# STANISLAUS COUNTYWIDE REGIONAL COMMUNITY GREENHOUSE GAS INVENTORY

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Stanislaus County

City of Modesto

City of Hughson

City of Ceres

City of Newman

City of Oakdale

City of Patterson

City of Riverbank

City of Turlock

City of Waterford

# Contents

# Tables

# Figures

**Page**

# Acronyms and Abbreviations

| | |
|---|---|
| AB | Assembly Bill |
| AR4 | IPCC Fourth Assessment Report |
| | |
| CAA | Clean Air Act |
| CAFE | Corporate Average Fuel Economy |
| Cal/EPA | California Environmental Protection Agency |
| CAP | Climate Action Plan |
| CARB | California Air Resources Board |
| CCA | Community Choice Aggregation |
| CEC | California Energy Commission |
| CEQA | California Environmental Quality Act |
| CFCs | chlorofluorocarbons |
| $CH_4$ | methane |
| $CO_2$ | carbon dioxide |
| CPUC | California Public Utilities Commission |
| | |
| EO | Executive Order |
| EPA | U.S. Environmental Protection Agency |
| ESPs | energy service providers |
| | |
| FED | Functional Equivalent Document |
| | |
| GHG | greenhouse gas |
| GWP | global warming potential |
| | |
| HCFCs | hydrochlorofluorocarbons |
| HFCs | hydrofluorocarbons |
| | |
| IOUs | investor-owned utilities |
| IPCC | Intergovernmental Panel on Climate Change |
| | |
| LAFCO | Local Agency Formation Commission |
| LCFS | Low Carbon Fuel Standard |
| LGOP | Local Government Operations Protocol |
| | |
| MCAP | municipal climate action plan |
| MID | Modesto Irrigation District |
| mph | miles per hour |
| MPOs | metropolitan planning organizations |

| | |
|---|---|
| MSR | Municipal Service Review |
| MT $CO_2e$ | metric ton carbon dioxide equivalent |
| MW | megawatt |
| | |
| $N_2O$ | nitrous oxide |
| NGOs | non-governmental organizations |
| NSPS | New Source Performance Standards |
| | |
| $O_3$ | ozone |
| | |
| PFCs | perfluorocarbons |
| PG&E | Pacific Gas and Electric |
| PUR | Pesticide Use Report |
| | |
| RPS | Renewable Portfolio Standard |
| RST | Regional Sustainability Toolbox |
| RTAC | Regional Targets Advisory Committee |
| RTPs | Regional Transportation Plans |
| | |
| SAR | Second Assessment Report |
| SB | Senate Bill |
| SCAG | Southern California Association of Governments |
| SCRSWPA | Stanislaus County Regional Solid Waste Planning Agency |
| $SF_6$ | sulfur hexafluoride |
| SGC | State of California Strategic Growth Council |
| SJVAPCD | San Joaquin Valley Air Pollution Control District |
| SP | service population |
| | |
| TDM | Travel Demand Model |
| TID | Turlock Irrigation District |
| | |
| UNFCCC | United Nations Framework Convention on Climate Change |
| USGS | United States Geological Survey |
| UWMP | Urban Water Management Plan |
| | |
| VMT | vehicle miles traveled |
| | |
| WARM | Waste Reduction Model |
| WMO | World Meteorological Organization |
| WWTPs | wastewater treatment plants |

# Study Purpose

The Stanislaus Regional GHG Inventory Project was completed as part of the *Stanislaus County Regional Sustainability Toolbox (RST)*, a group of initiatives funded through the State of California Strategic Growth Council (SGC). The proposal was submitted collaboratively by Stanislaus County (lead jurisdiction), and the Cities of Ceres, Hughson, Modesto, Newman, Oakdale, Patterson, Riverbank, Turlock and Waterford. The SGC grant contains the following requirements:

- **Consistency with State Planning Priorities—**the goal of the Stanislaus County RST is to provide a locally driven set of tools that are consistent with regional, state, and federal goals and standards. The Stanislaus County RST is intended to fit state, regional and federal sustainability goals, blueprint plans and GHG reduction thresholds into a locally relevant setting.
- **Reduction of Greenhouse Gases—**the intention of the RST is to identify locally specific, measurable actions that allows each jurisdiction to meet or preferably exceed Statewide greenhouse gas (GHG) reduction goals. As such, a central component of the RST is to establish a baseline GHG inventory for the entire county.
- **Collaboration—**the toolkit approach allows planning efforts to be both locally appropriate while also being regionally consistent. The RST is intended to be the implementation tool for several regional planning efforts including: StanCOG's Regional Transportation Plan, the Valley Blueprint, the Sustainable Communities Strategy, and the California Partnership for the San Joaquin Valley. The proposal includes collaboration with the Great Valley Center, California State University Stanislaus, Local Agency Formation Commission (LAFCO), ICLEI–Local Governments for Sustainability, Stanislaus County Health Services Agency and Stanislaus County Asthma Coalition.

This report provides the quantification (in terms of carbon dioxide equivalent [$CO_2e$]) of GHG community emissions for the county as a whole for the year 2005. Using the methodology for the regional inventory, separate GHG community inventories were prepared for each jurisdiction in the county and provided to the individual cities and the unincorporated county for their use.

This study is not a GHG reduction plan does it quantify GHG reductions. This study is a baseline GHG inventory only.

# Regional Emissions by Sector

Total GHG emissions in 2005 from the Stanislaus County Region (combined emissions from the nine incorporated cities and the County), referred to in this report as "the region" were 6,042,232 metric tons of carbon dioxide equivalent (MT $CO_2e$). Additional emissions arise from stationary sources and landfill sites (658,692 MT $CO_2e$). Stationary source emissions, while quantified and disclosed, were not included in the regional total because they are regulated by state and federal mandates. Landfill emissions for 2005, while quantified and disclosed, were not included in the regional total in order to avoid double-counting of waste sector emissions for 2005 as emissions for this sector were quantified based on 2005 waste generation instead. GHG emissions for the region are shown in table ES-1 and Figure ES-1. Table ES-1 and Figure ES-1 represent the region's baseline GHG inventory for the year 2005. The largest sources of GHG emissions in the region are Building Energy (Electricity plus Natural Gas), On-Road Transportation and Agriculture.

**Table ES-1. 2005 GHG Emissions Inventory for the Stanislaus County Region (MT $CO_2$e)**

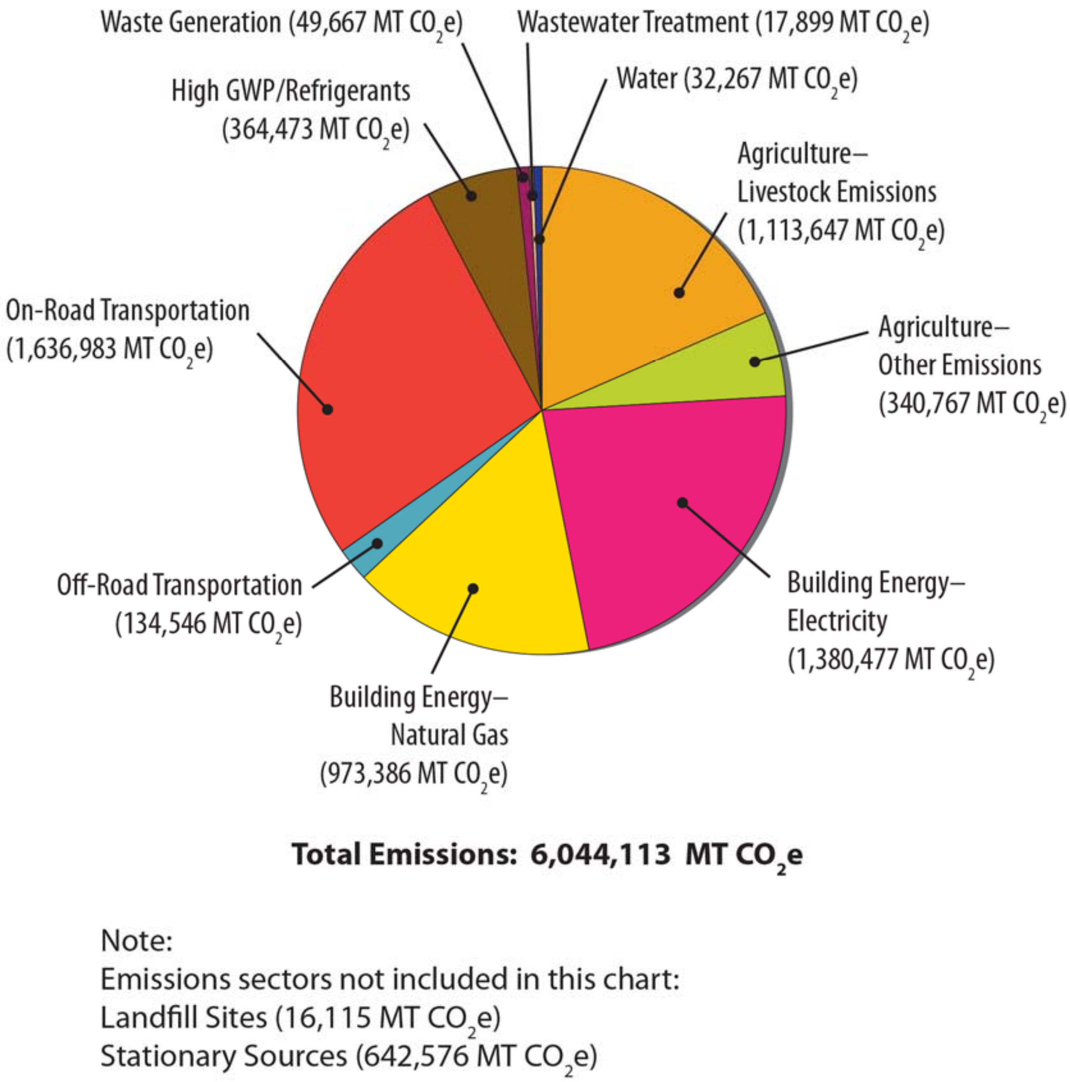
| | Sector | Emissions | Percent |
|---|---|---|---|
| Direct[a] | Agriculture—Livestock Emissions | 1,113,647 | 18% |
| | Agriculture—Other Emissions | 340,767 | 6% |
| | Building Energy—Natural Gas | 973,386 | 16% |
| | Off-Road Transportation | 134,546 | 2% |
| | On-Road Transportation | 1,636,983 | 27% |
| | High GWP/Refrigerants | 364,473 | 6% |
| Indirect[b] | Building Energy—Electricity | 1,380,477 | 23% |
| | Waste Generation | 49,667 | 0.8% |
| | Wastewater Treatment | 17,899 | 0.3% |
| | Water | 32,267 | 0.5% |
| Total | | 6,044,113 | 100% |
| Excluded[c] | Stationary Sources | 642,576 | |
| | Waste Landfill | 16,115 | |

a. Direct emissions are emissions that physically occur within the inventory boundary; see Chapter 1 for detail.

b. Indirect emissions are due to activity that occurs within the inventory boundary although the GHG emission may happen inside or outside the inventory boundary; see Chapter 1 for detail.

c. Stationary source emissions were excluded due to state and federal regulation of these sources. Landfill emissions were excluded to avoid double-counting with waste generation emissions.

**Figure ES-1. 2005 GHG Emissions Inventory for the Stanislaus County Region (MT $CO_2e$)—Sector View**




GHG emissions in the region are the result of daily activities of residents, employees, businesses, farms and industry in the region. A GHG inventory reflects the unique climate, character and economy of a particular region. Population, housing and employment for all participating jurisdictions in 2005 are shown in Table ES-2. The STANCOG Travel Demand Model (TDM) was used to estimate socioeconomic data because it represents a consistent source of data between all jurisdictions and resulted in estimates that are similar to socioeconomic data from other sources. There are differing socioeconomic data estimates from different sources, but the TDM results are close to these other estimates. The socioeconomic data in Table ES-2 represent the households, population, and jobs within each jurisdiction's geographical boundaries. Sphere of influence boundaries were not taken into consideration for the socioeconomic data estimates.

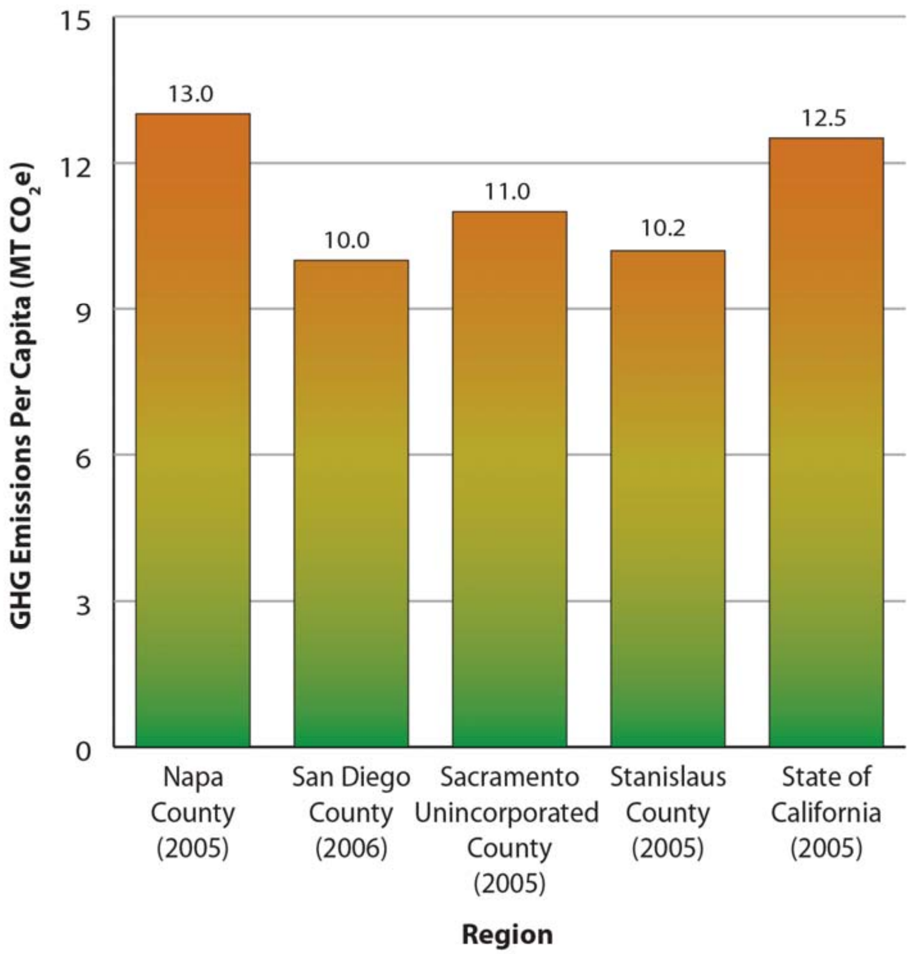
**Table ES-2. Socioeconomic Data For All Participating Jurisdictions in 2005**

| Jurisdiction | Households | Population | Employment |
|---|---|---|---|
| Ceres | 12,639 | 40,722 | 8,402 |
| Hughson | 1,915 | 6,091 | 749 |
| Modesto | 73,489 | 206,962 | 78,310 |
| Newman | 3,091 | 10,083 | 1,056 |
| Oakdale | 7,496 | 20,299 | 6,005 |
| Patterson | 5,414 | 19,167 | 2,273 |
| Riverbank | 6,477 | 21,417 | 3,452 |
| Turlock | 23,074 | 67,510 | 23,738 |
| Waterford | 2,447 | 8,169 | 476 |
| Unincorporated County | 36,730 | 113,740 | 47,521 |
| Total Stanislaus County | 172,772 | 514,160 | 171,982 |
| Source: StanCOG 2005 as reported by Fehr & Peers 2012 | | | |

The jurisdictions in the region are connected economically, logistically and socially. Thus examining GHG emissions for the region as a whole, as this document does, is advantageous. For certain aspects of GHG reduction planning, individual jurisdictions might opt to pursue programs or policies unique to their community, but for others, several communities or all communities may opt to pursue programs and policies together.

