City of South San Francisco

2005 Community-Wide Greenhouse Gas Emissions Inventory

FINAL

JANUARY 2011

Credits and Acknowledgements

City of South San Francisco

Steve Carlson, Senior Planner
Susan McCue, Sustainability Manager
Andy Tan, Transportation Engineer
Susan Kennedy, Assistant to the City Manager

PG&E Contributors

John Joseph, Green Communities and Innovator Pilots

This report was prepared by:

PMC®

500 12th Street, Suite 240
Oakland, CA 94607
www.pmcworld.com

With assistance from:

Fehr & Peers
Transportation Consultants

332 Pine St., 4th Floor
San Francisco, CA 94104
www.fehrandpeers.com

Credits and Acknowledgements

Acknowledgement and Disclaimer

U.S. Department of Energy

This material is based upon work supported by the Department of Energy under Award Number DE-SC0002494.

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Table of Contents

Table of Contents

Appendices

List of Tables

List of Figures

Table of Contents

Executive Summary

The Community-Wide Baseline Greenhouse Gas (GHG) Emissions Inventory (Inventory) is part of a continuing effort by the City of South San Francisco (City) to identify and assess the sources and quantities of GHGs within the city. The community-wide inventory complements the City's Government Operations GHG Emissions Inventory prepared in 2008. This Inventory identifies the major sources of GHG emissions within the city and provides a baseline against which future progress can be measured.[1]

Specifically, this Inventory does the following:

- Calculates GHGs from community-wide activities within the City's jurisdictional boundary in calendar year 2005;[2]
- Provides City decision-makers and the community with adequate information to inform policy decisions; and
- Forecasts how emissions will grow in the community if no behavioral changes are made.

The Inventory represents a key first step in the City's efforts to improve air quality, enhance sustainability, and ensure the safety and comfort of South San Francisco's residents for generations to come. In addition, this Inventory allows the City to quantitatively track and take credit for its numerous efforts related to energy efficiency and the mitigation of climate change. The Inventory was accepted by City Council on January 12, 2011.

WHAT ARE GREENHOUSE GAS EMISSIONS?

Gases that trap heat in the earth's atmosphere are called greenhouse gases, or GHGs. Greenhouse gases include carbon dioxide, methane, nitrous oxide, and fluorinated gases. While many of these gases occur naturally in the atmosphere, modern human activity has led to a steep increase in the amount of GHGs released into the atmosphere over the last 100 years. Collectively, these gases intensify the natural greenhouse effect, thus causing global average surface temperatures to rise, which in turn affects global climate patterns. GHGs are often quantified in terms of CO_2 equivalent, or CO_2e, a unit of measurement that equalizes the potency of GHGs.

Source: Intergovernmental Panel on Climate Change (IPCC), 2007

---

[1] In this report, the term "city" refers to the area inside the jurisdictional boundary of the City of South San Francisco.

[2] "Community-wide" or "community" refers to all activities within the city (as defined above), including those from businesses, industrial processes, residents, vehicles, and City government operations.

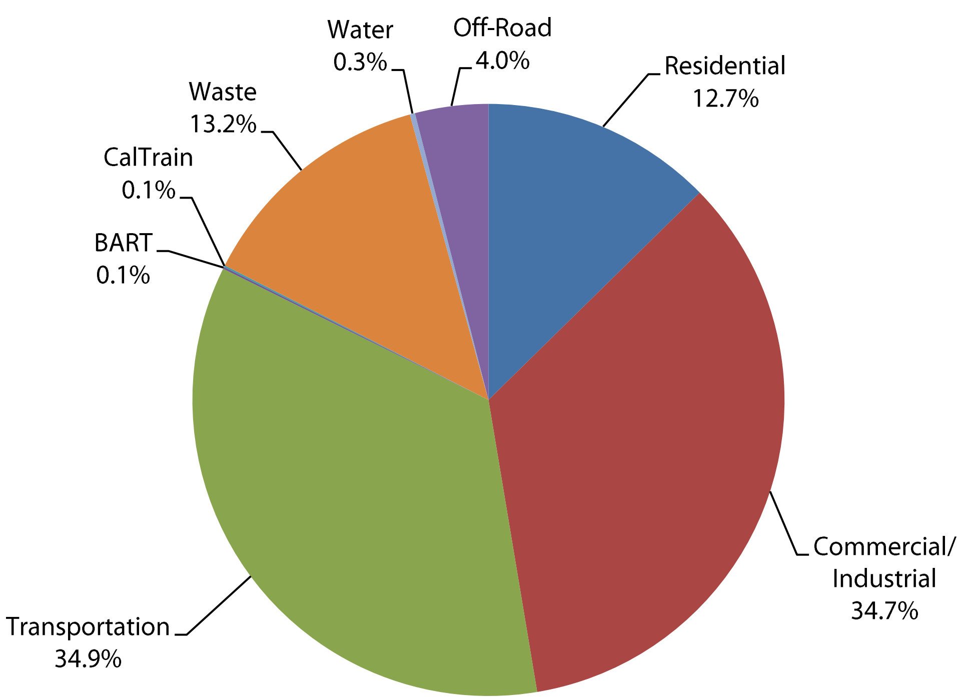
[2] "Community-wide" or "community" refers to all activities within the city (as defined above), including those from businesses, industrial processes, residents, vehicles, and City government operations.

EXECUTIVE SUMMARY

COMMUNITY-WIDE GHG INVENTORY RESULTS

The City of South San Francisco emitted approximately 560,414 metric tons of carbon dioxide equivalent ($MTCO_2e$) in the baseline year 2005. As shown in **Figure ES-1**, the transportation and nonresidential sectors are the largest contributors of emissions. The transportation sector produced approximately 195,788 $MTCO_2e$, representing 34.9% of total emissions. Emissions from the nonresidential sector accounted for 34.7% of total emissions, approximately 194,562 $MTCO_2e$. The residential sector contributed 12.7% of total emissions (70,892 $MTCO_2e$), and emissions from solid waste comprised 13.2% of the total (74,073 $MTCO_2e$). The Inventory includes trips to and from South San Francisco on BART and Caltrain, each contributing 0.1% of total emissions, or 612 and 508 $MTCO_2e$, respectively. Emissions from electricity use to deliver and treat water accounted for 0.3%, or 1,578 $MTCO_2e$, while off-road lawn, garden, and construction equipment use produced 4.0% of emissions, or 22,399 $MTCO_2e$. Stationary source emissions are identified and quantified in theInventory but are not included as part of the community-wide inventory results in **Figure ES-1** due to the City's limited control over these emissions.

Figure ES-1: Community GHG Emissions by Sector



DATA LIMITATIONS

The Inventory was developed with the best-available tools, data, and methodology; however, as with any GHG inventory, there are limitations to representing all sources of emissions in a local jurisdiction. The main factors that limit GHG inventories include (1) data availability, (2) privacy laws, and (3) a lack of a reasonable methodology. Lack of available data prevented the calculation of emissions from the following sources:

- Off-road vehicles and equipment (aside from lawn, garden, and construction equipment)
- Rail (aside from Caltrain and BART)
- Propane use
- Refrigerants

WHAT'S THE DIFFERENCE BETWEEN AN EMISSIONS INVENTORY AND A CARBON FOOTPRINT?

An emissions inventory incorporates GHG emissions that occur within the boundaries of a city based on standard protocol and industry standards. A carbon footprint, on the other hand, encompasses GHG emissions from the entire life cycle of a product, service, or activity. At this time, it is difficult to accurately estimate the community's comprehensive carbon footprint. However, individuals may reduce their carbon footprint by buying locally produced foods and goods, reducing packaging, and other behavioral changes.

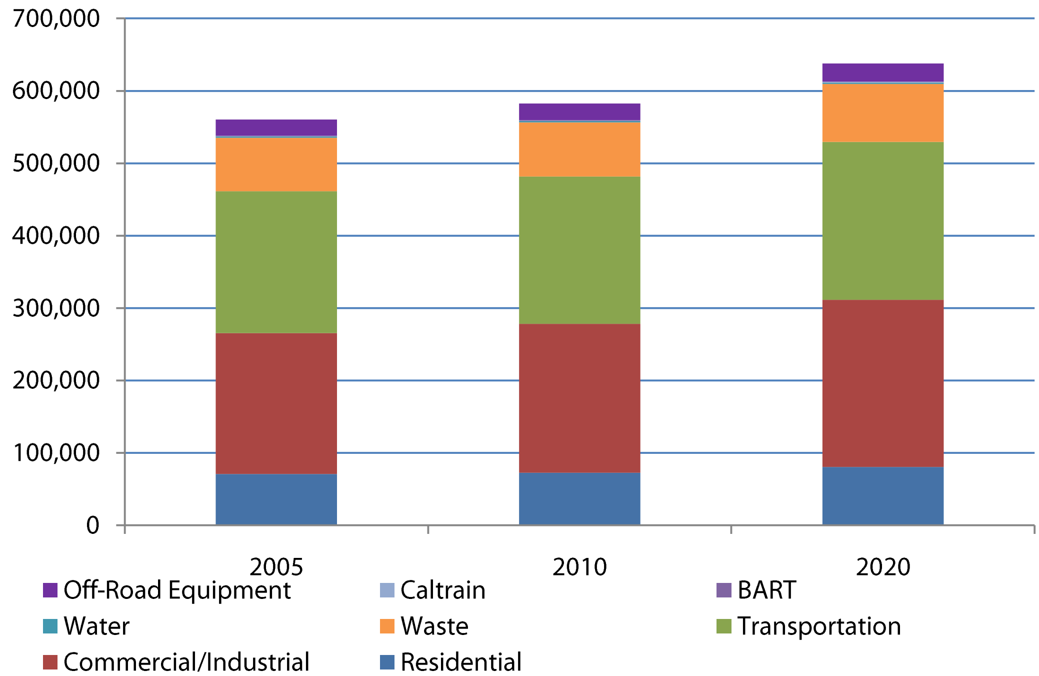
It is estimated that the sources not included in the Inventory, and explained further in this document, comprise less than 5.0% of total emissions in the city. As GHG inventories become more common, it is likely that methodology and accessibility to data will improve. The emissions identified in this report are primarily GHGs that the community has directly caused and has the ability to reduce through implementation of conservation actions, a Climate Action Plan, or corresponding efforts.

FORECAST AND NEXT STEPS

If consumption behaviors continue as indicated in 2005, GHG emissions will increase 13.8% to reach 637,852 $MTCO_2e$ by 2020. This forecast assumes business-as-usual consumption per capita, household, and service population while accounting for the population growth modeled in Association of Bay Area Governments (ABAG) 2009 Projections and job growth outlined in the South San Francisco General Plan.

EXECUTIVE SUMMARY

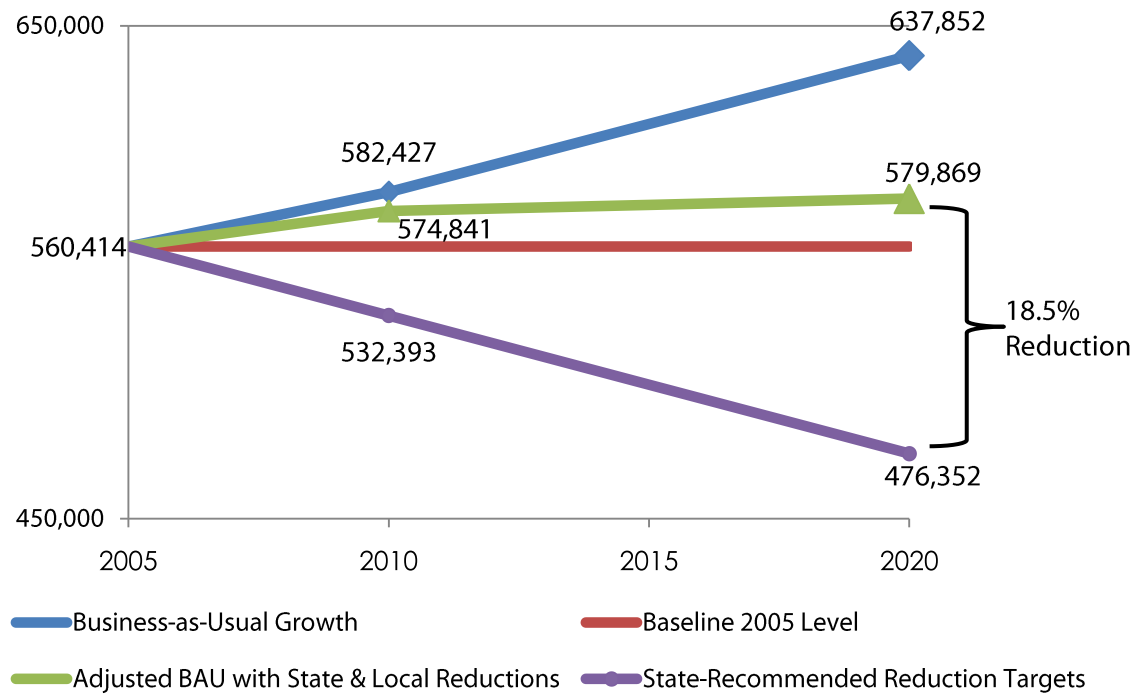
Figure ES-2: 2020 Business-As-Usual GHG Emissions Growth Forecast



The estimated 2020 business-as-usual (BAU) GHG emissions forecast was adjusted to incorporate state and federal vehicle technology, energy efficiency, and renewable electricity mandates, as well as local actions that have already been implemented to reduce GHG emissions. **Figure ES-3** compares the BAU GHG emissions forecast, the adjusted GHG emissions forecast, the baseline GHG emissions, and the potential GHG emissions reductions to achieve the City's target.

With this information, the City can make an informed determination of a reduction target. Conformance with the State of California's recommended reduction of 15% below present levels by 2020 would necessitate a 18.5% reduction below the city's adjusted growth projection (**Figure ES-3**).

Figure ES-3: Emissions Growth Forecast in Relation to State-Recommended Reduction Targets



As the City moves forward with sustainability actions and policies, including designation of an emissions reduction target, it will be important to continue identification and quantify the emissions reduction benefits of projects and policies that have been implemented since the 2005 baseline year. The benefits of existing strategies can be tallied against the Inventory to identify or credit reductions in place and to assist with selection of additional strategies to achieve the City's emissions reduction goal by 2020.

Introduction

This Inventory represents completion of the first step in the City's climate protection process. Quantifying recent-year GHG emissions is essential to establish: (1) a baseline against which to compare future changes in emission levels, and (2) an understanding of where the highest percentages of emissions are coming from and therefore the greatest opportunities for emissions reductions. This Inventory and the Government Operations GHG Emissions Inventory will provide the foundation for the City's Climate Action Plan.

This section introduces the Inventory, defines key terms used throughout the Inventory, and provides an overview of climate change science and regulation in California.

1.1 Background

In 2008, South San Francisco joined the Silicon Valley Climate Protection Partnership, a coalition of local governments from Santa Clara, San Mateo, and Santa Cruz counties and Joint Venture: Silicon Valley Network (JV:SVN). In 2008, JV:SVN contracted with ICLEI – Local Governments for Sustainability (ICLEI) to prepare a baseline GHG inventory of municipal operations for 27 local governments, including South San Francisco, utilizing standards outlined in the Local Government Operations Protocol. South San Francisco's Government Operations GHG inventory was completed in July 2009.

In August 2010, the City began the preparation of a community-wide GHG emissions inventory funded by the City's Energy Efficiency and Conservation Block Grant (EECBG) allocation from the United States Department of Energy (DOE) as part of the American Recovery and Reinvestment Act (ARRA). With the creation of a community-wide inventory, the City is embarking on an ongoing, coordinated effort to reduce GHG emissions, to improve air quality, and to reduce costs.

1.2 Climate Change Scientific Background

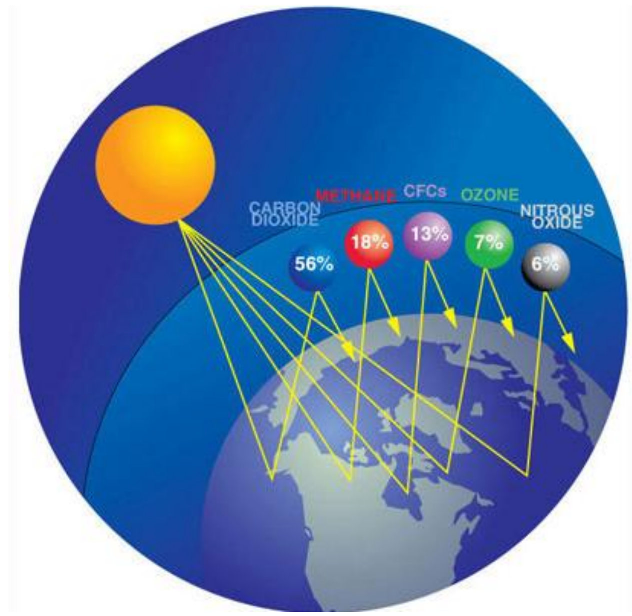
Scientific consensus holds that the world's population is releasing greenhouse gases (GHGs) faster than the earth's natural systems can absorb them. GHGs are released as byproducts of fossil fuel combustion, waste disposal, energy use, land-use changes, and other human activities. This release of gases, such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), creates a blanket around the earth that allows light to pass through but traps heat at the surface, preventing its escape into space (**Figure 1-1**). Known as the greenhouse effect, models show that this phenomenon could lead to a 2°F to 10°F temperature increase over the next 100 years. The Intergovernmental Panel on Climate Change (IPCC) warns that most of the warming observed over the last 50 years is attributable to human activities.[3]

[3] Intergovernmental Panel on Climate Change. Fourth Assessment Report, Working Group I. 2007. Climate Change 2007: The Physical Science Basis, Summary for Policy Makers.

INTRODUCTION

Although used interchangeably, there is a difference between the terms "climate change" and "global warming." According to the State of California (State), climate change refers to any long-term change in average climate conditions in a place or region, whether due to natural causes or as a result of human activity.[4] Global warming, on the other hand, is an average increase in the temperature of the atmosphere caused by increased GHG emissions from human activities.[5] The use of the term climate change is becoming more prevalent because it encompasses all changes to the climate, not just temperature. Additionally, the term climate change conveys temporality, implying that climate change can be slowed with the efforts of local, regional, state, national, and world entities.

Figure 1-1: The Greenhouse Gas Effect



Changes in the earth's temperature will have impacts for residents and businesses in South San Francisco. Some of the major impacts to the Bay Area expected to occur include the following, separated by sector:[6]

- Coastline: The Bay Area coastline could face inundation as a result of sea level rise and global warming. **Figure 1-2** shows the potential inundation level around South San Francisco in 2100, as modeled by the San Francisco Bay Conservation and Development Commission (BCDC). As temperatures rise, the ocean waters rise as well due to thermal expansion and the melting of glaciers and snowpack. The State's 2009 Climate Change Impacts Assessment (the 2009 Scenarios Project) estimates that the sea level will rise by 12 to 18 inches by 2050 and 21 to 55 inches by 2100.

---

[4] California Natural Resources Agency. 2009 California Climate Adaptation Strategy Discussion Draft. August 2009.

[5] U.S. Environmental Protection Agency, Climate Change website. http://www.epa.gov/climatechange/, accessed August 5, 2009.

[6] California Climate Change Center. Our Changing Climate: Assessing the Risks to California (2006), www.climatechange.ca.gov; Governor's Office of Planning and Research (OPR). Proposed CEQA Guideline Amendments for Greenhouse Gas Emissions. April 2009.

Figure 1-2: Anticipated Sea Level Rise Inundation by 2100

Source: BCDC 2010

- