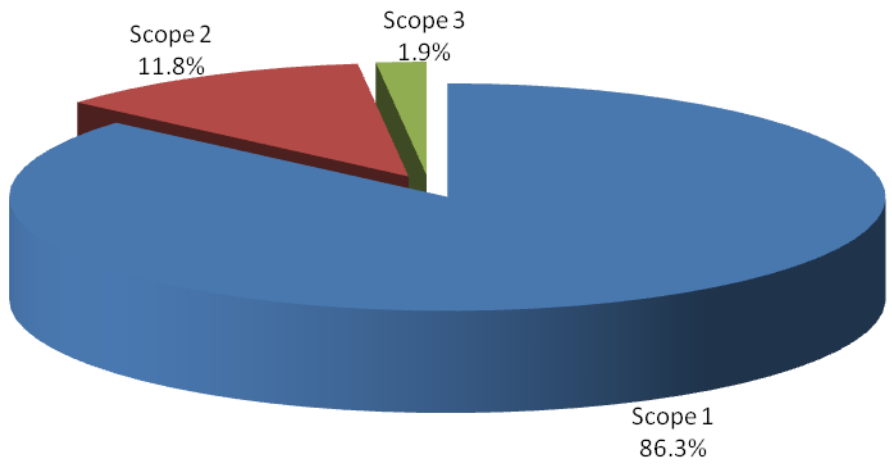
Total roll-up community emissions for Amador County were approximately 427,444 metric tons[3] of CO_2e in the year 2005. This roll-up does not include emissions categorized as information items. Because the sources that go into a roll-up number vary from community to community, this number should not be used for comparison purposes without a careful analysis of the basis of the number. Table 5 and Figure 3 present emissions by scope and sector.

[3] All emissions estimated using ICLEI's CACP 2009 Software.

Table 5: Community GHG Emissions per Sector per Scope (metric tons CO_2e)

Sector	Scope 1	Scope 2	Scope 3	TOTAL	Information Items
Residential	14,993	22,695	0	37,688	8,951
Commercial / Industrial	35,258	27,843	0	63,101	927
Transportation	268,185	0	0	268,185	0
Solid Waste and Wastewater	22,236	0	7,916	30,152	0
Agriculture	28,317	0	0	28,317	0
TOTAL	**368,990**	**50,538**	**7,916**	**427,444**	**9,878**
Percentage of Total CO_2e	**86.3%**	**11.8%**	**1.9%**	**100.0%**	

Figure 3: Community GHG Emissions by Scope

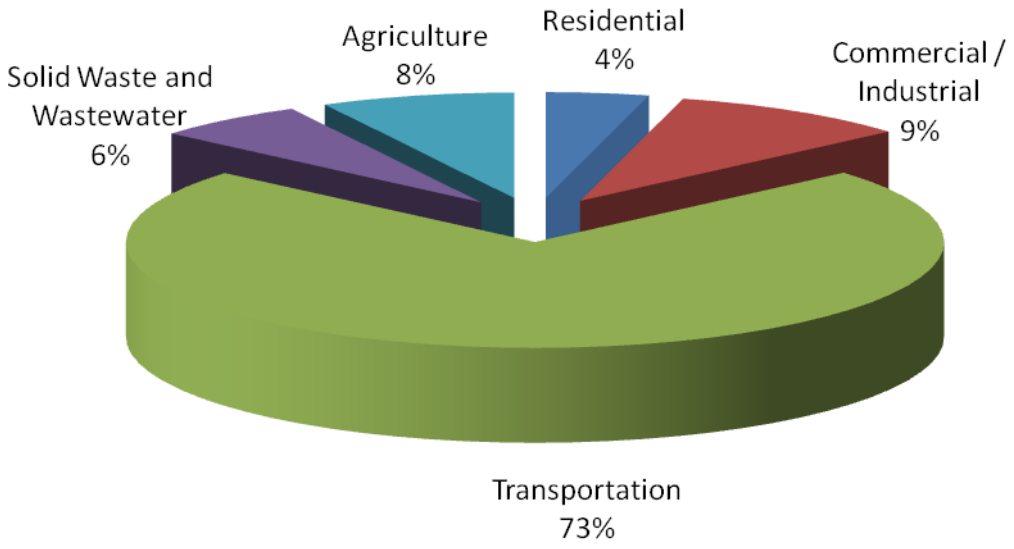


The following sections describe each of the individual scopes in more detail. As shown in Table 6 and Figure 4 below, the largest percentage of Scope 1 emissions came from the Transportation Sector (73%). The Transportation Sector emissions were the result of diesel and gasoline use within Amador County limits on local roads, on State highways, and by off-road vehicles. The remainder of Scope 1 emissions came from stationary fuel combustion (combustion of natural gas, propane, heating oil, etc.) in Amador County homes (Residential Sector, 4%), stationary fuel combustion in businesses/industry (Commercial / Industrial Sector, 9%), emissions associated with livestock and crops (Agriculture Sector, 8%), and fugitive emissions from wastewater treatment, the Buena Vista Landfill and small historic dumps (Solid Waste and Wastewater Sector, 6%).

Table 6: Community Scope 1 GHG Emissions (metric tons CO_2e)

Scope 1 Emissions By Sector	Residential	Commercial / Industrial	Transportation	Solid Waste and Wastewater	Agriculture	TOTAL
CO_2e (metric tons)	14,993	35,258	268,185	22,236	28,317	368,990
% of Total CO_2e	4%	9%	73%	6%	8%	100%
MMBtu	321,385	676,923	3,343,519	N/A	N/A	4,341,827

Figure 4: Community Scope 1 GHG Emissions



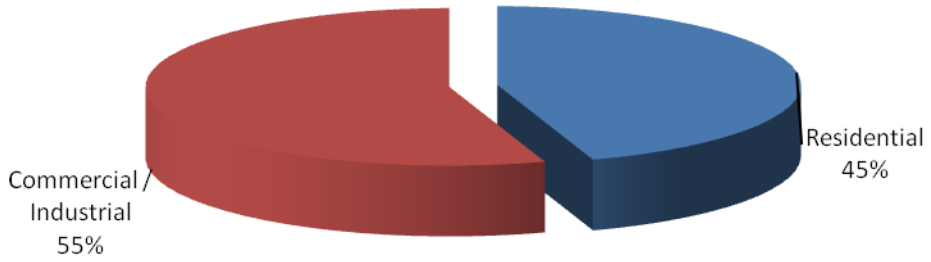
As shown in Table 7 and Figure 5, 55% of 2005 Scope 2 emissions were generated by the Commercial / Industrial Sector. 45% percent of Amador County's Scope 2 emissions came from electricity consumption by the Residential sector within County boundaries. As noted above in the general description of Scope 2 parameters, the actual emissions from these activities were generated outside of Amador County boundaries—in this case, at the source of electricity generation.

Table 7: Community Scope 2 GHG Emissions (metric tons CO_2e)

Scope 2 Emissions By Sector	Residential	Commercial / Industrial	TOTAL
CO_2e (metric tons)	22,695	27,843	50,538

% of Total CO_2e	45%	55%	100%
MMBtu	345,627	365,465	711,092

Figure 5: Community Scope 2 GHG Emissions



The remaining portion of emissions included in the County of Amador 2005 community inventory fall under the category of Scope 3. All emissions in this category are an estimate of future emissions over the lifecycle decomposition of waste and alternative daily cover (ADC) sent from within Amador County to a landfill in the base year (2005).[4]

In addition to Scope 1, Scope 2, and Scope 3 emissions, there were emissions of 9,878 metric tons CO_2e as information items. These emissions came from wood burned as a heating fuel in Amador County homes and the flaring of methane gas in the Buena Vista Landfill. Information items are not included in any inventory roll-up numbers.

Emissions by Sector

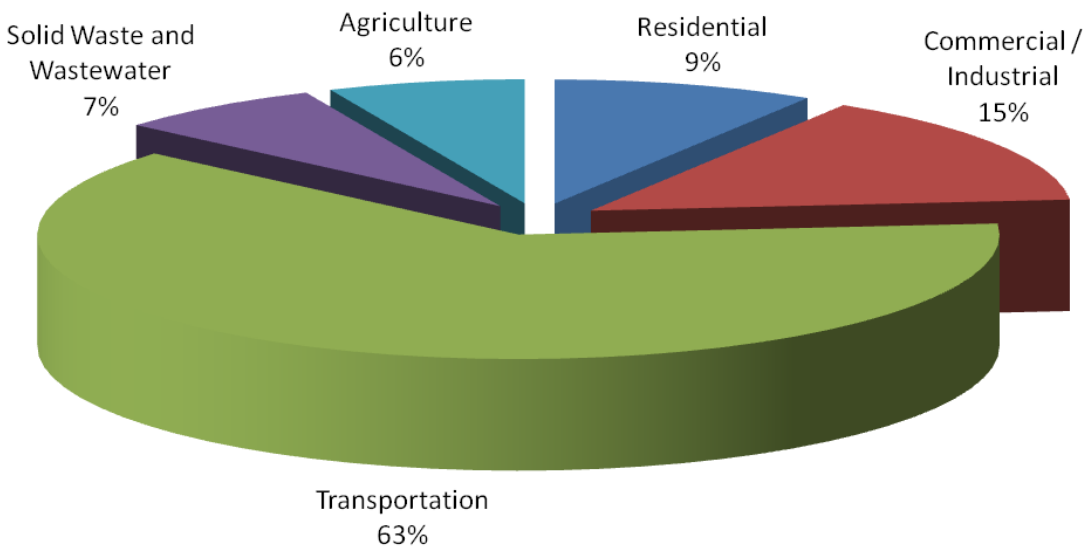
In addition to considering emissions via scopes, we can also focus specifically on each sector, with scopes aggregated by sector. As visible in Table 8 and Figure 6 below, emissions from the Transportation Sector (the same gasoline and diesel sources as that listed under Scope 1 above) accounted for 63% of total community emissions, and were by far the largest sources of community emissions. Electricity, natural gas, and stationary fuel consumption within the Residential Sector caused 9% of the County's overall emissions. Electricity, natural gas and stationary fuel combustion within the Commercial / Industrial Sector accounted for 15% of the County's emissions. The remaining 13% of emissions came from the Agriculture and Waste Sectors. See below for further detail on each sector.

[4] Later in the report there is more detail on emissions from the waste sector.

Table 8: Community GHG Emissions by Sector (metric tons CO_2e)

Community Emissions by Sector	Residential	Commercial / Industrial	Transportation	Waste	Agriculture	TOTAL
CO_2e (metric tons)	37,688	63,101	268,185	30,152	28,317	427,444
% of Total CO_2e	9%	15%	63%	7%	6%	100%
MMBtu	667,012	1,042,388	3,343,519	N/A	N/A	5,052,919

Figure 6: Community GHG Emissions by Sector



Residential

As shown in Table 8, Amador County's Residential Sector generated an estimated 37,688 metric tons of CO_2e in 2005. This estimate was calculated using 2005 electricity consumption data provided by PG&E, and estimates of home heating fuel use based on census and weather data. It only includes consumption through residential buildings. Data on fuel use from residential emergency generators was not available, and was not included in this inventory. Data on residential equipment usage, such as lawnmowers, were included within Off-Road emissions in the Transportation Sector. GHG emissions associated with residential transportation and residential waste generation were included separately in the Transportation and Waste Sector emissions totals, respectively. Appendix B provides detailed Residential Sector emissions methods.

Table 9 provides information on residential emissions on a per-household basis. Each household in Amador County generated 4.2 metric tons of GHG emissions in 2005. Per-household emissions can be a useful metric for measuring progress in reducing greenhouse gases and for comparing one's emissions with neighboring cities and against regional

and national averages. That said, when comparing figures, be aware that due to differences in emission inventory methods it can be difficult to get a directly comparable per-household emissions number.

Table 9: Amador County 2005 Greenhouse Gas Emissions per Household

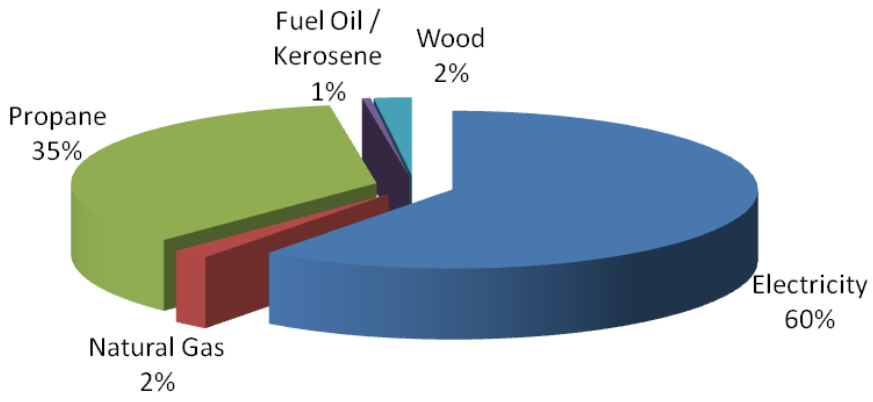
Number of Occupied Housing Units	**9,032**
Total Residential GHG Emissions (metric tons CO_2e)	**37,688**
Residential GHG Emissions/Household (metric tons CO_2e)	**4.2**

Table 10 and Figure 7 illustrate the breakdown of residential GHG emissions by fuel type. Approximately 60% of residential GHG emissions were generated through electricity provided by PG&E. Propane and fuel oil, used for home heating and water heating, generated 36% of residential GHG emissions respectively. Just 2% of residential GHG emissions were generated from the use of natural gas. Natural gas is also used in residences as a fuel for home heating, water heating, and cooking but is generally unavailable in unincorporated Amador County. Finally, wood used for home heating accounted for 2% of residential emissions (excluding biogenic CO_2 emissions).

Table 10: Residential Emissions by Fuel Type

Residential Emission Sources 2005	Electricity	Natural Gas	Propane	Fuel Oil / Kerosene	Wood	TOTAL
CO_2e (metric tons)	**22,695**	**755**	**13,309**	**171**	**758**	**37,688**
% of Total CO_2e	**60%**	**2%**	**35%**	**1%**	**2%**	**100%**
MMBtu	**345,627**	**14,212**	**209,443**	**2,301**	**95,429**	**667,012**

Figure 7: Residential Emissions by Fuel Type



Commercial / Industrial

As mentioned previously, Amador County's businesses and industries generated nearly 15% of community-wide GHG emissions in 2005, or 1,042,388 metric tons of CO_2e. In addition to emissions from natural gas and electricity consumption, there were additional Commercial / Industrial sector stationary combustion emissions included in this inventory.[5] These data were provided by the Amador Air District and includes CO_2, CH_4, and N_2O emissions from diesel, and propane**.** In Amador County, diesel generators constituted nearly all of these additional emissions, with insignificant emissions associated with one permitted propane generator at Buena Vista Landfill (not shown in Table 11). Stationary combustion emissions associated with Commercial / Industrial natural gas use were intentionally excluded from the Amador Air District data, assuming that the majority of natural gas-associated emissions were accounted for using natural gas usage data provided by PG&E. Appendix C provides details on Commercial / Industrial emissions methods.

As illustrated in Table 11 and Figure 8, operation of diesel generators accounted for just 1% (or 764 metric tons of CO_2e) of the Commercial / Industrial greenhouse gas emissions identified in this study. 55% of emissions were generated from the combustion of natural gas, used for space heating as well as any on-site generation of electricity and the operation of boilers. Commercial / Industrial electricity consumption accounted for 44% of the Commercial / Industrial greenhouse gas emissions sources.

Table 11: Commercial / Industrial Emissions by Source

Commercial / Industrial Emission Sources 2005	Electricity	Natural Gas	Diesel	TOTAL
CO_2e (metric tons)	**27,843**	**34,490**	**764**	**63,096**
% of Total CO_2e	**44%**	**55%**	**1%**	**100%**
MMBtu	**365,465**	**648,837**	**10,284**	**1,024,587**

[5] Stationary combustion emissions are those generated from on-site stationary commercial and industrial equipment including power plants and emergency generators.

Figure 8: Commercial / Industrial Emissions by Source

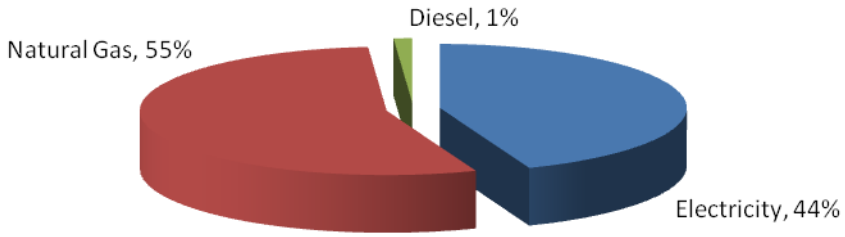


Table 12, below details the 2005 Commercial / Industrial stationary combustion greenhouse gas emissions from on site power generation as reported by the Amador Air District by facility in 2005. Diesel generators operated by CalTrans generated nearly 41% of these stationary combustion emissions. Refer to Appendix C for a detailed list of emissions fuel sources for each facility. The emissions for the facilities listed below are not inclusive of all emissions from these facilities. Natural gas emissions were not included due to confidentiality laws restricting the release of disaggregated utility data.

Table 12: Commercial / Industrial Stationary Combustion Emissions (2005)

Facility/Category	Address	GHG Emissions CO_2e (metric tons)
Generators Diesel CalTrans	Amador County, CA	312
Generators Diesel Horseshoe "A" Mine	Amador County, CA	192
Generators Diesel MP Associates	Amador County, CA	142
Generators Diesel Ham's Station	Amador County, CA	118
Generators Propane Buena Vista	Amador County, CA	0.1
Total		764.1

Transportation

As shown previously in Figure 6 and Table 8, Amador County's Transportation Sector accounted for 268,185 metric tons CO_2e, or 63%, of the County's 2005 GHG emissions. The Transportation Sector analysis included emissions from all vehicle use within Amador County's jurisdictional boundaries (whether on local roads or State highways passing through Amador County's jurisdiction), as well as off-road vehicles and machines.[6]

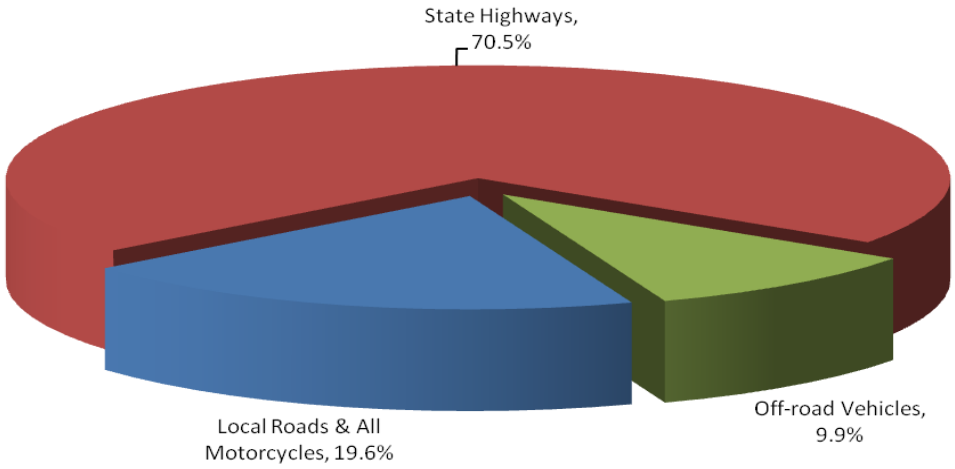
[6] See Appendix D for further information on Transportation Sector methods.

Figure 9 and Table 13, show that approximately 70.5% of Amador County's 2005 transportation-related greenhouse gas emissions were generated from vehicle miles traveled (VMT) on state highways located within County boundaries, while 19.6% was generated from vehicles on local roads and from motorcycles. Off-road vehicles generated the remaining 9.9% of transportation-related greenhouse gas emissions.

Table 13: Transportation Emissions by Type

Transportation Road Type Emissions Sources 2005	Local Roads & All Motorcycles	State Highways	Off-Road Vehicles	TOTAL
CO_2e (metric tons)	52,442	189,290	26,453	268,185
Percentage of Total CO_2e	19.6%	70.5%	9.9%	100%
MMBtu	723,327	2,620,192	data not available	3,343,519

Figure 9: Transportation Emissions by Type



Emissions from the air travel of Amador County residents were not included in the Transportation Sector analysis. With more time and the availability of additional data the greenhouse gas emissions from air travel could be estimated. However, because there were no major airports located within the geographic boundaries of Amador County it is reasonable to exclude air travel from this inventory. Please see Appendix D for more detail on methods used in calculating emissions from the Transportation Sector.

Solid Waste and Wastewater

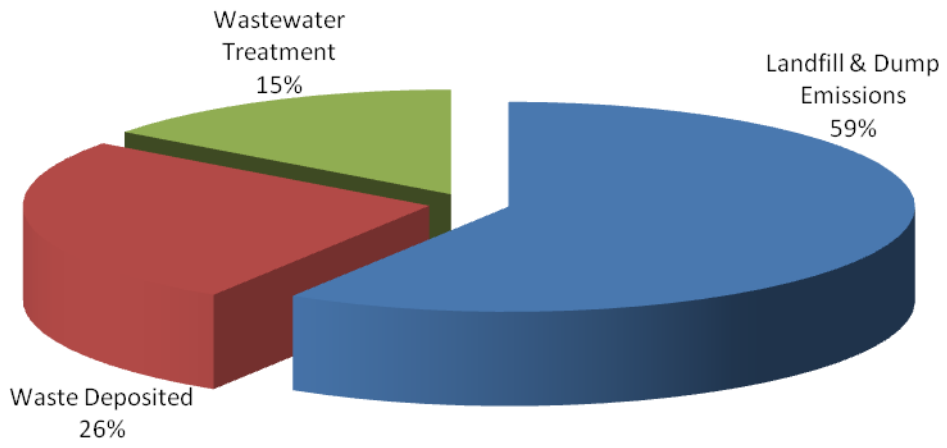
As noted above in Figure 6 and Table 8, the Solid Waste and Wastewater Sector constituted 7% of total 2005 emissions for the community of Amador County. Table 14 and Figure 10 detail Solid Waste and Wastewater emissions by category.

Table 14: Solid Waste and Wastewater Emissions by Category

Waste Emissions Categories 2005	Landfill & Historic Dump Emissions (Scope 1)	Waste Deposited (Scope 3)	Wastewater Treatment (Scope 1)	TOTAL
CO_2e (metric tons)	17,756	7,916	4,480	30,152
% of Total CO_2e	59%	26%	15%	100%

Solid Waste emissions are an estimate of methane generation from the anaerobic decomposition of organic wastes (such as paper, food scraps, plant debris, wood, etc.) that are deposited in a landfill. This inventory accounted for both 2005 Scope 1 fugitive emissions from Buena Vista Landfill & historic dumps within the jurisdiction, as well as Scope 3 future

Figure 10: Solid Waste and Wastewater Emissions by Category



emissions associated with all solid waste generated in 2005 within the community[7]:

- ***Buena Vista Landfill & Historic Dump Emissions (Scope 1):*** Total emissions from the Buena Vista Landfill and historic dump sites in 2005. These emissions were the result of decomposing organic waste-in-place in the landfill and dumps located in Amador County.[8] Specifically, included in the inventory were estimated fugitive emissions (emissions not captured by any methane recovery) coming off the landfill and dumps in 2005.

[7] See Appendix E for more information on methods and emissions factors used in the Solid Waste Sector analysis.

[8] It can take over 100 years for a given quantity of waste to fully decompose in a landfill, releasing methane and other gases as it breaks down. As such, base year landfill emissions are the result of many years of waste disposal.

- **W*aste Generation (Scope 3):*** Emissions from waste generated within Amador County in 2005 and from alternative daily cover (ADC) sent to landfills. These emissions were the estimated future emissions of 2005-generated waste or ADC that was sent to any landfill by Amador County residents or businesses. These emissions were categorized as Scope 3 because they are not emitted in the base year, but will result from the decomposition of the 2005 waste over the full 100+ year cycle of its decomposition.

The Scope 3 waste emissions method is relevant to policy development addressing waste diversion, while the Scope 1 method is most relevant to landfill gas management practices. Therefore both pieces of information are policy-relevant. Transportation emissions generated from the collection, transfer and disposal of solid waste were included in Transportation Sector GHG emissions.

Wastewater emissions are an estimate of fugitive N_2O and CH_4 emissions (Scope 1) from River Pines PUD Wastewater Treatment Plant (WWTP), Lake Camanche Wastewater Treatment Facilities (WWTF), and decentralized septic systems in 2005. Wastewater Sector constituted 0.08% for WWTPs, 4.3% for WWTF, and 95.6% for septic systems of Solid Waste and Wastewater 2005 emissions for the community of Amador County.

The wastewater emissions from centralized WWTPs were the result of two process choices: nitrification/denitrification and anaerobic digestion. Nitrification/denitrification is a process that can be employed at a treatment facility to reduce total Nitrogen levels within influent; municipalities who choose this process only reduce the eventual levels of N_2O, they do not eliminate them. The second choice of anaerobic digestion of collected sludge contributes to CH_4 emissions through the decomposition of organic material. Note that these emissions were the result of incomplete combustion of captured CH_4; capture and flaring of CH_4 gas is a necessary part of digester systems. Other processes may contribute to emissions levels including industrial/commercial loading and use of aerobic or anaerobic primary treatment.

Emissions from centralized WWTFs were the result of anaerobic digestion through facultative lagoons. There was no conventional capture technology so emissions were the direct result of the decomposition of organic matter within the lower depths of the pond where anaerobic/anoxic conditions occur. Additional processes that may contribute to emission levels include: industrial/commercial loading and prevalence of primary treatment before discharge into the pond.

Emissions from decentralized septic treatment were the result of anaerobic digestion through the use of baffled holding tanks, emitting primarily CH_4. Emissions from this process are the result of fugitive emissions from either the tank itself (if there is an exhaust vent) and from the surrounding soil, in which the leachate is finally deposited[9].

Agriculture

As shown in Table 8 and Figure 6, the Agriculture Sector in Amador County accounted for 28,317 metric tons CO_2e, or 6%, of the County's 2005 GHG emissions. Land use analysis showed that in comparison to the county as a whole, the

[9] See Appendix F for more information on methods and emissions factors used in the Wastewater Sector analysis.

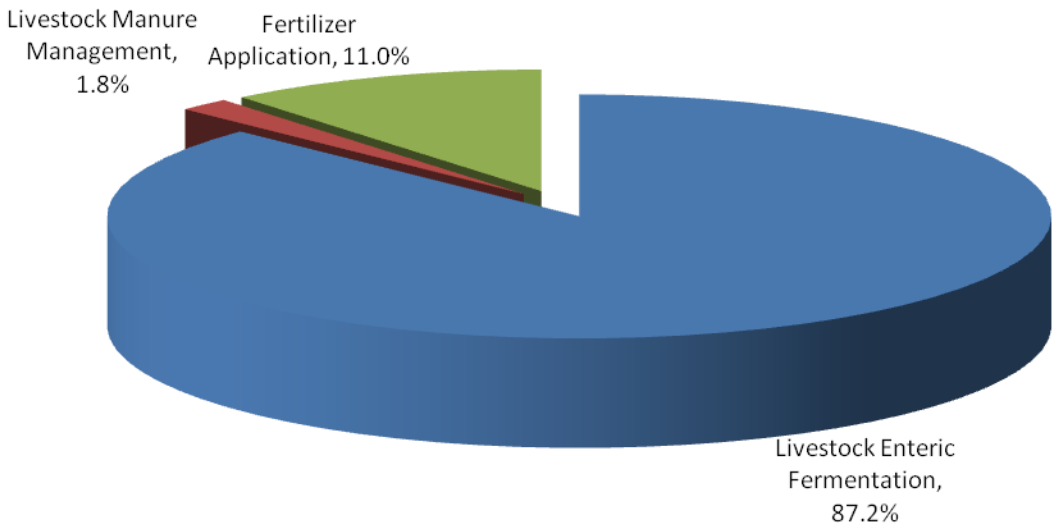
limited agriculture land within the city limits was deemed to be insignificant. As a result, emissions resulting from agricultural activity were assumed to be de minimis in the City Inventories and all emissions were attributed to the County. The Agriculture sector analysis includes three general sources of agricultural process emissions[10]: livestock enteric fermentation, livestock manure management, the application of fertilizer to crops (organic and inorganic).

Table 15: Agriculture by Sub-Sector

Agriculture Process Emissions Sources 2005	Livestock Enteric Fermentation	Livestock Manure Management	Fertilizer Application	TOTAL
CO_2e (metric tons)	24,705	505	3,107	28,317
Percentage of Total CO_2e	87%	2%	11%	100%
MMBtu	24,705	505	3,107	28,317

Table 15 and Figure 11 show that Livestock Enteric Fermentation and Manure Management contributed 89% of Amador County's total agricultural process emissions and Fertilizer Application contributed 11%. The emissions associated with energy consumption and transportation in the agricultural sector were reflected in the industrial and transportation emission totals respectively. The methodology and data sources used to quantify emissions from the agricultural sector are described in Appendix G.

Figure 11: Agricultural Emissions by Process



10 Process emissions are defined by the LGO Protocol as emissions from physical or chemical processing, other than fuel combustion.

Per Capita Emissions

Per capita emissions can be a useful metric for measuring progress in reducing greenhouse gases and for comparing one community's emissions with neighboring cities and against regional and national averages. That said, due to differences in emission inventory methods, it can be difficult to get a directly comparable per capita emissions number, and one must be cognizant of this margin of error when comparing figures.

As detailed in Table 16, dividing the roll-up number for community GHG emissions from Scopes 1, 2, and 3 in all sectors by population yields a result of 19.7 metric tons of CO_2e per capita. It is important to understand that this number is not the same as the carbon footprint of the average individual living in Amador County (which would include emissions from production of goods purchased from outside the community, emissions resulting from air travel, etc.).

Table 16: Amador County 2005 Greenhouse Gas Emissions per Capita[11]

Estimated 2005 Population	**21,706**
Community GHG Emissions (metric tons CO_2e)	**427,444**
GHG Emissions / Resident (metric tons CO_2e)	**19.7**

Conclusion & Next Steps

This analysis found that Amador County as a whole was responsible for emitting 427,444 metric tons of CO_2e in the base year 2005, with emissions from the Transportation Sector contributing the most to this total. (See summary table in Appendix A for more detail.)

Setting Emissions Reduction Targets

This inventory provides an emissions baseline that can be used to set emissions reduction targets for Amador County's community activities. The greenhouse gas emissions reduction target is a goal to reduce emissions to a certain percentage below base year levels by a chosen planning horizon year. . A target provides an objective toward which to strive and against which to measure progress.

In selecting a target, it is important to strike a balance between scientific necessity, ambition, and what is realistically achievable. Amador County should give itself enough time to implement chosen emissions reduction measures—noting that the farther out the target year is, the more Amador County should pledge to reduce. Amador County should establish linear interim targets for every two- to three-year period. Near-term targets facilitate additional support and accountability, and linear goals help to ensure continued momentum around local climate protection efforts. To monitor

[11] Per capita CO2e emissions were 24.3 tonnes per year for the United States and 13.0 tonnes for California (World Resources Institute: http://www.laedc.org/sclc/documents/Global_AB32Challenge.pdf)

the effectiveness of its programs, Amador County should plan to re-inventory its emissions on a regular basis; many jurisdictions are electing to perform annual inventories. ICLEI recommends conducting an emissions inventory every three to five years.

The Long-Term Goal

Near-term climate work should be guided by the long-term goal of reducing its emissions by 80 percent or more from the 2005 baseline level by the year 2050 (California Global Warming Solutions Act of 2006). By referencing a long-term goal that is in accordance with current scientific understanding, Amador County can demonstrate that it intends to do its part towards addressing greenhouse gas emissions from its community activities.

It is important to keep in mind that it will be next to impossible for local governments to reduce emissions by 80 to 95 percent without the assistance of state and federal policy changes that create new incentives and new sources of funding for emissions reduction projects and programs. However, in the next 15 years, there is much that local governments can do to reduce emissions independently. It is also important that Amador County works to reduce its emissions.

State of California Targets and Guidance

An integral component of the State of California's climate protection approach has been the creation of three core emissions reduction targets at the community level. On June 1, 2005 California Governor Schwarzenegger signed Executive Order S-3-05 establishing climate change emission reductions targets for the State of California. The California targets are an example of near-, mid- and long-term targets:

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

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

Creating an Emissions Reduction Strategy

This inventory identifies the major sources of emissions from Amador County's community activities and, therefore, where policymakers may like to target emission reduction activities. For example, since the Transportation and Commercial / Industrial Sectors were the major source of emissions from Amador County's community activities, it is possible that Amador County could meet near-term and medium-term targets by focusing emission reduction actions on the Transportation and Commercial / Industrial Sectors. The long term (2050) target will likely not be achievable only with major reductions in all sectors. Further, as Amador County promotes economic development to create jobs and

increase commercial and industrial activities we will increase our emissions in an effort to improve the quality of life for our residents. Amador County may look to utility providers to reduce the scope 2 gases by increasing hydroelectric and nuclear energy options.

Please note that, whenever possible, reduction strategies should include cost-saving projects that both reduce costs (such as energy bills) while reducing greenhouse gas emissions. These "low hanging fruit" are important because they frequently represent win-win situations in which there is no downside to implementation. Selecting these projects in the order of largest to smallest benefit ensures that solid, predictable returns can be realized locally. These projects may lower recurring expenditures, save taxpayer dollars, create local jobs, and benefit the community's environment.

Given the results of the inventory, SBC, and PG&E recommend that Amador County focus on the following tasks in order to significantly reduce emissions from its community activities:

- Reducing vehicle miles traveled by increasing public transportation, and developing and encouraging usage of bicycle lanes on local roads
- Improving electricity and natural gas energy efficiency through cost-savings programs from PG&E such as Sierra Business Council's Sierra Nevada Energy Watch
- Participate in Phase III of PG&E's Green Communities Program: Develop a local Climate Action Plan

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

Project Resources

Tools have been created for Amador County to use to assist with future monitoring inventories. These tools are designed to work in conjunction with the IEAP, which is the primary reference document for conducting an emissions inventory. The following tools should be saved as resources and supplemental information to this report:

- The "Master Data Workbook" that contains most or all of the raw data (including emails), data sources, emissions, notes on inclusions and exclusions, and reporting tools;
- The "Data Gathering Instructions" on the types of emissions and data collection methodology for each inventory sector.

Appendices

Appendix A - Detailed Community Greenhouse Gas Emissions in 2005

Sector	Emissions Source	Equiv CO_2 (metric tons)	Equiv CO_2 (%)	Energy (MMBtu)	Data Source
Residential					
	Electricity	22,695	5.3%	345,627	PG&E
	Natural Gas	755	0.2%	14,212	
	Propane	13,309	3.1%	209,443	Estimation based on EPA's GHG Inventory Guidance, and US Census Bureau
	Fuel Oil / Kerosene	171	0.0%	2,301	
	Wood	758	0.2%	95,429	
Subtotal Residential		37,688	8.8%	667,012	
Commercial / Industrial					
	Electricity	27,843	6.5%	365,465	PG&E
	Natural Gas	34,490	8.1%	648,837	
	Diesel	764	0.2%	10,284	Amador Air District
	Propane	0	0.0%	1	
Subtotal Commercial		63,097	14.8%	1,024,587	
Transportation					
Local Roads AVMT			0.0%		Caltrans/CARB
	Gasoline	44,477	10.4%	618244	
	Diesel	7,778	1.8%	105083	
State Highways AVMT					
	Gasoline	161,116	37.7%	2239537	
	Diesel	28,174	6.6%	380654	
Motorcycles AVMT					
	Gasoline, Diesel	187	0.0%	Unavailable	
Off Road AVMT					CARB
	Combined	26,453	6.2%	Unavailable	
Subtotal Transportation		268,185	62.7%	3,343,518	
Solid Waste and Wastewater					
Wastewater Treatment					
	River Pines WWTP	4	0.0%	N/A	Amador County Department of Environmental Health Mule Creek State Prison River Pines PUD Dave Loftis, Amador Water Agency US Census Bureau, http://www.census.gov/
	Lake Camanche WWTF	193	0.0%	N/A	
	Septic Systems	4,283	1.0%	N/A	
Total Waste Disposed (w/o ADC)			0.0%		
	Paper Products	4,420	1.0%	N/A	CalRecycle
	Food Waste	1,733	0.4%	N/A	
	Plant Debris	465	0.1%	N/A	
	Wood/Textiles	1,298	0.3%	N/A	
Landfill			0.0%		

	Buena Vista Partial Methane Capture Landfill	16,350	3.8%	N/A	Jim McHargue (209) 223-6375 Waste Management
	Historical Dumps	1,407	0.3%	N/A	CalRecycle data
Subtotal Waste		30,153	7.1%	N/A	
Agriculture					
	Livestock Enteric Fermentation	24,705	5.8%	N/A	Department of Agriculture
	Livestock Manure Management	505	0.1%	N/A	
	Fertilizer Application	3,107	0.7%	N/A	
Subtotal Agriculture		28,318	6.6%	N/A	
Grand Total		398,535	100.0%		

Appendix B - Residential Sector Notes

Table B-1 Data Inputs:

Electricity Consumption PG&E	kWh	101,077,368
Natural Gas Consumption PG&E	Therms	142,118
Liquid Propane Gas Consumption	BTUs	203,684,414,341
Fuel Oil / Kerosene Consumption	BTUs	2,301,033,097
Wood for Home Heating Consumption	BTUs	95,429,042,268

Table B-2 Data Sources:

Electricity	kWH	Pacific Gas & Electric
Natural Gas	Therms	Pacific Gas & Electric
Liquid Propane Gas, Fuel Oil/Kerosene	Heating Degree Days	http://www.ncdc.noaa.gov/oa/documentlibrary/hcs/hcs.html
	Home Heating Estimates:	ACS B25040 Report, Home Heating Fuel, ACS 2005-2009 5-Year Estimates
	Space Heating and Water Heating Factors	Green House Gas Inventory Guidance, USEPA, Municipal Clean Energy Program, State and Local Branch http://climateprotection.org/pdf/Appendix-F-USEPA-Draft-Regional-Inventory-Guidance-1-20-09.pdf
Wood for Home Heating	Heating Degree Days	http://www.ncdc.noaa.gov/oa/documentlibrary/hcs/hcs.html
	Home Heating Estimates:	ACS B25040 Report, Home Heating Fuel, ACS 2005-2009 5-Year Estimates
	Space Heating Factors	Green House Gas Inventory Guidance, US EPA, Municipal Clean Energy Program, State and Local Branch http://climateprotection.org/pdf/Appendix-F-USEPA-Draft-Regional-Inventory-Guidance-1-20-09.pdf

Methods:

Utility Derived Data

Electricity and natural gas consumption data was collected from Pacific Gas & Electric Company (PG&E) for all facilities within the unincorporated Amador County. The data provided was broken out by residential, commercial and industrial use where possible. The residential electricity and natural gas data was entered into the Clean Air and Climate Protection software where the greenhouse gas emissions were calculated using PG&E's reported grid emissions factors for electricity and default combustion emissions factors for natural gas.

Non-Utility Derived Data

Liquid propane gas, fuel oil / kerosene and wood for home heating estimations were determined using three sources of data: heating degree days, home heating fuel type estimates and space heating and water heating factors. First, the heating degree days were determined for Amador County using the reported numbers by NOAA for the San Joaquin drainage. Then, the number of homes within unincorporated Amador County using liquid propane gas, fuel oil / kerosene or wood for home heating was determined by reviewing the 2005 – 2009 American Community Survey 5-Year

Estimate for Housing by Home Heating Source. Next, the space heating and water heating factors were determined by reviewing the US EPA Greenhouse Gas Inventory Guidance. Once collected, the annual space heating totals in BTUs for liquid propane gas, fuel oil / kerosene and wood were calculated by multiplying the total 2005 heating degree days by the number households in unincorporated Amador County using propane, fuel oil and wood for space heating by the respective EPA space heating factor. Please see factors and calculations in Table B-3. It was assumed that a home employing propane or kerosene for space heating uses the same fuel for water heating. Therefore the annual water heating totals in BTUs for liquid propane gas and fuel oil / kerosene were calculated by multiplying the number of households in unincorporated Amador County using propane or fuel oil by the respective EPA water heating factor. It was also assumed that a household employing wood for space heating employs electricity, rather than wood, for water heating.

Table B-3 Home Heating Calculations

Fuel Type	**Propane**	**Fuel Oil / Kerosene**	**Wood**
Total 2005 Heating Degree Days	2,841.00	2,841.00	2,841.00
# Homes Using Other Fuels for Space Heating	4,278.00	6.00	38.00
Space Heating Factor (BTU/HDD/Household)	11,647.00	11,647.00	11,647.00
Water Heating Factor (BTU/YR/Household)	15,869,024.00	15,869,024.00	N/A
Annual space heating subtotal = *(factor x HDD x # of households)*	141,555,285,306.00	1,555,188,969.00	95,429,042,268.00
Annual water heating subtotal = *(factor X # of households)*	67,887,684,672.00	745,844,128.00	N/A
Total BTU	**209,442,969,978.00**	**2,301,033,097**	**95,429,042,268.00**

Appendix C - Commercial / Industrial Sector Notes

Table C-1 Data Inputs:

Commercial	Electricity Consumption	kWh	88,413,868
	Natural Gas Consumption	Therms	6,488,371
Industrial	Electricity Consumption	kWh	Fails 1515 Rule: Included in Commercial Total
	Natural Gas Consumption	Therms	Fails 1515 Rule: Included in Commercial Total
Direct Access	Electricity Direct Access Residential	kWh	191,278
	Electricity Direct Access Commercial	kWh	18,667,418
Power Generation	Diesel Consumption	Gallons	74,525
	Propane Consumption	Gallons	12

Table C-2 Data Sources:

Electricity	kWH	Pacific Gas & Electric
Natural Gas	Therms	Pacific Gas & Electric
Direct Access	kWh	California Energy Commission
Power Generation	Diesel and Propane Consumption	Amador Air Pollution Control District

Methods:

Utility Derived Data

Electricity and natural gas consumption data was collected from PG&E for all facilities within the unincorporated Amador County. The data provided was broken out by residential, commercial and industrial use where possible. The commercial / industrial electricity and natural gas data was entered into the Clean Air and Climate Protection software where the Green House Gas emissions were calculated using PG&E's reported grid emissions factor for electricity and default combustion emissions factor for natural gas. Due to the limited number of industrial facilities in Amador County, PG&E was not able to release industrial electricity and natural gas data split out from the commercial data. Therefore, all industrial electricity and natural gas usage is contained within the commercial electricity and natural gas totals.

Direct Access Data

Direct access is energy supplied by a competitive energy service provider other than the utility, but uses a utility's transmission lines to distribute the energy. All direct access data was provided by the California Energy Commission and used in the direct access calculator (see below). The total direct access electricity consumption for Amador County was used to determine the percent of direct access for residential and commercial / industrial that was used in the calculation of the direct access electricity consumed within unincorporated Amador County. The calculated direct access totals for unincorporated Amador County were entered into the Clean Air and Climate Protection software where the Green House Gas emissions were calculated using the California Grid Average emissions factor.

Table C-3 Direct Access Electricity Calculations

Electricity Consumption (Million kWh)							
County	Sector	Year	Utility		Direct Access		Total
			Million kWh	%	Million kWh	%	
Amador County	Residential	2005	139.176	49.18%	0.263	0.86%	139
Amador County	Commercial / Industrial	2005	143.800	50.82%	30.361	99.14%	174
Total (MWh)			283		31		314
Total %			90.23%		9.77%		100.00%

Sector	PG&E Total kWh	% DA Usage	DA kWh
Residential	101,077,368	0.19%	191,278
Commercial / Industrial	88,413,868	21.11%	18,667,418

Calculations to Estimate Proportion	
0.19%	99.81%
17.43%	82.57%

Power Generation Data

Power generation data was collected from the Amador Air Pollution Control District. The fuel usage in gallons was received for all stationary engines under permit in 2005. This was entered into the Clean Air and Climate Protection software to calculate the green house gas emissions. The default combustion emissions for diesel and propane were used.

Appendix D - Transportation Sector Notes

Table D-1 Data Inputs:

Transportation	**Local Roads (VMT)**	Annual VMT ([%] Gasoline [%] Diesel) By Vehicle Type	77,423,800 Annual VMT 92.85% Gasoline 41.64% - Passenger Car 48.08% - Light Truck/SUV/Pickup 3.13% Heavy Truck 6.29% Diesel 0.21% Passenger Car 0.03% - Light Truck/SUV/Pickup 6.05% - Heavy Truck
	State Highway (VMT)	Annual VMT ([%] Gasoline [%] Diesel) By Vehicle Type	280,461,301 Annual VMT 92.85% Gasoline 41.64% - Passenger Car 48.08% - Light Truck/SUV/Pickup 3.13% Heavy Truck 6.29% Diesel 0.21% Passenger Car 0.03% - Light Truck/SUV/Pickup 6.05% - Heavy Truck
	Off-road Vehicles	Diesel (gallons) Gasoline (gallons)	1,850,528 Diesel Gallons 1,148,053 Gasoline Gallons 38,815 CNG Gallons

Data Sources:

On-Road Emissions –

Caltrans, 2006. 2005 California Public Road Data. Division of Transportation System Information.

Available at: http://www.dot.ca.gov/hq/tsip/hpms/hpmslibrary/hpmspdf/2005PRD.pdf.

California Air Resources Board, 2011. EMFAC2011.

Available at: http://www.arb.ca.gov/msei/modeling.htm

Off-Road Emissions –

California Air Resources Board, 2007. OFFROAD2007.

Available at: http://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles.

Railyard Miles Data Source – US Department of Transportation GIS Data

Amador County Transportation Commission Contact: Charles Field, Executive Director, Charles@actc-amador.org, 209-267-2282

Methods:

On-Road Emissions

Since actual fuel consumption data is not available at a jurisdiction level, on road emissions for local roads and state highways are estimated using vehicle-miles traveled (VMT) estimates coupled with vehicle type and fuel breakdown. The methodology for collecting and conditioning this data is as follows:

Local Roads VMT

Annual VMT on Local Roads are recorded by Caltrans' Highway Performance Monitoring System, which estimates VMT on local roads within various jurisdictions. Local roads annual VMT for unincorporated county communities was taken from Caltrans 2005 California Public Road Data, and is shown in Table D-1.

Clean Air Climate Protection software identifies motorcycle emissions as an off-road emissions source. County-wide motorcycle CO2 emissions are produced in the California ARB's EMFAC2011 model. To produce motorcycle CO_2 emissions specific to the unincorporated county, EMFAC2011 motorcycle emissions were disaggregated by applying the population ratio of 57.78% (ratio of unincorporated county population to county-wide population). EMFAC2011 produces daily emissions outputs, which need to be multiplied by 365 in order to produce annual estimates.

Table D-2: State Highway VMT, Jurisdiction share of recorded highway miles

	Jurisdiction	Total Highway Miles	US Hwy	State Hwy	Proportion
Amador Co		126.95		126.95	100.00%
	Amador City	0.71		0.71	0.56%
	Ione	4.01		4.01	3.16%
	Jackson	4.21		4.21	3.32%
	Plymouth	1.30		1.30	1.02%
	Sutter Creek	2.30		2.30	1.81%
	Unincorporated Co	114.43		114.43	90.14%

Table D-3: Unincorporated County share of highway VMT

Amador County Highway VMT	Unincorporated County Share of Hwy Miles	Unincorporated County VMT
311,151,550	**90.14%**	**280,461,301**

State Highway VMT attributed to the unincorporated county is based on the amount of recorded highway miles within the jurisdiction, taken from Caltrans 2005 California Public Road Data. In order to estimate the State Highway VMT within the unincorporated county, the proportion of 90.14% was multiplied by the total county-wide State Highway VMT recorded by Caltrans (311,151,550) to result in State Highway VMT value shown in Table D-1.

Fuel/Vehicle Type Breakdown and Emissions Calculations

Since Caltrans does not provide VMT by fuel and vehicle type, fuel and vehicle type breakdown was extracted from California ARB's EMFAC2011 model, which provides this information by air basin. The EMFAC2011 model was run for example year 2005; daily VMT from this model was summed and proportioned by fuel and vehicle classification

(Passenger Car, Light-Duty Truck/SUV/Pickup, Heavy-Duty Truck, and Motorcycles). These percentages were applied to the jurisdiction-specific annual VMT figures produced from the Caltrans report, resulting in final VMT figures by fuel and vehicle type. EMFAC2011 data was not used alone because this dataset was aggregated by air basin. Methods to disaggregate the EMFAC2011 data by city and county jurisdiction could not appropriately be developed so the above method was performed to produce VMT for each jurisdiction. This data was input into ICLEI's Clean Air and Climate Protection software which applies the appropriate emissions factors to produce the final CO_2e emissions quantity.

Off-Road Emissions

Off-road emissions were estimated with standard procedures using California ARB's OFFROAD2007 modeling program. OFFROAD2007 produces emissions for various off-road, fuel-consuming machines at the county level. In order to produce disaggregated emissions data, it is necessary to only consider machines types that are operated within the unincorporated county. For the unincorporated county communities, agricultural equipment, construction & mining equipment, entertainment equipment, industrial equipment, lawn and gardening equipment, light commercial equipment, pleasure crafts, railyard operations, recreational vehicles and transport refrigeration units were considered. The unincorporated county assumes 100% emissions from agricultural equipment, construction & mining equipment, pleasure crafts, and recreational equipment because they do not play a role in the incorporated cities. This information was collected in an initial questionnaire distributed to Amador County staff. After identifying the applicable machine classifications, the data was proportioned by population to represent the unincorporated county's share of the emissions compared to the entire county. Further mapping analysis was conducted using GIS to proportion the amount of railways within each jurisdiction to appropriately disaggregate railyard emissions. This map is available in the Off-Road Fuels Working Data tab in the Master Data Workbook for this inventory. The data produced by OFFROAD2007 is daily usage – the final data was multiplied by 365 in order to produce annual emissions. The final data that was entered into CACP was annual emissions of CO_2, CH_4, and N_2O, in tons. Table D-4 shows the proportions applied to each off-road machine category.

Table D-4: Off-Road Proportions by Category

Off Road Machine Type Category	Proportion Applied to OFFROAD 2007 County-Wide Output
Agricultural Equipment	100.00%
Construction & Mining Equipment	100.00%
Entertainment Equipment	57.78%
Industrial Equipment	57.78%
Lawn & Gardening Equipment	57.78%
Light Commercial Equipment	57.78%
Pleasure Craft	100.00%
Railyard Operations	91.54%
Recreational Equipment	100.00%
Transport Refrigeration Units	57.78%

Appendix E - Solid Waste

Table E-1: Data Inputs

Waste –Buena Vista Landfill	Total 2005 Landfill Gas Collected	million standard cubic feet	99
	Surface covered by Landfill Gas Collection System	square feet	696,960
	Surface not covered by Landfill Gas Collection System	square feet	566,280
	Percentage of Methane in Collected LFG	0.50 default	32%
	Destruction Efficiency of Methane	0.99 default	99%
	Landfill Gas Collection Efficiency	0.75 default	75%
	Methane Soil Oxidation Factor	0.10 default	10%
Waste – Historic Dumps	Year opened / closed		1920 /1974
	Landfill Waste	short tons	214,122
	Rainfall	inches/yr	37
	Associated k value		0.038
Waste Deposited	2005-Generated Solid Waste	short tons/yr	43,398

Data Sources:

Waste Deposited: Cal Recycle:
http://www.calrecycle.ca.gov/LGCentral/Reports/ReportViewer.aspx?ReportName=eDRSCountyWideOrigin&CountyID=3&ReportYear=2005

Historic Dumps: Waste Deposited and US Census data for population (http://www.census.gov/)

Buena Vista Landfill information from Waste Management

Methods - Solid Waste in Landfills and Dumps within Jurisdictional Boundaries:

There are a variety of emissions associated with solid waste management services including collection, processing, and storage of solid waste generated from residents and businesses. Collection emissions are included in the transportation sector of this report. The most prominent source of emissions from solid waste facilities is fugitive methane released by the *anaerobic* decomposition of organic waste over time in dumps and landfills. The scale of these emissions depends upon the size and type of the facility and the presence of a landfill gas collection system. Our analyses do not account for the biogenic production of CO_2 during *aerobic* processes, including the burning of methane.

The Buena Vista Landfill is located in Amador County and received waste into 2004. The facility has a partial methane-capture system. Waste Management provided information about the landfill gas and the landfill areas. Standard default values were used for the collection efficiency, soil oxidation factor and destruction efficiency (see Data Inputs above). Standard equations found in the "Local Government Operations Protocol", Ver. 1.1, were used to determine Scope 1 methane emissions.

Historic dumps sites also produce methane emissions. Assumptions regarding associated emissions include:

- Solid waste generated is proportional to population (using US Census Bureau population data).
- From 1920-1970's, 25% of waste was burned and 75% went to local dumps sites.
- 20% of historic dump sites were burn dumps (CA Dept of Toxic Substance Control/ Cal Recycle)
- Dumps generate 60% of emissions of landfills. (IPCC/ICLEI)

These assumptions were used to create the input values necessary for the California Air Resources Board's first-order-decay model, which was used to calculate 2005 methane emissions from dumps across the county between 1920 and 1974.

Methods – 2005-Generated Solid Waste:

Solid waste generated within the county in 2005 was transferred to remote landfills for disposal. The emissions associated with this waste are defined as Scope 3. They occur at the landfill sites over the entire period of decomposition (estimated to be about 100 years). Scope 3 emissions were calculated using standard emission factors and equations.

Information on the waste collected from unincorporated Amador County was taken from the Cal Recycle website after data from a local waste hauler was deemed too low. Perhaps it did not include self-haul data or perhaps Amador County generates relatively small quantities of refuse due to the low population.. The data was in the form of short tons/yr. Waste characterization values were provided by the California Integrated Waste Management Board (CIWMB) specifically tailored to 2005.

Table E-2: Waste Composition

Paper Products	Food Waste	Plant Debris	Wood/Textile	All Other Waste
21.00%	14.55%	6.89%	21.79%	35.77%

Appendix F – Wastewater Sector Notes

Table F-1: Data Inputs

Wastewater	**Centralized**	Ave Total Nitrogen Discharged	kg N / day	N/A
		Total Population Served	People	441
	Anaerobic Digester	Total Population Served	People	N/A
	Lagoon	Total Population Served	People	583
	Septic	Total Population Served	People	20682
Census Bureau		Average Household Size	People	2.398

Data Sources:

Amador County Department of Environmental Health

Mule Creek State Prison

River Pines PUD

Dave Loftis, Amador Water Agency

US Census Bureau, http://www.census.gov/

Methods:

Within any community based green house gas inventory wastewater treatment will only account for a small portion of total emissions. Wastewater can be treated using either: centralized plants (with or without anaerobic digestion), lagoons, or septic systems. The two emissions associated with these processes are methane (CH_4) and Nitrous Oxide (N_2O); calculating the makeup and amount of emissions depends on the processes involved and the management practices employed. Amador County's population uses all of these methods to treat their wastewater.

Within Amador County there is only one centralized wastewater treatment plant (WWTP), under the jurisdiction of River Pines PUD (RP-PUD). The RP-PUD WWTP, a centralized system, uses aerobic processes to degrade the organic content of their influent. The system also utilizes two processes, nitrification and denitrification, in order to reduce N_2O levels. There are no additional industrial or commercial sources which would contribute to the organic loading of the influent. The plant does not employ an anaerobic digester, choosing rather to haul the collected sludge away to a landfill. Using data on population served, emissions were calculated with standard equations. In addition to the centralized WWTP there is one lagoon facility serving residents of Lake Camanche. The treatment of wastewater at this facility occurs within facultative ponds, degrading the biological material through anaerobic processes and producing CH_4. As in the centralized plant, there are no additional industrial or commercial sources. Using data on population served, emissions were calculated with standard equations. Residents not on a centralized or lagoon system are by default on septic. These systems are able to serve either multiple or individual households. Septic treatment involves anaerobic processes to degrade organic matter, emitting primarily CH_4. By subtracting the population served on centralized and

lagoon treatment from the total unincorporated population of the county, an approximation of the population served by septic was made and CH_4 emissions were calculated with standard equations.

Appendix G – Agriculture Sector Notes

Table G-1: Data Inputs

Agriculture	**Livestock Enteric Fermentation**	Cattle and Calves (headcount)	16,000
		Hogs and Pigs (headcount)	300
		Sheep and Lambs (headcount)	1,500
		Goats (headcount)	800
	Manure Management	Cattle and Calves (headcount)	16,000
		Hogs and Pigs (headcount)	300
		Sheep and Lambs (headcount)	1,500
		Goats (headcount)	800
	Fertilizer Application (Direct and Indirect Emissions)	Grapes Crop Area (acres)	3,874
		Walnuts Crop Area (acres)	391
		Fruits and Nut Misc* Crop Area (acres)	23.25
		Hay, Alfalfa Crop Area (acres)	467
		Hay, Grain Crop Area (acres)	1,037
		Hay, Other Area (acres)	164
		Irrigated Pasture Crop Area (acres)	1,545
		Misc Field Crops** Crop Area (acres)	82

***Includes Tomatoes, Olives, Cucumbers, Apples and Pears**
****Includes Sudan Grass, Corn, Pumpkins and Wheat**

Data Sources:

Amador County Crop Report 2005:

http://www.co.amador.ca.us/index.aspx?page=632

Methods:

Data on livestock headcounts and crop acreage were collected from the 2005 Amador County Crop Report. It was determined that agricultural land within city limits was insignificant, therefore all crop and livestock emissions were attributed to the County.

Livestock Enteric Fermentation and Manure Management Emissions

Livestock enteric fermentation and manure management emissions were calculated by multiplying the number of heads of each livestock group by the specific livestock emission factors. Livestock enteric fermentation and manure

management emission factors were taken from the California Air Resources Board Green House Gas Inventory Methodology. It was assumed that all livestock were raised on pasture and all cattle herds existed in a ratio of 25 Cows : 25 Calves : 1 Bull.

Table G-2: Livestock Emission Factors

Livestock Emission Factors			
Livestock Name	**Enteric Fermentation Coefficient CH4 (Kg per year per head)**	**Manure Management Coefficient CH4 (Kg per year per head)**	**Manure Management Coefficient N2O (Kg per year per head)**
Cattle and Calves	72.5	1.4	0
Steers	44.55	1.56	0
Heifers	46.06	2.07	0
Swine	1.5	0.6	0
Dairy Cows	119.24	3.37	0
Sheep and Lambs	8	0.78	0
Goats	5	0.375	0

Source: California Air Resources Board: Documentation of California's 2000-2008 GHG Inventory - http://www.arb.ca.gov/cc/inventory/doc/doc_index.php

Fertilizer Application (Direct and Indirect Emissions)

Due to limited availability of data on site-specific fertilizer application in Amador County it was assumed that an average of 140 lbs per acre per year of fertilizer was applied for all crops and improved pasture. This was determined by reviewing the Sacramento County Green House Gas Inventory Report and Appendices. The same average was used in the Sacramento County Green House Gas Inventory. Direct and indirect fertilizer application emissions were calculated by multiplying the acres of cropland by 140 lbs per acre, converting to tons and then multiplying by the direct and indirect N20 emission factors respectively. Direct and indirect fertilizer application emissions were taken from the California Air Resources Board Green House Gas Inventory Methodology.

Table G-2: Fertilizer Use Emission Factors

Fertilizer Use Emission Factors			
Fertilizer Use	**Average lbs per acre***	**Direct N20 Emission Coefficient (Kg per ton)****	**Indirect N20 Emission Coefficient (Kg per ton)****
Synthetic	140	14.25	4.63
Organic	140	14.25	6.06

*Average used in Sacramento County GHG Inventory: http://www.dera.saccounty.net/Portals/0/docs/Final_SACCTY_GHG_June09_stacked_small.pdf
**Source: California Air Resources Board: Documentation of California's 2000-2008 GHG Inventory - http://www.arb.ca.gov/cc/inventory/doc/doc_index.php