Figure ES-2 shows per capita emissions for the Stanislaus region compared to the state average in 2005 and several other jurisdictions. In general, per capita emissions in the Stanislaus region were very similar to the rest of California in 2005. Emissions trends specific to each sector are discussed in Chapters 2.

**Figure ES-2. Per Capita Emissions (Excluding Agriculture) Compared to Other Jurisdictions**




Per capita emissions in the figure above were determined using the total of emissions from sectors that were common to all of the inventories listed and that used a similar methodology such that the per capita value is roughly an "apples to apples" comparison.

Emissions from agriculture, land use change, and other select sectors were excluded if they were not relevant to all jurisdictions (e.g. agriculture) or are not routinely included in local inventories (e.g. land use change).

In general, per capita emissions in Stanislaus County in 2005 were very similar to other parts of the state of California.

# Chapter 1
# **Background**

The Stanislaus County Regional Greenhouse Gas Inventory Project completed a baseline greenhouse gas (GHG) inventory for the entire county for the year 2005.[1] A GHG inventory is commonly completed by an entity seeking to better understand the sources, magnitude, and trends in GHG emissions. Common entities include nations, states, local governments, public organizations such as universities or a joint powers authority, or a private corporation or facility (e.g., a single oil refinery). A GHG inventory may serve the purposes of regulatory compliance, basic research, purchase or sale of GHG credits on the voluntary market, or as a baseline for measuring the achievements of voluntary or required sustainability practices.

Standard protocols exist for conducting GHG inventories at all scales. Rules and procedures for GHG inventories have been developed by a variety of government and non-government entities including the Intergovernmental Panel on Climate Change or IPCC (a part of the World Meteorological Organization or WMO), the U.S. Environmental Protection Agency (EPA), the California Air Resources Board (CARB), the San Joaquin Valley Air Pollution Control District (SJVAPCD), the World Resources Institute, the California Climate Registry, ICLEI—Local Governments for Sustainability, the Association of Environmental Professionals and others.

Prior to 2006 when the state of California passed Assembly Bill (AB) 32, the majority of California cities and counties had not completed a GHG inventory. As such, GHG reduction planning at the local level is closely linked to state level GHG planning that has occurred since 2006. Further, many communities, including those in Stanislaus County, are completing a GHG inventory for the first time and familiarizing themselves with the process.

This section provides definitions of common terms used in the GHG inventory process, a brief history of GHG planning in California, a description of the co-benefits typically associated with GHG planning and an overview of Stanislaus County.

## Greenhouse Gas Definitions

**Greenhouse Gas—**A GHG is any gas that absorbs infrared radiation in the atmosphere. GHGs include, but are not limited to, water vapor, carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), hydrochlorofluorocarbons (HCFCs), ozone ($O_3$), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride ($SF_6$). Of these, all but water vapor and $O_3$ are regulated under AB 32 and accounted for in the state's GHG inventory.

**Community GHG Inventory—**A community inventory includes GHG emissions associated with the activities of the community as a whole, including residents, businesses, and the municipal

[1] GHG community inventories for the individual jurisdictions in the County were also prepared as part of this project. The community inventories were provided separately to the jurisdictions for their use.

government operations.[2] For example, a community GHG inventory includes emissions due to energy used to power and heat homes and businesses; fuel used by vehicles that have either an origin or destination within the jurisdiction; waste that is generated by residents and businesses in the jurisdiction and sent to landfills; fuel use at large stationary sources such as factories or industrial facilities; livestock and fertilizer use; fuel use by off-road equipment; and others.

**Municipal GHG Inventory—**A municipal inventory includes GHG emissions associated with a City or County's services and municipal operations. For example, a municipal GHG Inventory includes emissions due to the following: energy used by City or County buildings such as the courthouse, city hall or the jail; fuel used by the City or County vehicle fleet; waste generated by the City and County employees; process emissions associated with treating wastewater if the City or County operates a plant; fugitive emissions of methane from landfills if the City or County operates a landfill; and fuel use by City and County employees commuting to and from work. The GHG emissions associated with a City or County's municipal operations are typically 1 to 5% of the community's emissions as a whole.

**Unit of Measure—**The unit of measure used throughout this GHG inventory is the metric ton of $CO_2$ equivalent, abbreviated as MT $CO_2e$. This is the international unit that combines the differing impacts of all greenhouse gases into a single unit, by multiplying each emitted gas by its global warming potential (GWP). GWP is the measure of how effective a greenhouse gas is at trapping heat in the earth's atmosphere. GWP compares the relative warming effect of the GHG in question to that of carbon dioxide.[3]

**Boundary—**A GHG inventory represents emissions due to activities associated with a certain boundary. This boundary can be organizational, operational or geographic. These boundaries determine which emissions are accounted for and reported by the entity.

**Direct Emissions—**Direct emissions include direct releases of GHGs that physically occur within the boundary and are related to fuel combustion, process emissions or fugitive emissions. For example, the combustion of fuel by vehicles driving within the boundary, the combustion of natural gas or other fuel by industries or facilities within the boundary or the release of methane from livestock physically located within a jurisdiction.[4]

**Indirect Emissions—** Indirect releases of GHGs. Indirect releases are GHG emissions that result from *activity* that occurs within the boundary but the physical release of the GHG emission occurs outside of the boundary. For example, residents and businesses within the county use electricity by turning on lights or other electronic equipment but the power plant where the electricity is generated, and where fuel is burned to generate the electricity, may be located far away from the county. Electricity use is considered an indirect emission.

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[2] Municipal government emissions are included in the regional community inventory when the emissions occur within the county boundary overall. Sometimes municipal government emissions do not occur within the community boundary.

[3] The GWP of $CO_2$ is, by definition, one (1). The GWP values used in this report are based on the IPCC Second Assessment Report (SAR) and United Nations Framework Convention on Climate Change (UNFCCC) reporting guidelines and are as follows: $CO_2$ = 1, Methane ($CH_4$) = 21, Nitrous Oxide ($N_2O$) = 310, Sulfur Hexaflouride ($SF_6$) = 23,600 (IPCC 1996; UNFCCC 2006). Although the IPCC Fourth Assessment Report (AR4) presents different GWP estimates, the current inventory standard relies on SAR GWPs to comply with reporting standards and consistency with regional and national inventories (Intergovernmental Panel on Climate Change 2007).

[4] Biogenic $CO_2$ emissions are excluded from the inventory as they do not result in net atmospheric increases in $CO_2$.

**Excluded Emission—**In this report, two sources were quantified but not included in the regional totals. Stationary source emissions were excluded due to state and federal regulation and control over these sources. Landfill emissions for 2005 due to historical waste generation were excluded because emissions associated with 2005 waste generation were considered for appropriate to include as a measure of 2005 activity.

**Emissions Sector**—An emissions sector is a category of GHG emissions reflecting the nature of the activity producing the GHG emissions, for example *building energy* or *on-road transportation*. GHG emissions sectors included in this inventory are: agriculture, building energy, off-road transportation, on-road transportation, high global warming potential gases (refrigerants), waste landfills, waste generation, wastewater treatment, water consumption and stationary sources.

**Emission Factor—**An emission factor is a unique value equating the amount of GHGs emitted per unit of a given activity, for example metric tons of $CO_2$ per gallon of gasoline burned.

**Baseline Year—**The baseline year for any entity is the first year for which emissions are inventoried and reported. For this inventory, the baseline year is 2005.

**Climate Action Plan (CAP)/Greenhouse Gas Reduction Plan**—"Climate Action Plan" is a term commonly used in California for a planning document designed to reduce an entity's GHG emissions over a period of time. Some communities use different terms such as a "Greenhouse Gas Reduction Plan." The specific components of a GHG reduction plan are not required by law or articulated in California GHG legislation. However, air districts and other agencies such as ICLEI have produced guidance for what should be included in a GHG reduction plan. In addition, CEQA guidelines adopted in 2010 describe elements required in GHG reduction plans if a jurisdiction intends to tier CEQA project compliance off a jurisdictional reduction plan. GHG reduction plans typically include: a baseline GHG inventory, a projection of GHG emissions to 2020 (or other future years), a GHG reduction target for 2020 (or other future years), GHG reduction strategies that together achieve the target, implementation actions, monitoring requirements, and adaptive steps to be taken to ensure the jurisdiction meets its identified target.

# Greenhouse Gas Emissions and Planning in the United States and California

## National and State Level Inventories

EPA completes a GHG inventory each year for the United States. GHG inventory data is available for every year beginning in 1990. The state of California also completes an annual GHG inventory and data is available beginning in 2000. The national and state of California GHG inventories for the year 2005 are shown below in Figure 1-1 and Table 1-1 in units of million MT CO2e. Please note that the California Energy Commission (CEC) and the EPA present inventory data slightly differently.

**Figure 1-1. United States and California GHG Inventories in 2005**

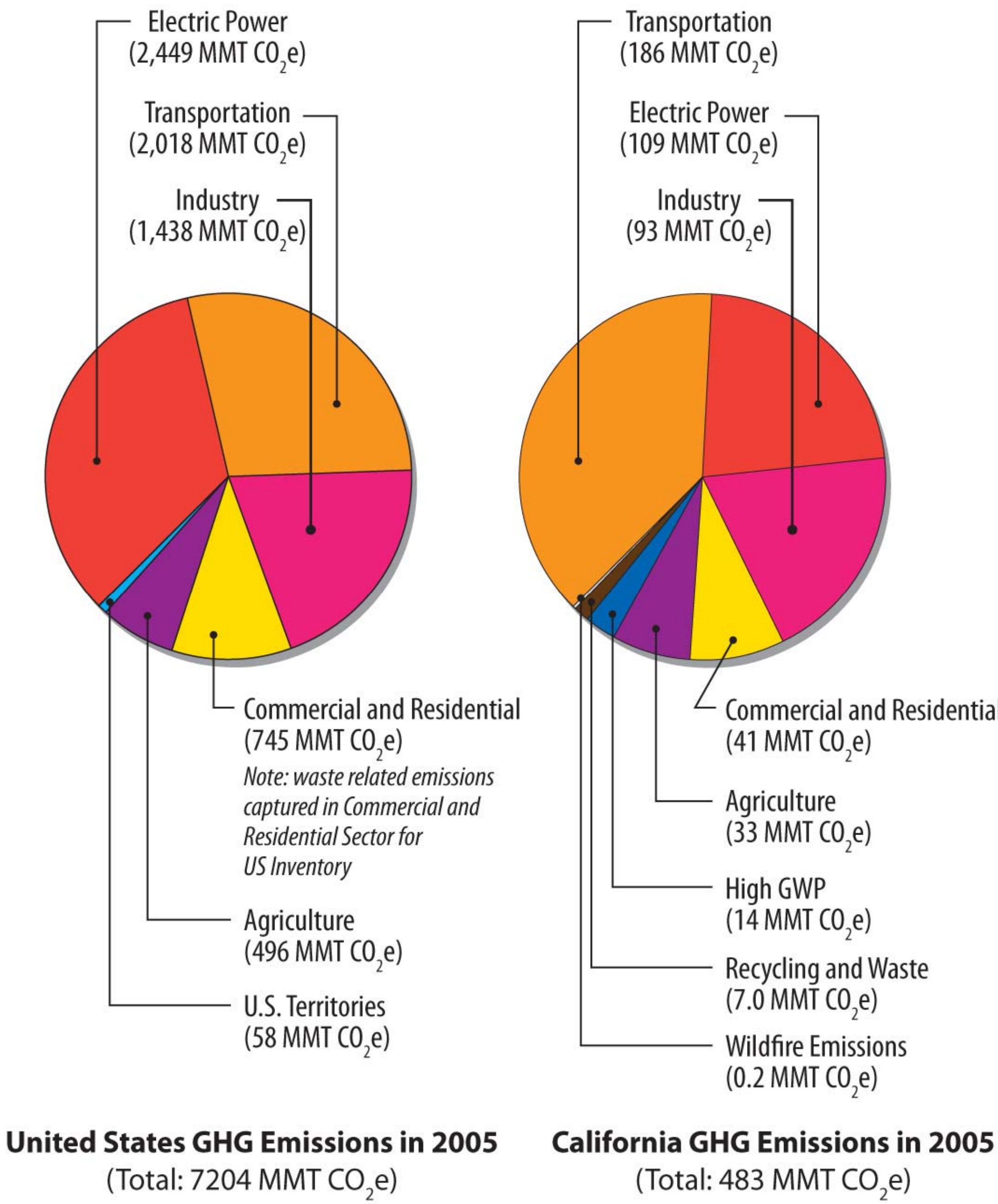


**Table 1-1a. United States GHG Inventory in 2005**

| Sector | Million MT $CO_2e$ | % of total national emissions |
|---|---|---|
| Transportation | 2018 | 28 |
| Electric Power | 2449 | 34 |
| Commercial and Residential[a] | 745 | 10 |
| Industrial | 1438 | 20 |
| Agriculture | 496 | 7 |
| U.S. Territories | 58 | 1 |
| Total | 7204 | 100 |

Source: U.S. Environmental Protection Agency 2012

a. Includes emissions from landfills, wastewater treatment, on-site stationary combustion such as natural gas and high GWP substances

**Table 1-1b. California GHG Inventory in 2005**

| Sector | Million MT $CO_2e$ | % of total state emissions |
|---|---|---|
| Transportation | 186 | 38 |
| Electric Power | 109 | 23 |
| Commercial and Residential | 41 | 9 |
| Industrial | 93 | 19 |
| Recycling and Waste | 7 | 1 |
| High GWP | 14 | 3 |
| Agriculture | 33 | 7 |
| Wildfire Emissions | < 1 | <1 |
| Total | 483 | 100 |

Source: California Air Resources Board 2011a

Fossil fuels are burned to create electricity which powers homes and commercial/industrial buildings, to create heat and to power our vehicles. In the United States, vehicle emissions represent approximately 28% of all emissions (U.S. Environmental Protection Agency 2010a). Vehicle emissions represented approximately 38% of all GHGs emitted by Californians in 2005. Energy used to power buildings is the other primary source of GHGs in the United States and California. Other sources of GHG emissions include agriculture, land clearing, the decomposition of waste in landfills, refrigerants, and certain industrial processes.

# National and State Legislation

Although there is currently no federal overarching law specifically related to climate change or the regulation of GHGs, pursuant to authority under the Clean Air Act, the USEPA is taking a lead role in regulating certain specific emissions sources including stationary sources. Key legislative and regulatory actions are summarized in Table 1-2.

The State of California has adopted legislation, and regulatory agencies have enacted policies, addressing various aspects of climate change and GHG emissions mitigation. Much of this legislation and policy activity is not directed at local jurisdictions but rather establishes a broad framework for the state's long-term GHG mitigation and climate change adaptation program.

Summaries of key regulations and legislation at the federal and state levels that are relevant to the GHG planning in the Stanislaus region are provided in Table 1-2 below. Figure 1-2 displays a timeline of key state and federal regulatory activity.

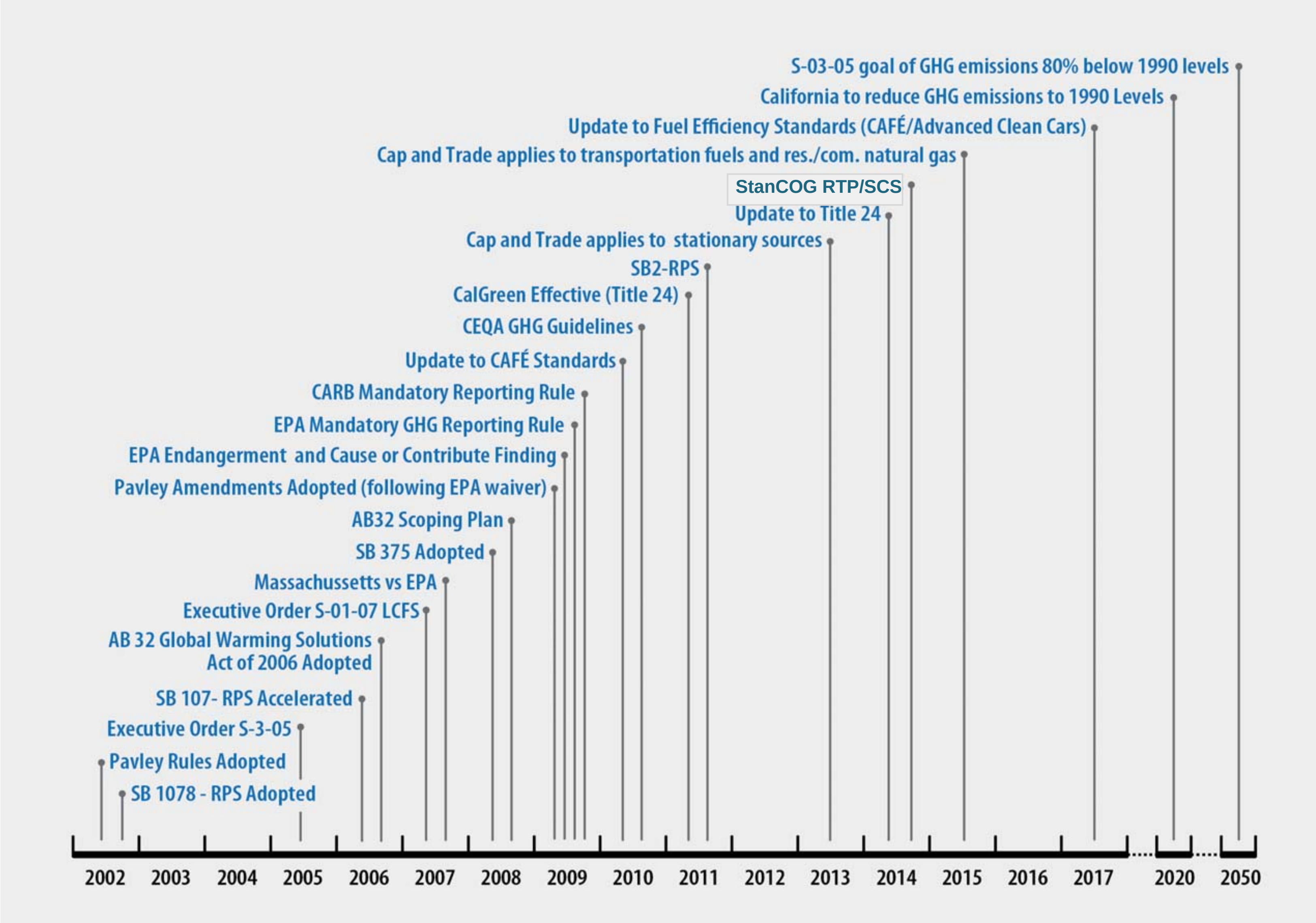
**Table 1-2. Summary of Key Federal and State Legislation and Regulations**

| Federal | |
|---|---|
| Massachusetts et al. vs. U.S. Environmental Protection Agency (2007) | Twelve states and cities including California, in conjunction with several environmental organizations, sued to force EPA to regulate GHGs as a pollutant pursuant to the Clean Air Act (CAA) in Massachusetts et al. v. Environmental Protection Agency 549 US 497 (2007). The court ruled that the plaintiffs had standing to sue, GHGs fit within the CAA's definition of a pollutant, and the EPA's reasons for not regulating GHGs were insufficiently grounded in the CAA. |
| U.S. Environmental Protection Agency Endangerment Finding (2009) | In its "Endangerment Finding," the Administrator of the EPA found that GHGs, as described above, threaten the public health and welfare of current and future generations. The Administrator also found that the combined emissions of these well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG pollution that threatens public health and welfare. Although the Finding of Endangerment does not place requirements on industry, it is an important step in EPA's process to develop regulation. This measure is a prerequisite to finalizing EPA's proposed GHG emission standards for light-duty vehicles, which were jointly proposed by EPA and the Department of Transportation's National Highway Safety Administration in 2009. |
| U.S. Environmental Protection Agency Cause or Contribute Finding (2010) | In its "Cause or Contribute Finding" the EPA Administrator found that the combined emissions of these well-mixed GHG from new motor vehicles and new motor vehicle engines contribute to the GHG pollution that threatens public health and welfare. |
| U.S. Environmental Protection Agency Mandatory Reporting Rule for GHGs (2009) | Under the rule, suppliers of fossil fuels or industrial GHGs, manufacturers of vehicles and engines, and facilities that emit 25,000 MT or more per year of GHGs are required to report annual emissions to the EPA. The first annual reports for the largest emitting facilities, covering calendar year 2010, were submitted to the EPA in 2011. The mandatory reporting rule does not limit GHG emissions but establishes a standard framework for emissions reporting and tracking of large emitters. |
| U.S. Environmental Protection Agency Settlement Agreements to Address GHG Emissions from Refineries and Electricity Generation (2010) | In 2010, the EPA entered into two settlement agreements to issue rules that will address GHG emissions from fossil fueled power plants and refineries. Regulations on both types of facilities will be coordinated with regulatory action on traditional types of pollutants and promulgated through the New Source Performance Standards (NSPS). The authority to issue regulations is under the Clean Air Act as confirmed by the U.S. Supreme Court ruling. |
| Update to Corporate Average Fuel Economy (CAFE) Standards (2009, 2012) | The Corporate Average Fuel Economy (CAFE) standards establish stricter fuel economy requirements and require automakers to cut GHG emissions in new vehicles by roughly 25% by 2016. New standards for model years 2017–2025 were issued in 2012 and will achieve a fleet average in 2025 of 54.5 miles per gallon. |

| State | |
|---|---|
| Executive Order S-03-05 (2005) | Executive Order (EO) S-03-05 established the following GHG emission reduction targets for California's state agencies.<br>By 2010, reduce GHG emissions to 2000 levels.<br>By 2020, reduce GHG emissions to 1990 levels.<br>By 2050, reduce GHG emissions to 80% below 1990 levels.<br>Executive orders are binding only on state agencies and not on local governments or private properties. Accordingly, EO S-03-05 will guide state agencies' efforts to control and regulate GHG emissions but will have no direct binding effect on local efforts. The Secretary of the California Environmental Protection Agency (Cal/EPA) is required to report to the Governor and state legislature biannually on the impacts of global warming on California, mitigation and adaptation plans, and progress made toward reducing GHG emissions to meet the targets established in this executive order. |
| Assembly Bill 1493—Pavley Rules (2002, amendments 2009)/ Advanced Clean Cars (2012) | Known as "Pavley I," Assembly Bill (AB) 1493 standards were the nation's first GHG standards for automobiles. AB 1493 required the California Air Resources Board (CARB) to adopt vehicle standards that will lower GHG emissions from new light duty autos to the maximum extent feasible beginning in 2009. Additional strengthening of the Pavley standards (Advanced Clean Cars) was adopted for vehicle model years 2017–2025. Together, the two standards are expected to increase average fuel economy to roughly 43 mpg by 2020 and reduce GHG emissions from the transportation sector in California by approximately 14%. The new federal CAFE standards, described above, are the analogous national policy. |
| Senate Bills 1078/107 and Senate Bill 1—Renewable Portfolio Standard (2002, 2006, 2011) | California's Renewable Portfolio Standard (RPS), obligates investor-owned utilities (IOUs), energy service providers (ESPs), and Community Choice Aggregations (CCAs) to procure 33% of retail sales from eligible renewable sources by 2020. The California Public Utilities Commission (CPUC) and CEC are jointly responsible for implementing the program. |
| Assembly Bill 32—California Global Warming Solutions Act (2006) | AB 32 codified the state's GHG emissions target by requiring that the state's global warming emissions be reduced to 1990 levels by 2020. Since being adopted, the CARB, CEC, CPUC, and Building Standards Commission have been developing regulations that will help meet the goals of AB 32 and EO S-03-05. The Scoping Plan for AB 32 identifies specific measures to reduce GHG emissions to 1990 levels by 2020, and requires CARB and other state agencies to develop and enforce regulations and other initiatives for reducing GHGs. Specifically, the Scoping Plan articulates a key role for local governments, recommending they establish GHG reduction goals for both their municipal operations and the community consistent with those of the state (i.e., approximately 15% below current levels). |
| Executive Order S-01-07—Low Carbon Fuel Standard (2007) | EO S-01-07 essentially mandates: (1) that a statewide goal be established to reduce the carbon intensity of California's transportation fuels by at least 10% by 2020, and (2) that a Low Carbon Fuel Standard (LCFS) for transportation fuels be established in California. |
| Assembly Bill 939, title 27 (2009)—Landfill Methane Regulation | This regulation is a discrete early action GHG reduction measure, as described in the California Global Warming Solutions Act of 2006 (AB 32; Stats. 2006, chapter 488). It will reduce methane emissions from landfills primarily by requiring owners and operators of certain uncontrolled landfills to install gas collection and control systems, and by requiring existing and newly installed gas collection and control systems to operate optimally. |

| | |
|---|---|
| Senate Bill 375—Sustainable Communities Strategy (2008) | SB 375 provides for a new planning process that coordinates land use planning, regional transportation plans, and funding priorities in order to help California meet the GHG reduction goals established in AB 32. SB 375 requires regional transportation plans, developed by metropolitan planning organizations (MPOs) to incorporate a "sustainable communities strategy" (SCS) in their Regional Transportation Plans (RTPs). The goal of the SCS is to reduce regional vehicle miles traveled (VMT) through land use planning and consequent transportation patterns. CARB set regional GHG reduction targets that will focus each SCS. The regional targets were released by CARB in September 2010. SB 375 also includes provisions for streamlined California Environmental Quality Act (CEQA) review for some infill projects such as transit-oriented development. StanCOG is preparing the SCS for Stanislaus County and is scheduled to complete and adopt the SCS in late 2013. |
| California Title 24 Energy Efficiency and Green Building (2008, 2011, 2014) | Title 24 provides voluntary and mandatory energy efficiency standards for new residential and non-residential buildings, as well as major modifications to existing buildings. The last update was adopted in 2013, which takes effect in 2014. The California Green Building Standards Code (included in Title 24) established requirements for planning and design for sustainable site development, water conservation, material conservation, and internal air contaminants. |
| CARB GHG Mandatory Reporting Rule Title 17 (2009) | CARB approved a rule requiring mandatory reporting of GHG emissions from certain sources, pursuant to AB 32. Facilities subject to the mandatory reporting rule must report their emissions from the calendar year 2009 and have those emissions verified by a third party in 2010. In general the rule applies to facilities emitting more than 25,000 MT $CO_2e$ in any given calendar year or electricity generating facilities with a nameplate generating capacity greater than 1 megawatt (MW) and/or emitting more than 2,500 MT $CO_2e$ per year. Additional requirements also apply to cement plants and entities that buy and sell electricity in the state. |
| California Cap and Trade Program (2011) | CARB adopted the California Cap and Trade program, formalizing a complex market system designed to help California reach the GHG emissions reductions targets set forth in AB 32. The regulation which went into effect on January 1, 2013 and was identified as a key strategy in the AB 32 Scoping Plan, sets a cap on the annual GHG emissions from the state's largest emitters, stationary sources such as oil refineries, power plants, fuel distribution centers, cement plants and other industrial processes. The regulation establishes a price signal which will drive long term investment in cleaner fuels and efficient energy use. |
| AB 341 Mandatory Commercial Recycling (2011) | This legislation requires commercial businesses and multi-family building owners to support the reuse, recycling, composting or other diversion of solid waste from disposal by either self-haul, subscription to a hauler, arrangement for pickup of recyclable materials or subscription to a recycling service. The law took effect in mid-2012. |

**Figure 1-2. GHG Related Legislation, Regulation, and Executive Orders**



# Local Level Planning

The AB 32 Scoping Plan lays out California's plan for achieving the GHG reductions required by AB 32. Specifically the Scoping Plan describes a list of measures that the state will undertake, and the expected GHG reductions associated with these measures before 2020. Because the state does not have jurisdictional control over some of the activities that produce GHG emissions in California, the AB 32 Scoping Plan articulates a unique role for local governments in achieving the state's GHG reduction goals. The AB 32 Scoping Plan recommends, but does not require, local governments to reduce GHG emissions from both their *municipal operations* and the *community at large* to a level that is 15% below current levels.

At the time of the Scoping Plan adoption in 2008, a 15% reduction from 2005–2008 levels was the state's burden of reduction to meet 1990 emissions levels. However, this calculation was based on an *estimate* only of the level of emissions during the period 2005 to 2008. Subsequent development of actual inventories for 2005 to 2008 indicates that a 10% to 11% reduction is needed by 2020 to meet 1990 emissions levels.

Many jurisdictions across California have completed a GHG Inventory, a GHG reduction plan, or both. These plans generally address two types of emissions.

- Community inventory and reduction plans address emissions that arise from the community at large (residents, businesses and their associated activities within the jurisdictional boundary).
- Municipal inventory and reduction plans address emissions that arise from the municipal operations only (County or City buildings, vehicle fleet, activities required to provide services to the jurisdiction).

Completing a GHG inventory is the first step towards either of these goals. In addition to this regional community inventory, the cities and unincorporated area of Stanislaus County previously completed municipal GHG inventories for the year 2005. As a separate part of the RST project, community inventories were developed for each jurisdiction for the year 2005 using the same methodology used for the regional inventory and provided to them for their use.

This report presents a community GHG inventory data for the region as a whole (sum of emissions from all incorporated cities and the unincorporated county) for the baseline year 2005.

## Benefits of Greenhouse Gas Planning and Accurate Accounting

Local governments often pursue GHG planning for multiple reasons. A reduction in GHG emissions is often a co-benefit of other activities, primarily energy efficiency related activities or other environmental mitigation. With accurate accounting of GHG emissions in the jurisdiction, a community can "take credit" for the GHG benefits associated with a range of policies, programs and activities that the jurisdiction is pursuing anyway. This section describes co-benefits typically associated with GHG accounting and planning and vice versa.

### Greenhouse Gas Reduction Benefits

The completion of a community and/or municipal GHG inventory and the subsequent step to identify policies and programs that will reduce GHG emissions over time can demonstrate that local planning is promoting consistency with AB 32, (i.e., that a local government is doing its fair share to help meet the state goals overall).

## Energy Use Benefits

In the state of California, GHG emissions associated with the energy used to power and heat our buildings represent approximately 23% of total GHG emissions in 2005. Building energy related emissions represent a similar percent of total emissions at the City or County level as well. For financial reasons, including the increased availability of utility incentives and retrofit grants, local governments, home-owners and businesses opt to conduct energy efficiency retrofits to existing construction. Building ordinances for newer construction ensure optimum energy savings for new occupants. These energy savings benefit the energy customer as well as the utility and also result in lower GHG emissions.

## Financial Benefits

In addition to the financial benefits associated with energy efficient construction and retrofits, other financial savings are often associated with actions commonly pursued as part of a City or County's GHG planning. For example, when waste diversion programs decrease the amount of waste going to landfills, fewer landfill fees are paid. When comprehensive water conservation efforts are pursued, water bills are lower. During times of high fuel costs, alternative modes of transportation including bus, rail, bike, ride-share or employer sponsored shuttles can greatly reduce individual's fuel costs. In the agriculture and forestry sectors (and others) it is also possible to develop GHG offset projects by establishing specific management practices or installing specific equipment on the site. The offset project can then be sold on the voluntary market. Finally, through the efforts of gathering the data required to complete a GHG inventory and regularly update it, many communities identify ways to streamline data and reporting for other programs, increasing efficiency within city departments.

## Additional Co-Benefits

Additional co-benefits of GHG planning and accounting are generally associated with improved air quality, increased sustainability of the water supply, increased aesthetics in communities and public health.

## Tiering under CEQA

Amendments to the CEQA guidelines in March 2010 describe that CEQA project evaluation of GHG emissions can tier off a programmatic analysis of GHG emissions reductions provided that the GHG reduction plan includes the following (CEQA Guidelines Section 15183.5):

1. Quantify greenhouse gas emissions, both existing (a) and projected (b) over a specified time period, resulting from activities within a defined geographic area.
2. Establish a level, based on substantial evidence, below which the contribution to GHG emissions from activities covered by the plan would not be cumulatively considerable. This usually involves setting a GHG reduction target as part of the plan that is consistent with the state's goals. Participating jurisdictions in Stanislaus have not set GHG reduction targets as part of this effort.
3. Identify and analyze the GHG emissions resulting from specific actions or categories of actions anticipated within the geographic area.

4. Specify measures or a group of measures, including performance standards that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level.
5. Monitor the plan's progress.
6. Adopt the GHG Reduction Strategy in a public process following environmental review.

The Amendments to the CEQA guidelines create a streamlined CEQA process for the analysis of greenhouse gas emissions at the project level. Individual projects could demonstrate consistency with an over-arching GHG reduction plan, where one exists, in lieu of a comprehensive project-level GHG analysis in order to reach a *less than significant* determination. This approach is also supported by the San Joaquin Air Pollution Control District.

This report quantifies *existing* greenhouse gas emissions only (baseline year 2005) within the county boundary. To prepare a qualified GHG reduction plan that could be used for CEQA tiering, Stanislaus jurisdictions would need to use the separately prepared individual jurisdictional community inventories and then complete steps 1b–6 above.

# Overview of Stanislaus County

Stanislaus County is located in California's Central Valley and is bordered by San Joaquin County to the north, Merced County to the south, Santa Clara County to the west and Calaveras and Tuolumne Counties to the east. The San Joaquin River flows north through the center of the county and eastern areas of the county are known as the "gateway to Yosemite". Nine incorporated cities are present in Stanislaus County: Ceres, Hughson, Modesto, Newman, Oakdale, Patterson, Riverbank, Turlock and Waterford. The major industry in the unincorporated county is agriculture. Significant industries in Stanislaus cities include the following: food packaging and processing, agricultural support, wine production, agriculture, government offices and education, and tourism. According to the U.S census, the total population of Stanislaus County was 446,997 in 2000 and 514,453 in 2010. In 2005, the population of Stanislaus County was 514,160. Socioeconomic data (population, jobs and housing) for all jurisdictions in Stanislaus County for year 2005 are shown below in Table 1-3.

**Table 1-3. Socioeconomic Data for All Participating Jurisdictions in 2005**

| Jurisdiction | Households | Population | Employment |
|---|---|---|---|
| Ceres | 12,639 | 40,722 | 8,402 |
| Hughson | 1,915 | 6,091 | 749 |
| Modesto | 73,489 | 206,962 | 78,310 |
| Newman | 3,091 | 10,083 | 1,056 |
| Oakdale | 7,496 | 20,299 | 6,005 |
| Patterson | 5,414 | 19,167 | 2,273 |
| Riverbank | 6,477 | 21,417 | 3,452 |
| Turlock | 23,074 | 67,510 | 23,738 |
| Waterford | 2,447 | 8,169 | 476 |
| Unincorporated County | 36,730 | 113,740 | 47,521 |
| Total Stanislaus County | 172,772 | 514,160 | 171,982 |
| Source: StanCOG 2005 as reported by Fehr & Peers 2012 | | | |

# Chapter 2
# Sector Summaries

This section presents the 2005 Stanislaus Regional GHG emissions inventory. Results are presented by sector. The GHG emissions for the region as a whole (i.e., "regional inventory") for 2005 are presented in Table 2-1 and Figure 2-1. Per capita (Total emissions/population) and per service population (Total emissions/population plus jobs) emissions for the Stanislaus region were 11.8 MT CO2e/person and 8.8 MT CO2e/service population (SP), respectively. These values include Agriculture. The following sub-sections each describe a different sector of the inventory. The physical processes resulting in emissions will be described for each and a general overview of emissions in the sector will be provided. Complete discussion of the data acquisition, emissions calculations and methodologies, and data sources used can be found in Chapter 3.

**Table 2-1. 2005 GHG Emissions Inventory for the Stanislaus County Region (MT $CO_2$e)**

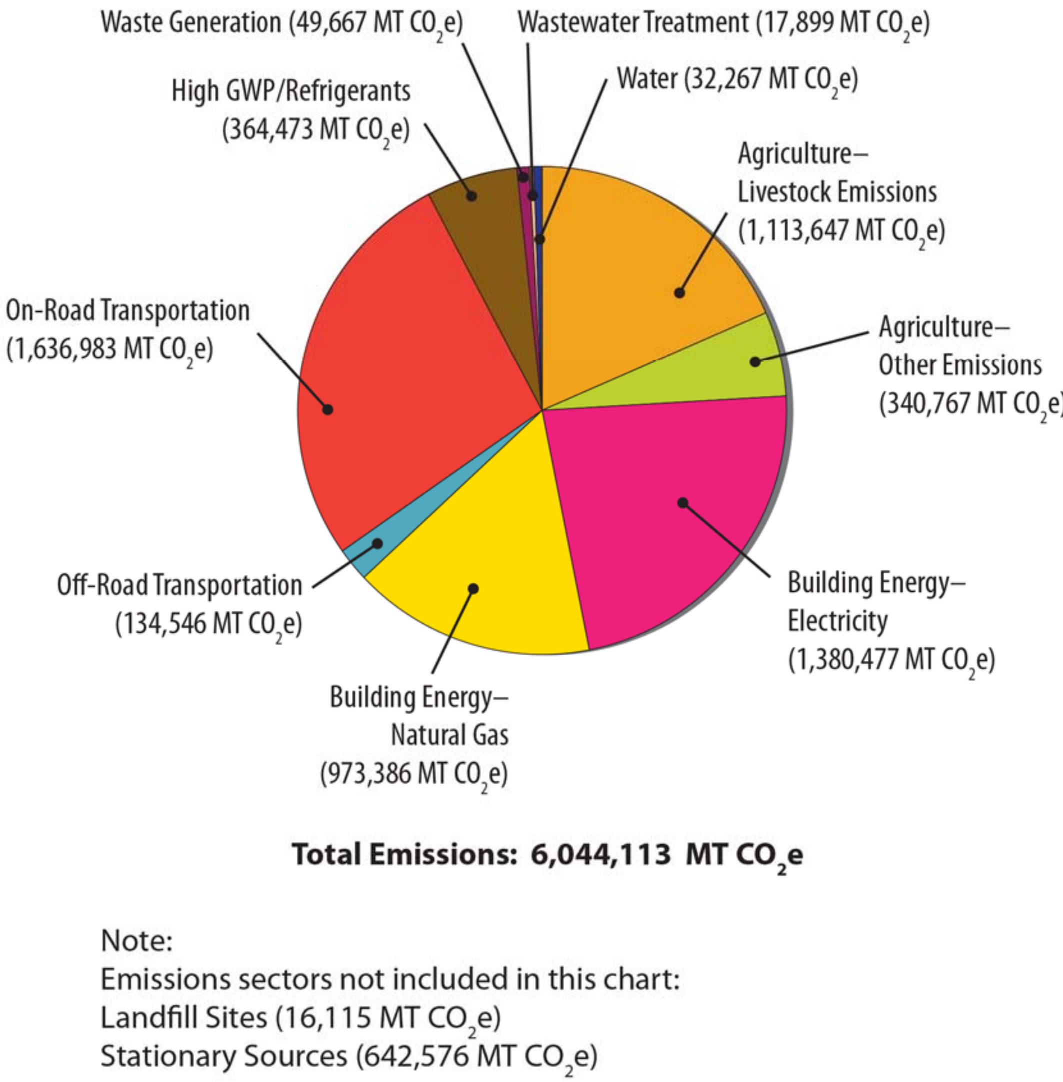
| | Sector | Emissions | Percent |
|---|---|---|---|
| Direct[a] | Agriculture—Livestock Emissions | 1,113,647 | 18% |
| | Agriculture—Other Emissions | 340,767 | 6% |
| | Building Energy—Natural Gas | 973,386 | 16% |
| | Off-Road Transportation | 134,546 | 2% |
| | On-Road Transportation | 1,636,983 | 27% |
| | High GWP/Refrigerants | 364,473 | 6% |
| Indirect[b] | Building Energy—Electricity | 1,380,477 | 23% |
| | Waste Generation | 49,667 | 0.8% |
| | Wastewater Treatment | 17,899 | 0.3% |
| | Water | 32,267 | 0.5% |
| Total | | 6,044,113 | 100% |
| Excluded[c] | Stationary Sources | 642,576 | |
| | Waste Landfill | 16,115 | |

a. Direct emissions are emissions that physically occur within the inventory boundary; see Chapter 1 for detail.

b. Indirect emissions are due to activity that occurs within the inventory boundary although the GHG emission may happen outside the inventory boundary; see Chapter 1 for detail.

c. Stationary source emissions were excluded due to state and federal regulation of these sources. Landfill emissions were excluded to avoid double-counting with waste generation emissions.

**Figure 2-1. GHG Emissions Inventory for the Stanislaus County Region (MT $CO_2e$)**




# Agriculture

Emissions in the agriculture sector are direct emissions resulting from the application of fertilizer to crops and the activity of livestock[5]. 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 and released) and indirect (following volatilization of ammonia and oxides of nitrogen from managed soils) pathway (Intergovernmental Panel on Climate Change 2006). Emissions of $CH_4$ and $N_2O$ can also result from livestock production through enteric fermentation and manure management. Both direct and indirect emissions of $N_2O$ are accounted for in this inventory.

[5] Livestock related GHG emissions result from enteric fermentation, by ruminants, and also from manure by all livestock types. The decomposition of manure in ponds, stockpiles or other manure storage and treatment systems results in the release of $CH_4$ and $N_2O$, depending on conditions.

Agriculture emissions account for approximately 24% of the region's total GHG emissions inventory in 2005. Comparatively, agricultural emissions in the state of California were approximately 7% of total emissions in 2005. Stanislaus County is a large agriculture producing region for the state and for the nation. As California agriculture is concentrated in certain areas of the state, agricultural related emissions will only be a significant fraction of total emissions in select communities, such as the unincorporated portions of Stanislaus County. Stanislaus County ranked 6th among 58 counties in California for total dollar value of agriculture products, ranked 4th among 58 counties for total value of livestock products and ranked 2nd among 58 counties for almond production (USDA Census of Agriculture 2007). In 2005, agriculture emissions in Stanislaus represent approximately 4.5% of agriculture related emissions statewide.

The four general sources of agricultural emissions accounted for in this inventory are: livestock enteric fermentation, livestock manure management, $N_2O$ emissions from the application of fertilizer and pesticide, and the burning of fuel by agricultural vehicles and equipment. A complete description of methods and data used can be found in Chapter 3. Table 2-2 and Figure 2-2 present 2005 agriculture emissions by source. Figure 2-3 compares Stanislaus County's agricultural emissions to the state and national agricultural emissions, while Table 2-3 compares the county's agricultural emissions to other agricultural producing counties in California.

**Table 2-2. GHG Emissions from Agriculture Sources in 2005 (MT $CO_2$e)**

| Agricultural Source | Total Sector Emissions | Percentage |
|---|---|---|
| Livestock Enteric Fermentation and Manure Management | 1,113,647 | 76.6% |
| Fertilizer Application | 169,120 | 11.6% |
| Pesticide Usage | 2,090 | 0.1% |
| Agricultural Equipment | 169,557 | 11.7% |
| Total Emissions | 1,454,414 | 100.0% |

**Figure 2-2. GHG Emissions from Agriculture Sources in 2005 (MT $CO_2e$)**

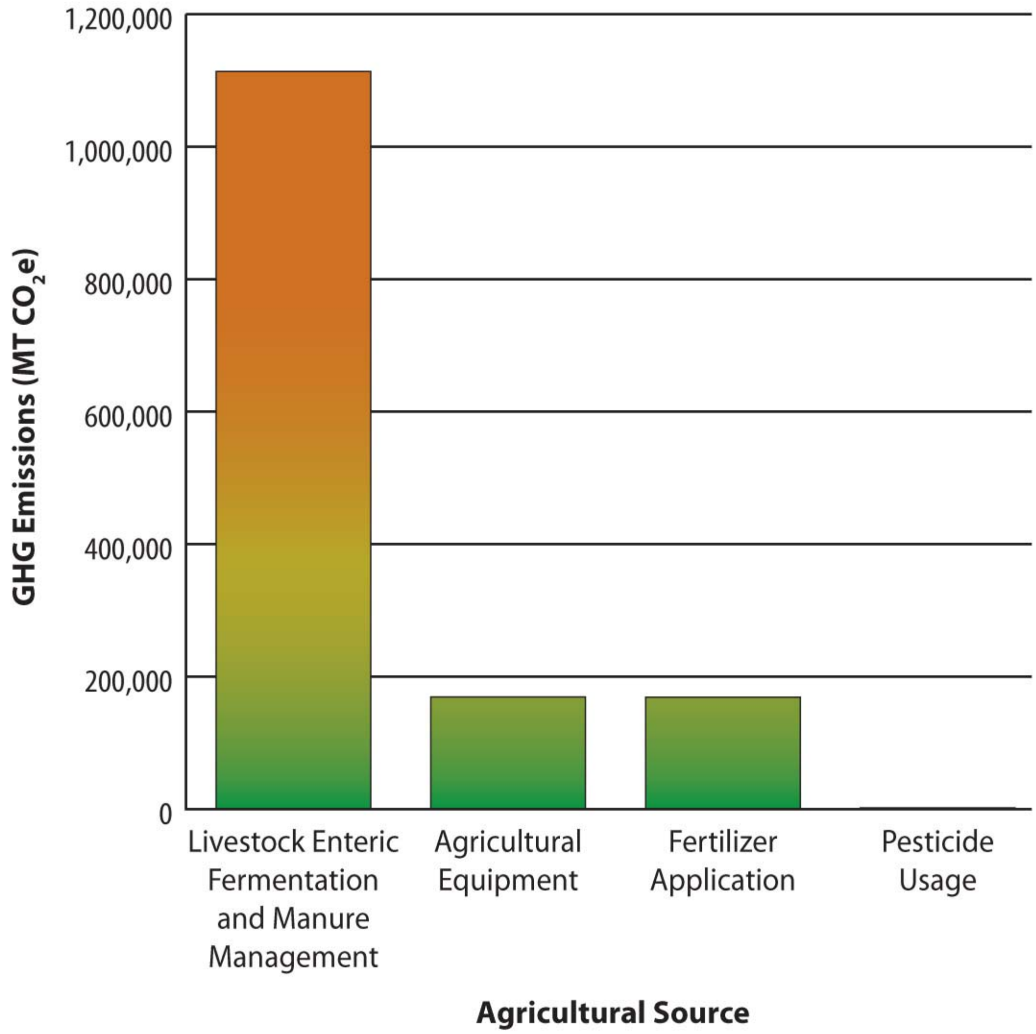


**Figure 2-3. Comparison of Stanislaus GHG Emissions from Agriculture to National and State Level Agriculture Emissions**

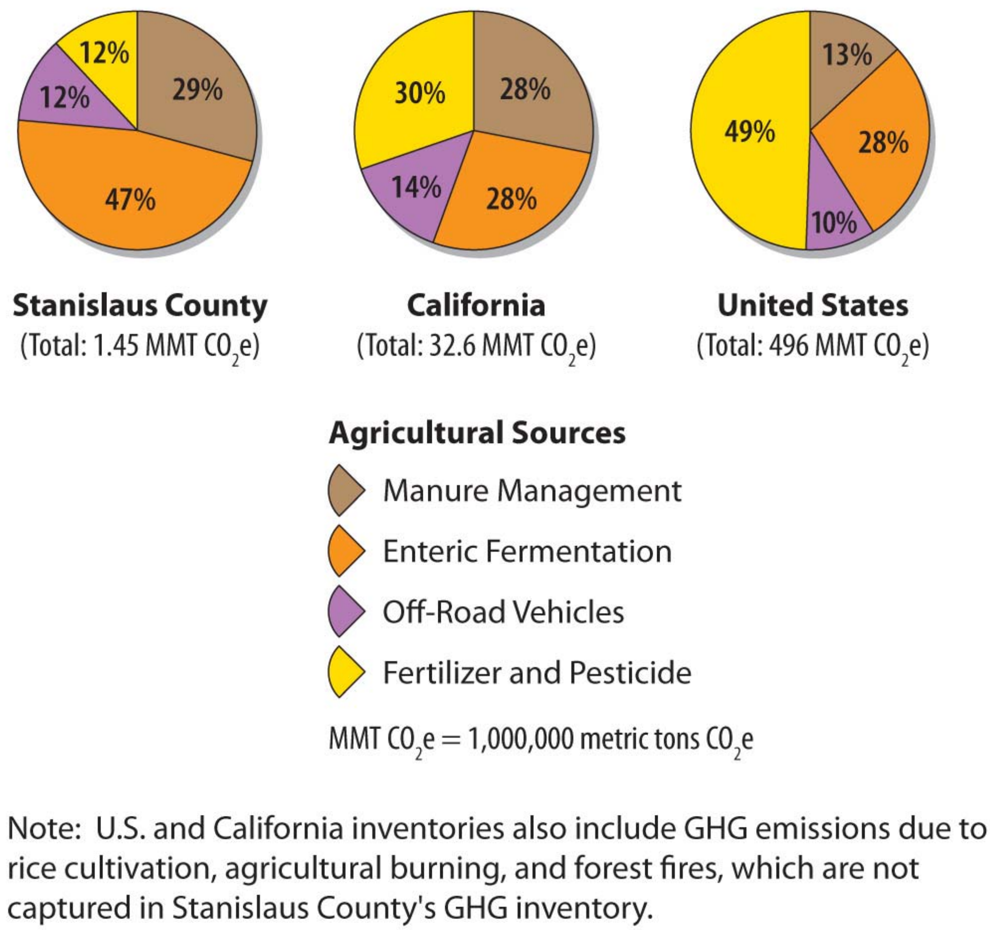



**Table 2-3. Stanislaus Agriculture Emissions Compared to Other California Agriculture Producing Counties**

| County | Agriculture-Related Emissions (MT $CO_2e$) | Year | Sources Included in Emissions |
|---|---|---|---|
| Stanislaus County[a] | 1,454,414 | 2005 | All agriculture sources |
| San Joaquin County[b] | 951,023 | 2007 | All agriculture sources |
| Tulare County[c] | 3,294,870 | 2007 | Dairy/feedlots |
| Yolo County[d] | 297,341 | 2008 | All agriculture sources |

Note:

a. This work

b. San Joaquin County 2011

c. Tulare County 2011

d. Yolo County 2010

# Building Energy

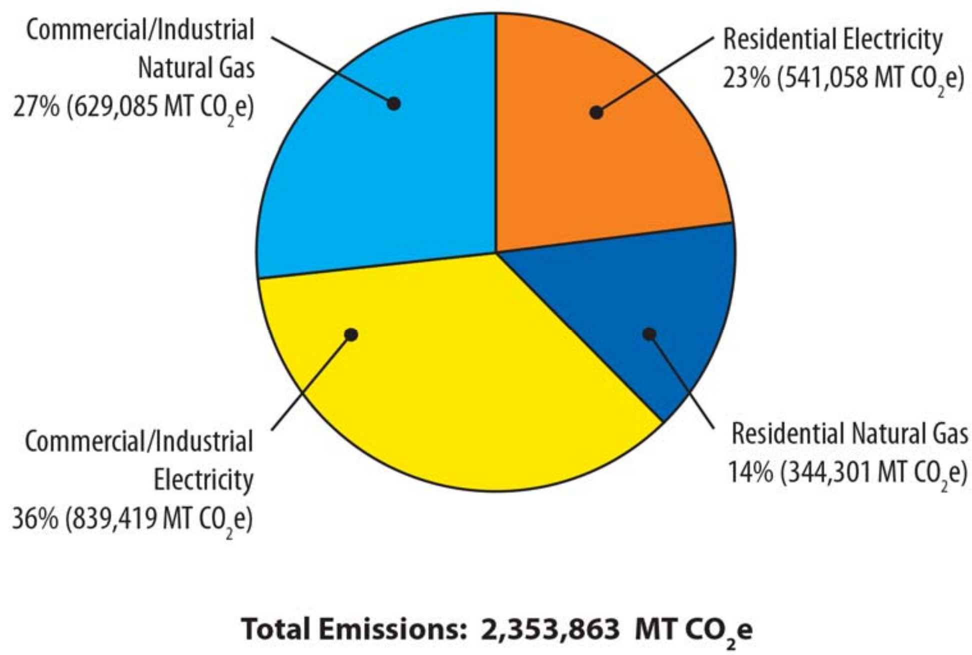
GHG emissions result from the use of electricity and natural gas by residential, commercial, and industrial buildings in the region. Emissions associated with building energy use accounted for 39% of the total regional emissions in 2005 (Table 2-1). Residents and business in the region receive electricity and natural gas from Pacific Gas and Electric (PG&E), Turlock Irrigation District (TID) and Modesto Irrigation District (MID). Electricity use in buildings results in indirect emissions from the power plants that produce electricity. These plants may be located either within or outside of the county and the combustion of the fuel to produce the electricity always occurs in a different location from the user. Electricity emissions are classified as indirect emissions. Natural gas consumption in buildings by furnaces and other appliances result in direct emissions where the natural gas is combusted; these are classified as direct emissions.

Table 2-4 presents the energy consumption (residential, commercial and industrial buildings) in 2005 for the region. The proportions of energy type and end users to the regional total of GHG emissions in this sector are shown in Figure 2-4. This data captures direct access customers in the PG&E service area. MID and TID confirmed the absence of direct access customers in their service areas. Building energy use emissions are generally a function of the number of residents and businesses, types and ages of buildings, predominant types of industry and the composition of the power supply.

**Table 2-4. Building Energy Consumption—Residential and Commercial/Industrial Electricity and Natural Gas in 2005**

| | Residential Building Energy Use | | Commercial/Industrial Building Energy Use | |
|---|---|---|---|---|
| | Electricity (kwh) | Natural Gas (therms) | Electricity (kwh) | Natural Gas (therms) |
| Regional Total | 1,682,405,061 | 64,710,119 | 2,592,105,029 | 118,233,329 |

**Figure 2-4. Proportion of Regional GHG Emissions in the Building Energy Sector Due to Electricity and Natural Gas Use by Various End Users (MT $CO_2$e)**




Building energy related emissions within the region are the result of commercial/industrial electricity consumption (36%) followed by commercial/industrial natural gas consumption (27%), residential electricity (23%) and residential natural gas (15%).

Building energy related emissions in the state of California accounted for approximately 23% of total state GHG emissions in 2005, while building energy emissions were approximately 39% of total Stanislaus regional emissions in 2005 (California Air Resources Board 2011a). Building energy use is typically between 25–40% of a community's total GHG emissions depending on the other dominant sources of emissions in the community, the presence or absence of large commercial or industrial users, and the climate and age of the building stock (i.e., older homes in colder regions of the state require more heating).

# On-Road Transportation

This sector includes GHG emissions that result from the burning of fuel by on-road vehicles traveling in the region. On-road vehicle emissions account for 27% of the region's total emissions in 2005 and approximately 38% of California's statewide emissions during the same year. These emissions are considered direct emissions.

The Stanislaus Council of Governments, or StanCOG, travel demand model was used to develop vehicle miles traveled (VMT) estimates for the region in 2005 (Fehr and Peers 2012). The model captures vehicle trips, including truck trips, by different travel purposes, including home-based work, shopping and recreational trips, and non-home based trips. The travel demand model area includes all of Stanislaus County. Adjacent counties (San Joaquin, Merced, Santa Clara, Calaveras, Tuolumne, Mariposa, and Alameda) are represented by external gateways where major roadways provide access into the overall model area. These stations capture the traffic entering, exiting or passing through the model area on major county and state roadways (e.g., State Route 99, Interstate 5, and State Route 108).

Transportation modeling and the quantification of GHGs in this analysis are consistent with the methods being used for the development of StanCOG's Sustainable Communities Strategy.

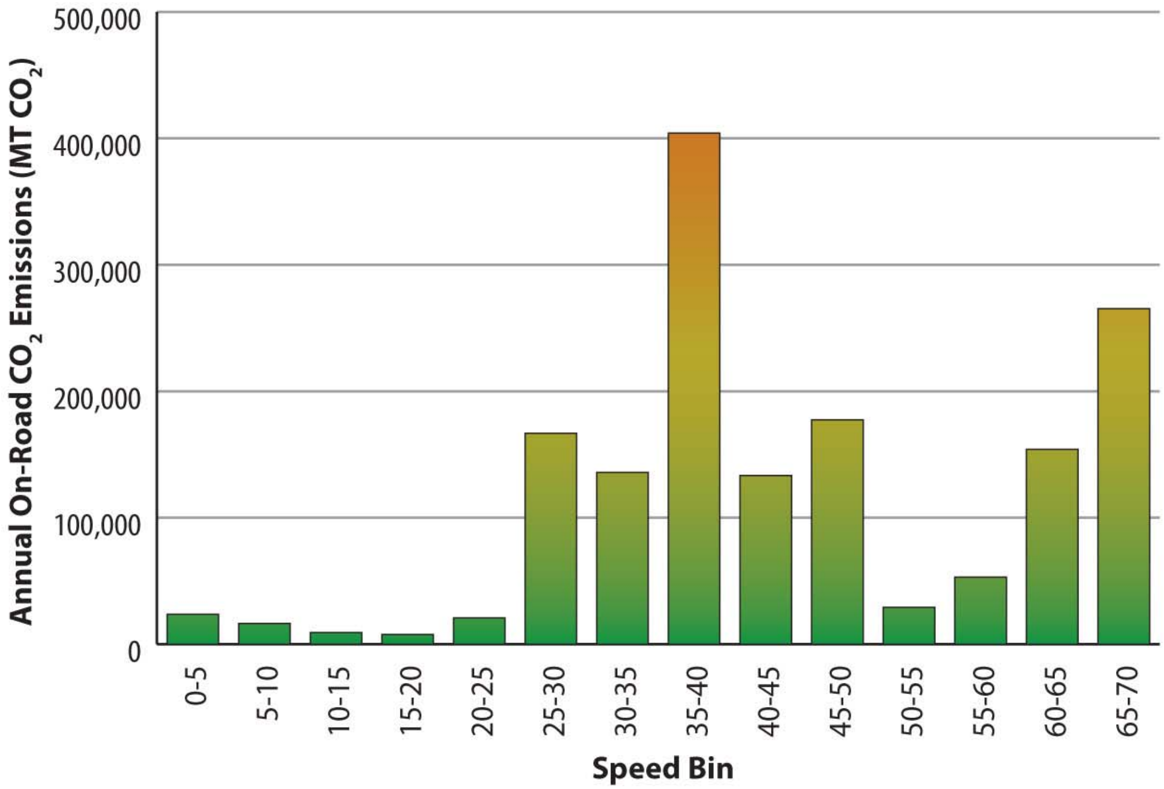
Table 2-5 and Figure 2-5 present regional VMT and associated GHG emissions in 2005 by vehicle speed bins. Because the fuel economy of vehicles depends on the speed, the fuel consumption and GHG emissions partially depend on the speed at which vehicles are generally traveling. In general, the majority of VMT in the region occur at speeds between 35 and 50 miles per hour (mph) with about 15% occurring above speeds of 60 mph (highway traffic).

**Table 2-5. Regional VMT and GHG Emissions by Speed Bin**

| Speed Bin (MPH) | Annual VMT | Annual $CO_2$ Emissions (MT $CO_2$) |
|---|---|---|
| 0-5 | 17,380,883 | 23,690 |
| 5-10 | 15,549,764 | 16,374 |
| 10-15 | 10,893,718 | 9,147 |
| 15-20 | 11,154,315 | 7,746 |
| 20-25 | 34,372,085 | 20,845 |
| 25-30 | 305,504,699 | 166,798 |
| 30-35 | 268,670,649 | 135,914 |
| 35-40 | 838,474,144 | 404,119 |
| 40-45 | 282,636,011 | 133,411 |
| 45-50 | 373,459,791 | 177,517 |
| 50-55 | 59,046,214 | 29,083 |
| 55-60 | 100,798,989 | 53,002 |
| 60-65 | 266,157,328 | 154,179 |
| 65-70 | 450,077,391 | 265,409 |
| Total | 3,034,175,981 | 1,597,233 |

Note: The emissions in this table are $CO_2$ emissions, not $CO_2e$ emissions. $CH_4$ and $N_2O$ emissions from on-road transportation were calculated using a different methodology.

**Figure 2-5. Regional GHG Emissions by Speed Bin in 2005 (MT $CO_2$)**




Note: The emissions in this table are $CO_2$ emissions, not $CO_2$e emissions. $CH_4$ and $N_2O$ emissions from on-road transportation were calculated using a different methodology. Emissions of $CO_2$ typically account for 95-98% of $CO_2$e emissions in the On-Road Transportation sector.

# Off-Road Transportation

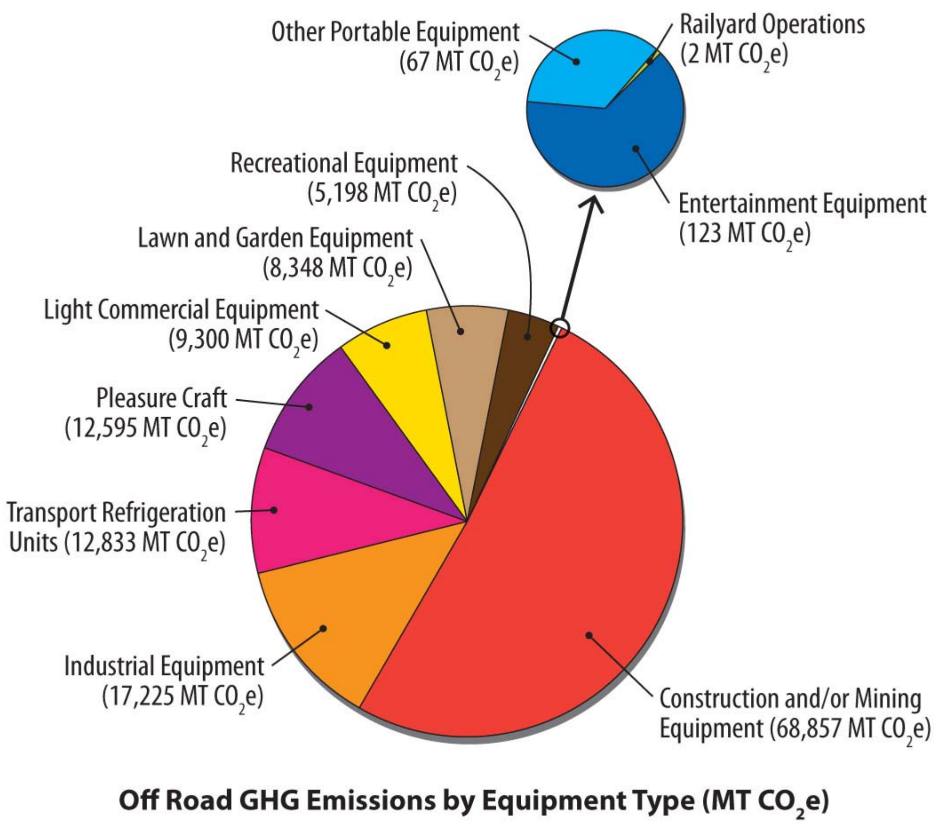
This sector captures fuel consumption by all types of off-road vehicles and equipment being used in the region, referred to in this document as "Off-Road Transportation". Off-road equipment includes recreational boats and vehicles, equipment for industry, construction, and lawn and garden maintenance (agricultural equipment was included in the agricultural sector). GHG emissions result from the combustion of diesel or gasoline to power these vehicles and equipment. These emissions were calculated at the county level using CARB's OFFROAD 2007 model. Off-road equipment emissions accounted for approximately 2% of the total regional emissions in 2005 (Table 2-1, Figure 2-1). These emissions are direct emissions resulting from equipment fuel combustion. Table 2-6 and Figure 2-6 present the regional GHG emissions due to off-road equipment in 2005 by equipment type. Construction and/or mining equipment account for 51% of the total regional emissions in this sector.

**Table 2-6. Regional GHG Emissions Due to Off-Road Equipment in 2005 by Equipment Type**

| Equipment Type | Off-Road Emissions (MT $CO_2e$) |
|---|---|
| Construction and Mining Equipment | 68,857 |
| Entertainment Equipment | 123 |
| Industrial Equipment | 17,225 |
| Lawn and Garden Equipment | 8,348 |
| Light Commercial Equipment | 9,300 |
| Other Portable Equipment | 67 |
| Pleasure Craft | 12,595 |
| Rail yard Operations | 2 |
| Recreational Equipment | 5,198 |
| Transport Refrigeration Units | 12,833 |
| Total | 134,546 |

Note: Emissions from off-road vehicles in the county were determined using CARB's OFFROAD 2007 model. The OFFROAD model provides the amount and type of fuel consumed at the county level for a wide variety of off-road vehicle and equipment categories, such as construction equipment, lawn and garden equipment, and industrial equipment.

**Figure 2-6. GHG Emissions Due to Off-Road Equipment in 2005 from Various Off-Road Equipment Types**



# Stationary Sources

This source category accounts for GHG emissions from fuel combustion and fugitive (process) emissions at primarily industrial facilities located in the region. Emissions from these facilities, including GHG emissions, are regulated by SJVAPCD, CARB, and/or the USEPA and local jurisdictions usually defer to state and federal authority to regulate these sources. In addition, given the state and federal framework of regulation, local regulation of such sources could result in confusion and inconsistencies in the regulation of such large sources between jurisdictions, which is undesirable. Thus, while emissions were quantified from stationary industrial source they were excluded from GHG totals for the region. Were these sources to be included in the regional total, emissions from these sources would account for approximately 10% of total regional emissions in 2005 and are primarily associated with facilities that support the agriculture or food packaging industry.

GHG emissions from stationary sources result from onsite fuel use that is not provided by a central natural gas utility such as PG&E (natural gas use is accounted for in the building energy category (Chapter 1, *Background*). Combusted fuels accounted for in this sector include diesel, distillate oil, liquid petroleum gas, propane, natural gas (from non-utility sources), digester gas, gasoline, waste gas, waste oil, vapor recovery gas, landfill gas or any fuel combusted by a source required to obtain a permit from the SJVAPCD. A number of stationary sources in the region are also required to report GHG emissions to CARB under California's Mandatory Reporting Rule (MRR) for GHG emissions. Per SJVAQCD policy, fuel use data used to estimate GHG emissions in this report does not include facilities that have requested their fuel use be kept confidential. Fuel used by equipment not requiring a District permit, such as residential combustion equipment, portable equipment, mobile equipment, and permit exempt stationary combustion equipment, is also not included in the estimate of GHG emissions from stationary sources.

Several power generation facilities are located in the region. Emissions associated with these facilities are captured in the Building Energy sector where the end use activity occurs.

# Waste

The regional GHG inventory includes GHG emissions due to two distinct waste sources. The first, *waste generation*, is forward looking, as it accounts for the GHG emissions that will occur in the future due to waste that is created during the inventory year (2005) and sent to a landfill during the inventory year (2005), but decomposes in the landfill over many future years (2005 and beyond). The activity of generating the waste occurs completely inside the jurisdiction boundary and during the inventory year (2005), but the GHG emissions may occur outside the boundary at a distant landfill. These emissions are classified as indirect emissions and included in the regional total.

The second waste source, *landfill sites*, is backward looking and accounts for the GHG emissions that occur at specific landfill sites located in the boundary and are the result of all the waste that has historically been deposited at that site and is currently decomposing in the landfill during the inventory year. The activity of generating the waste occurred in the past, and occurred in any of the jurisdictions that send waste to the specific landfill site. Site specific landfill emissions are only reported as an informational item in this document because if they were included in regional totals, there would be a double-counting of emissions from the waste sector due to combining of the backward-looking and forward-looking emissions that would distort the presentation of an annual emissions estimate. It was decided to include the forward-looking emissions from waste generation as they are emissions associated with the inventory year activity and to disclose the backward-looking landfill emission as an informational item only because it is related to prior year waste generation before the inventory year. The discussion below relates only to the region's *waste generation* during 2005.

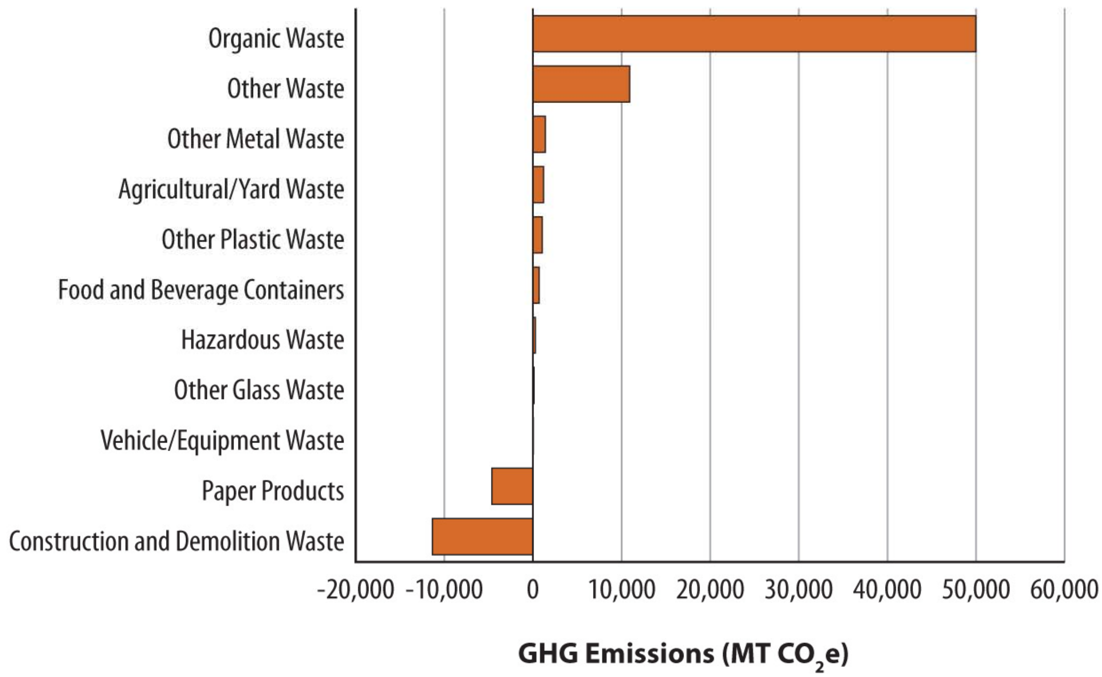
GHG emissions due to solid waste generated within the region in 2005 were 49,667 MT $CO_2e$ and account for approximately 0.8% of total regional emissions. GHG emissions due to waste generated in the region are fugitive emissions of $CH_4$ that occur at the various receiving landfills, and are considered an indirect emission. The materials disposed of in the region are recycled, composted, placed in a landfill, or combusted for energy at the Covanta Facility on Fink Road. The emissions calculated here include those that result only from the decomposition of waste placed in a landfill. Energy that is produced by combusting waste at the Covanta facility is sold to PG&E. Associated GHG emissions are captured in the Building Energy sector and are lower (on a per kwh basis) than GHG emissions associated with the burning of fossil fuels to produce equivalent amounts of electricity. Tons of waste of each type generated in the region in 2005 are shown in Table 2-7. Regional GHG emissions that result from the landfilling of each type of waste are shown in Figure 2-7 (California Department of Resources Recycling and Recovery 2012a and 2012b)[6].

**Table 2-7. Waste Generation by Waste Type (Tons)**

| Waste Type | Tonnage by Waste Type (Short Tons) |
|---|---|
| Agricultural/Yard Waste | 85,201 |
| Food and Beverage Containers | 29,971 |
| Other Waste | 14,922 |
| Construction and Demolition Waste | 82,805 |
| Other Plastic Waste | 44,885 |
| Other Glass Waste | 4,810 |
| Organic Waste | 105,979 |
| Hazardous Waste | 374 |
| Paper Products | 177,784 |
| Other Metal Waste | 13,507 |
| Vehicle/Equipment Waste | 1,564 |
| Total | 561,801 |
| Source: California Department of Resources Recycling and Recovery 2012a and 2012b | |

[6] All data related to waste generation in this document was obtained through CalRecycle which tracks waste data across the state. Individual local waste haulers may have more detailed and often more accurate data for waste generation amounts and profiles for a specific community. Data collection from all individual waste service providers was beyond the scope of this regional effort.

**Figure 2-7. Regional GHG Emissions by Waste Type (MT $CO_2$e)**




Waste generated in the region is either diverted (through recycling, composting, etc.) or transported to one of 16 different landfills located throughout the state (California Department of Resources Recycling and Recovery2012a). Much of the waste generated in the county is exported to landfills outside the county. According to CalRecycle, in 2005, the region exported 50%-75% of the waste generated to landfills outside of the county border, depending on the jurisdiction. As such, the majority of these emissions will not occur within the county, but the county is responsible for creating this waste during the inventory year.

In 2005, the percentage of waste diverted from landfills in the county was between 48%-61%, depending on the jurisdiction (California Department of Resources Recycling and Recovery 2012b). The state average in 2005 was 52%.

# Water

The majority of water demand in Stanislaus County is met with supplies from local groundwater and surface water including the Tuolumne River. The Oak Flat Water District, servicing the West Side Area receives State Water Project deliveries. Table 2-8 and Figure 2-8 shows the total amount of water consumed in the region in 2005 by end user. Table 2-9 shows the various water sources for the region and the associated energy of each.

**Table 2-8. Water Consumption by End User Sector in 2005 (Agriculture, Commercial/Industrial, Residential)**

| End Use | Water Consumption (Acre-feet/year) |
|---|---|
| Residential | 142,258 |
| Commercial/Industrial | 206,073 |
| Agricultural | 1,284,759 |
| Total | 1,633,089 |
| Source: Individual jurisdiction Urban Water Management Plans, Stanislaus Local Agency Formation Commission 2011, and United States Geological Survey 2009 | |

**Figure 2-8. Water Consumption by End User Sector in 2005 (Agriculture, Commercial/Industrial, Residential)**

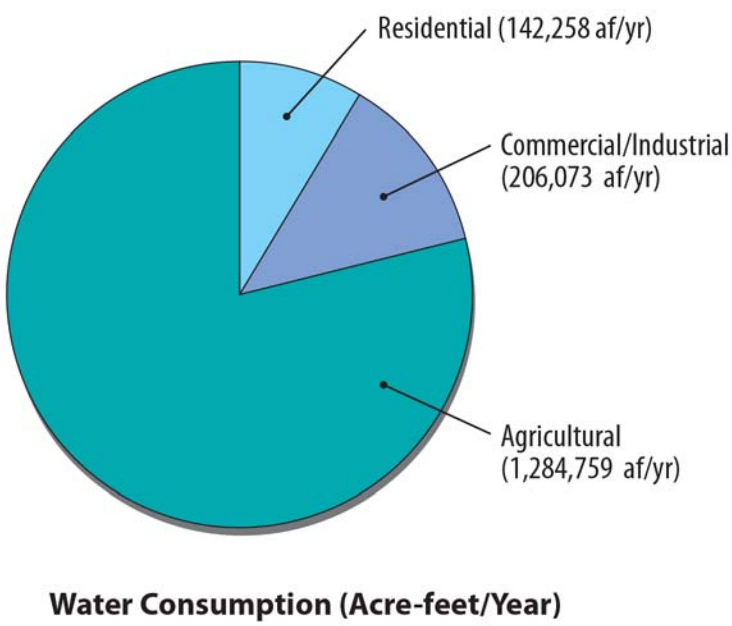



**Table 2-9. Water Sources for the Region and Associated Energy Intensity (kwh/MG)**

| Water Source | Energy Intensity (kWh/Million Gallon) |
|---|---|
| Ground Water—San Joaquin River Basin | 896 |
| Surface Water—State Water Project to the San Joaquin Valley | 1,510 |
| Source: California Air Pollution Control Officers Association 2010 | |

GHG emissions associated with water consumption are due to electricity use for water supply and conveyance (i.e., energy used to bring water to the region from other areas or energy consumed to pump water locally), electricity use for water treatment, and water distribution (i.e., energy used to move water within the region from treatment facilities to end users). Energy associated with pumping, treatment and local distribution are accounted for in the building energy sector. Only the GHG emissions related to conveying water to the county are reported in this section.

GHG emissions related to water consumption accounted for approximately 0.5% of the region's total emissions in 2005. The term "water consumption" as used in this section includes the following indirect emissions by activity: Emissions due to water consumed by residential, commercial/industrial, and agricultural end users in the region are included and were calculated based on information in Urban Water Management Plans (UWMP) in the county.

# Wastewater

GHG emissions result from two activities associated with the treatment of commercial/industrial and domestic wastewater: 1) energy consumed to power the treatment facilities and 2) fugitive emissions of $CH_4$ and $N_2O$ that occur during the chemical and biological degradation of the waste. Local governments often own and operate wastewater treatment plants (WWTPs) and thus the GHG emissions associated with a specific plant, regardless of the population it serves, are captured in a jurisdiction's municipal GHG inventory. Because some jurisdictions do not own and operate WWTPs and rely on a plant operated by a neighboring jurisdiction and because the activity of *generating* wastewater occurs within the physical boundary of the jurisdiction, these GHG emissions are also captured in the community inventory presented in this report

GHG emissions due to the treatment of wastewater generated by residents, businesses and facilities in the region account for approximately 0.3% of total regional GHG emissions in 2005 (Table 2-1 and Figure 2-1). The majority of the region's residents and businesses are served by 8 WWTPs located within the boundary of this inventory. GHG emissions that result from electricity and/or natural gas used to power the facilities are classified as indirect emissions and are included in the inventory in the building energy sector. Fugitive emissions of $CH_4$ and $N_2O$ that result from the treatment and breakdown of waste in the facility are classified as direct emissions if occurring at a plant within the inventory boundary and indirect emissions if the receiving plant is located outside of the inventory boundary. GHG emissions associated with the treatment and breakdown of waste can vary by a large amount from plant to plant, depending on the technology in place at the plant and the presence or absence of anaerobic or facultative lagoons, and not necessarily on the amount of wastewater treated at the plant or the size of the population it serves. Thus, WWTPs that serve small rural communities may produce more emissions than large plants serving many times more people.

To estimate GHG emissions due to wastewater generated within the region, per capita GHG emissions factors were developed for each WWTP using information as reported in the jurisdictions' municipal GHG inventories. Plant specific factors were then applied to populations with an adjustment for commercial and industrial activity per the LGOP. Four of the eight WWTPs located in the region capture and flare the fugitive emissions (biogas) onsite; the other four facilities do not capture the biogas. Emissions from flared methane and methane used as fuel are not counted towards total emissions as they are considered to be equivalent to the gases produced from natural decomposition processes.[7]

[7] Modesto Municipal Inventory

# Refrigerants/High GWP Gases

Refrigerants often contain greenhouse gases. Direct release of these compounds through leaks or during maintenance of the equipment that use these compounds is a direct GHG emission. Total emissions from refrigerants and other high GWP gases were 364,473 MT $CO_2e$ and account for approximately 6% of total regional GHG emissions in 2005. Refrigerant emissions also account for approximately 3% of California's statewide GHG emissions (California Air Resources Board 2010b).

High-GWP gases are emitted from residential and commercial/industrial stationary refrigeration and air-conditioning equipment. High-GWP refrigerants include chlorofluorocarbons (CFCs), HCFCs, and HFCs. These gases are regulated under the Montreal Protocol and the Kyoto Protocol. Each of these refrigerants has a very high global warming potential, ranging between 500 and 10,000 times more potent than $CO_2$ (California Air Resources Board 2009a). Refrigerant uses are categorized by CARB accordingly:

- *Large commercial refrigeration* includes refrigerated equipment found in supermarkets, large grocery stores, and other retail food establishments.
- *Small commercial refrigeration* includes stand-alone display cases, small walk-in cold rooms, and other small refrigeration equipment used primarily in convenience stores, small grocery stores, pharmacies, and restaurants.
- *Large commercial AC* includes centrifugal chillers and packaged chillers used for comfort cooling in non-residential commercial buildings, while *small commercial AC* includes unitary AC systems used for commercial building comfort cooling.
- *Residential AC and refrigeration* include packaged AC units and refrigerator-freezers used in households (California Air Resources Board 2009a).

Refrigerant emissions for the region were calculated using statewide emissions published by CARB and scaled to the local level using household population and commercial/industrial natural gas consumption data.

# Chapter 3
# Methods

This section describes data sources and methods used to estimate GHG emissions from all sectors for the region.

Double counting of GHG emissions would result in emissions from a specific source being attributed to more than one sector, which would result in an overestimate of total GHG emissions. Careful attention was paid to the development of each sector's emissions estimates to ensure that double counting of emissions did not occur.

## Agriculture

### What the Sector Includes

This sector includes emissions from agricultural activities associated with the combustion of fossil fuels in agricultural equipment, fugitive emissions of methane and nitrous oxide from manure management, fugitive emissions of methane from enteric fermentation, fugitive emissions of nitrous oxide from fertilizer use, and pesticide related GHG emissions.

### Methodology

#### Fuel Combustion Emissions from Agricultural Vehicles

Agricultural vehicles include tractors, pumps, small farm equipment, and other vehicles used for agricultural purposes. Emissions from agricultural vehicles were calculated using CARB's OFFROAD2007 model. The OFFROAD2007 model estimates emissions at the county level for multiple equipment and vehicle types.

#### Emissions from Manure Management, Enteric Fermentation, and Fertilizer Use

To estimate emissions in these agricultural sub-sectors, populations in various livestock categories and acres of agricultural land types within the region were obtained from the USDA Agriculture Census for 2005. This data includes the population of milk cows, beef cows, other cattle, hogs and pigs, poultry, sheep, lambs, and goats, as well as amounts and types of fertilizer application for each U.S. county for 2002 and 2007 (U.S. Department of Agriculture 2007). A linear extrapolation was used to estimate 2005 population data and fertilizer acreage. Manure management and enteric fermentation emissions were calculated using livestock population numbers and standard emissions factors used in the California state GHG inventory and developed by CARB (2010).

Emissions resulting from fertilizer use were calculated using the number of acres treated with fertilizers found in the USDA's Agriculture Census in conjunction with CARB equations and protocols for estimating direct and indirect $N_2O$ emissions from fertilizer application (U.S. Department of Agriculture 2007; California Air Resources Board 2011a).

Pesticide related emissions were estimated using acres of each crop type and the corresponding pesticide carbon intensity factors, and pesticide application rates from the California Pesticide Use Report (PUR) dataset, collected and managed by the California Department of Pesticide Regulation (Pesticide Action Network 2010)[8].

## Data Sources

U.S. Department of Agriculture (USDA). 2007. http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/California/

California Air Resources Board. 2011a. California Greenhouse Gas Inventory Data 2000 to 2009 and Technical Support Document. http://www.arb.ca.gov/cc/inventory/data/data.htm

Pesticide Action Network. 2010. Available: http://www.pesticideinfo.org/DCo.jsp?cok=50

# Building Energy

## What the Sector Includes

Building energy emissions include both direct emissions from onsite natural gas consumption (heating and cooking) and indirect emissions from electricity consumption. This sector captures both residential and commercial/industrial buildings or facilities. Indirect emissions from electricity consumption occur as a result of combustion of fossil fuels at power plants, although the activity of using electricity occurs (e.g., lighting or air conditioning) within the inventory boundary.

## Methodology

Electricity and natural gas usage data (aggregated by end user categories) was collected from the utilities serving the region. These utilities include: MID, PG&E, and TID. GHG emissions due to electricity use were calculated by applying utility and year-specific $CO_2$ emission factors (MT $CO_2e$/MWH) to the total electricity consumption. $CO_2$ electricity emission factors for MID and PG&E were taken from Public Utility Protocol Reports[9] (these utilities publicly report their emissions to the California Climate Action Registry), while the $CO_2$ electricity emission factor for TID was provided by TID. Weighted averages of the emission factors were calculated for cities that receive electricity from more than one utility. Electricity emission factors for $CH_4$ and $N_2O$ were taken from on E-Grid (U.S. Environmental Protection Agency 2010b) values for California and are identical for all three utilities. TID and MID confirmed that no direct access customers are present within their service areas. Electricity consumption data as provided by PG&E accounts for direct access customers within their service area.

Natural gas is provided to the county by PG&E. Natural gas consumption by end user category for the whole region in 2005 was provided by PG&E. GHG emissions due to natural gas consumption were estimated by multiplying natural gas consumption (therms) by the natural gas emission

[8] Original source for all pesticide use data used by PAN is the California Pesticide Use Report (PUR) dataset, collected and managed by the California Department of Pesticide Regulation.

[9] California Climate Action Registry Public Reports: < http://www.climateregistry.org/>

factors for $CO_2$, $CH_4$, and $N_2O$ from the Climate Registry General Reporting Protocol version 3.1 (California Climate Action Registry 2009).

## Data Sources

- Electricity consumption for the region by end user category and 2005 carbon intensity of electricity (residential, commercial, industrial) for 2005—TID
- Electricity consumption for the region by end user category and 2005 carbon intensity of electricity (residential, commercial, industrial) for 2005—MID
- Electricity and natural gas consumption for the region by end user category and 2005 carbon intensity of electricity (residential, commercial, industrial) for 2005—PG&E
- $CO_2$, $CH_4$ and $N_2O$ emission factors for natural gas combustion—California Climate Action Registry General Reporting Protocol v. 3.1

# Landfill Sites

## What the Sector Includes

This sector includes $CH_4$ emissions from solid waste that was *already in place* during the inventory year 2005 in landfill sites in the county. The waste that is in place in these landfills may have been generated by many jurisdictions over many years and the methane that is physically released in a given year is the combination of decomposing waste from many years in the past. Landfill emission were quantified for 2005 but were excluded from the regional GHG inventory because the emissions from waste generation were considered more appropriate to include in the regional total as they are tied to waste generating activity that occurred in 2005 versus the landfill emissions which are tied to prior year historical waste generation. Per the LGOP, landfill emissions, for landfills owned and operated by a jurisdiction, should be included in a municipal inventory as they are under the operational control of the jurisdiction. Emissions associated with the three landfills located in the unincorporated county area (Bonzi, Fink Road, and Geer Road) were not captured in the municipal inventories and are included here as an informational item only.

## Methodology

Emissions resulting from the decomposition of waste in place at regional landfills were modeled using CARB's landfill emissions tool (California Air Resources Board 2011b). Staff reports from CEC and CARB were used to determine the year in which the landfills opened and the waste in place at interim years (California Energy Commission 2002; California Air Resources Board 2009b). Composting facilities in the county were not analyzed for GHG emissions because of the biogenic nature of compost pile emissions (U.S. Environmental Protection Agency 2010a). The landfill emissions tool requires an annual waste deposition as well as daily cover and climate conditions at the landfill to generate annual $CO_2$ and $CH_4$ emissions for each year that waste is present in the landfill. An assumed landfill gas capture rate of 75% was applied to $CH_4$ emissions from 2005 at each landfill. $CO_2$ emissions from landfills are considered biogenic and were not included in this analysis.

## Data Sources

- CEC Staff Report 500-02-041V1. September 2002. Landfill Gas to Energy Potential in California.
- CARB. Stationary Source Division. May 2009. Initial Statement of Reasons for the Proposed Regulation to Reduce Methane Emissions from Municipal Solid Waste Landfills.
- CARB FOD Landfill Emissions Tool

# Off-Road Transportation

## What the Sector Includes

This sector includes emissions due to the burning of fuel by all types of off-road vehicles and equipment operating in the county including but not limited to residential (e.g., lawn and garden), commercial/industrial (e.g., transportation refrigeration units, construction), oil, gas and mining equipment, pleasure craft and recreational vehicles, and portable pumps and generators.

## Methodology

Emissions from off-road vehicles in the county were estimated using CARB's OFFROAD 2007 model (California Air Resources Board 2007). The OFFROAD model provides the annual activity level (hours of operation per year or gallons of fuel consumed per year) and type of fuel consumed for a wide variety of off-road vehicle and equipment categories. Outputs are provided at the county level. The fuel consumed was summed for each equipment and vehicle category and multiplied by corresponding fuel emission factors from the California Climate Action Reserve (2009) General Reporting Protocol v 3.1. The CCAR emission factors relate the amount of $CO_2$, $CH_4$, and $N_2O$ emitted per gallon of gasoline, diesel, or liquefied propane consumed.

## Data Sources

- California Climate ActionRegistry General Reporting Protocol v 3.1. January 2009
- CARB's OFFROAD 2007 model
- Regional socioeconomic data (Table ES-2)

# On-Road Transportation

## What the Sector Includes

This sector includes emissions from on-road transportation in the region. Emissions from this sector are due to the combustion of fossil fuels (such as diesel and gasoline) used to power all on-road vehicles (e.g., light and medium duty autos, medium and heavy duty trucks, buses, and motorcycles).

## Methodology

Traffic modeling was conducted for the region using the StanCOG Travel Demand Model for the year 2005. This same model, and all underlying assumptions and inputs, will also be used for all SB 375 Planning in the region. The StanCOG model runs were performed by traffic analysts at Fehr and Peers.

$CO_2$ emissions from on-road vehicles were estimated using VMT data as output by the StanCOG Travel Demand Model and emission factors (grams $CO_2$/mile) by speed bin from the CT-EMFAC model (California Department of Transportation 2007). The StanCOG travel demand model includes multiple vehicle trip types such as home-based work, shopping and recreational trips, and non-home based trips. For this analysis, VMT was estimated for the region using the accounting guidelines set forth by the SB 375 Regional Targets Advisory Committee. VMT for the county is defined as:

1. All County-County (CC-CC) trips: All trips that travel from one part of the County to another part of the county area.
2. One-half of County-External (CC-EC) trips: One-half of the trips with an origin in the county and a destination outside Stanislaus County.
3. One-half of External-County (EC-CC) trips: One-half of the trips with an origin outside Stanislaus County and a destination in the county.

$CH_4$ and $N_2O$ emissions were calculated using the VMT data and emission factors (grams $CH_4$/mile or grams $N_2O$ /mile) as provided by the EMFAC2011 model (California Air Resources Board 2011c). The EMFAC2011 model was also used to determine the vehicle category profile in Stanislaus County. The vehicle category distribution indicates the vehicle types in the county such as light duty autos, light duty trucks, heavy duty trucks and buses. The proportions of vehicle types were multiplied by total VMT and then by the corresponding vehicle type emission factor from the EPA to estimate $CH_4$ and $N_2O$ emissions.

## Data Sources

- StanCOG TDM outputs for the region
- *CT EMFAC model
- U.S. Environmental Protection Agency. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005, EPA 430-R-07-002, Annex 3.2, (April 2007)

# Refrigerants/ High GWP gases

## What the Sector Includes

Refrigerant emissions are produced by air conditioning use and other refrigerant applications in commercial/industrial and residential buildings.

## Methodology

ICF used a top down approach to estimate refrigerant emissions, using state-level data provided by CARB (California Energy Commission 2006). Residential refrigerant emissions were estimated by scaling state-level residential refrigerant emissions to the region based on the number of households.

Commercial/industrial refrigerant emissions were determined by scaling state level commercial refrigerant use to the region based on commercial natural gas consumption. The CEC has determined a correlation between the commercial natural gas use and commercial refrigerant emissions (California Energy Commission n.d.).

## Data Sources

- California GHG Emission Inventory 2000–2009 (California Air Resources Board 2012)
- Natural gas consumption by end user category (residential, commercial, industrial) for 2005—PG&E
- Regional socioeconomic data (Table ES-2)

# Stationary Sources

## What the Sector Includes

This sector includes emissions from stationary combustion of fossil fuels (except natural gas, which is included in the building energy use sector), and industrial process emissions.

## Methodology

Emissions resulting from the combustion of fuels at stationary sources were estimated using fuel consumption information for permitted sources provided by the SJVAPCD (Leland Villalvazo, SJVAPCD, pers. comm.). Data from the SJVAPCD included a list of fuel types and the amount consumed and captures those sources emitting greater than 25,000 MT CO2e per year and are required to report under California's Mandatory Reporting Rule. Fuel consumption quantities were multiplied by corresponding carbon intensity fuel emission factors from the Climate Registry to obtain GHG emissions.

## Data Sources

- California Climate Action Registry General Reporting Protocol v 3.1 (January 2009)
- SJVAPCD, personal communication Leland Villalvazo

# Waste Generation

## What the Sector Includes

This sector includes methane emissions that will result from the decomposition of waste in landfills, from waste that was generated by in the region in 2005. These emissions are also known as the "future methane commitment" of the waste. $CO_2$ emissions due to waste generated in 2005 are not considered in this analysis because they are considered biogenic in origin.

## Methodology

Emissions from waste generation were calculated using publicly available data from CalRecycle and emission factors based on EPA's Waste Reduction Model (WARM). ICF altered emission factors from WARM to discount emissions from waste collection vehicles, and recycling related emissions, as these are life cycles and should not be included in a community GHG inventory. Waste in the region is collected by the City of Modesto and SCRSWPA who is responsible for waste collection in the cities and unincorporated areas in Stanislaus County except Modesto.

A 1999 Stanislaus County waste profile from CalRecycle was used to estimate the total tons of each type of waste generated in the region in 2005 (California Department of Resources Recycling and Recovery 2012a and 2012b). Total waste tonnage in 2009 was obtained for Modesto and SCRSWPA, also from CalRecycle. For each material type such as used oil, paint, or lumber, the modified EPA WARM emission factor that relating $CO_2e$ emissions per ton of waste were applied. The amount of each material type was multiplied by the material's corresponding emission factors to find emissions by material type, and the emissions from all material types were summed to estimate total emissions.

## Data Sources

- California Department of Resources Recycling and Recovery (CalRecycle)
- U.S. EPA's Waste Reduction Model (WARM).

# Wastewater Treatment

## What the sector includes

These emissions are associated with the treatment of industrial, residential, and commercial wastewater produced by each participating jurisdiction. These emissions result from fugitive emissions of $CH_4$ and $N_2O$ that occur during the chemical and biological breakdown of wastewater at the WWTP.

## Methodology

Fugitive and process emissions that result from the treatment of wastewater were estimated using each of the County's jurisdiction's municipal GHG inventories. The municipal inventories were prepared prior to this analysis and quantify the GHG emissions resulting from municipal operations, including direct and indirect emissions from individual wastewater treatment plants. For this analysis, ICF used the following data from the municipal inventories: WWTP service population and process emissions (direct emissions). In addition, ICF made several adjustments to parameters in the municipal inventories including the following changes: emissions resulting from electricity consumption at the WWTPs were omitted to avoid overlap with the building energy sector, methane emissions at aerobic plants were omitted using LGOP guidance, $N_2O$ process emissions were added where necessary, and service populations were changed using an adjustment factor (from LGOP) to include previously unaccounted for industrial wastewater.

Per capita values for wastewater emissions were developed using the ICF-adjusted municipal inventory wastewater emissions and the WTTP service populations. To determine wastewater treatment plant related emissions, the per capita values were applied to the population that resides within the county boundary only.

Emission from septic systems were estimated and added to WWTP emissions. The amount of people using septic systems was estimated using information in communities' General Plans. A per capita septic system emission factor from the Local Governments Operations Protocol was used to determine $CH_4$ and $N_2O$ emissions resulting from septic system use (Local Governments Operations Protocol 2010).

## Data Sources

- Municipal GHG Inventories—all jurisdictions (available upon request from the individual cities in Stanislaus County)
- CARB. May 2010. LGOP for the quantification and reporting of greenhouse gas emissions inventories. V 1.1.

# Water

## What the sector includes

Emissions from water consumption were estimated based on the energy associated with the distribution of water to jurisdictions in the region.

## Methodology

Emissions from the conveyance of water (i.e., the transport of water supplies from outside the inventory boundary to within the boundary) were calculated using information about total water consumption and water sources from each of the County jurisdiction's UWMPs. GHG emissions associated with the energy required to treat and locally distribute water that is supplied from other areas are captured in the building energy sector. The UWMPs for some jurisdictions were unavailable, and, in these cases, water consumption data was taken from Municipal Service Reviews (MSR) conducted by the LAFCO (Stanislaus Local Agency Formation Commission 2011). Water consumption data for the unincorporated county was estimated using 2005 data from the United States Geological Survey (USGS) (2009).

In some instances, water consumption was not available for the baseline inventory year (2005). In these cases, water consumption was scaled from an alternative year to the baseline year using population. This method assumes that water consumption changes proportionally with population. In other cases, water consumption by end use (residential, commercial, etc.) was not available. It was assumed that jurisdictions where consumption by end use was unavailable have average proportions of end use consumption as cities with similar population sizes. Alternately, end use consumption was determined using the proportions of commercial/industrial and residential acres for jurisdictions with available acreage data.

Water consumption data from the sources of water in the county, groundwater, surface water, and recycled water, were taken from the UWMPs, MSRs, and USGS. The electricity required to convey water from each source was estimated using electricity intensity factors from CAPCOA (CAPCOA 2010). Electricity consumption required for water conveyance to each jurisdiction was multiplied by carbon intensity factors from the associated utilities to arrive at GHG emissions resulting from water conveyance.

# Data Sources

- CAPCOA 2010
- Municipal Service Reviews from the LAFCO
- UWMPs from the jurisdictions that have a publicly available UWMP
- USGS Water Study

# Chapter 4
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# Personal Communications

Villalvazo, Leland. Supervising Air Quality Specialist. San Joaquin Valley Air Pollution Control District. February 2012—email with Lindsey McAlpine of ICF International regarding amount of fuel burnt at permitted stationary sources in each jurisdiction.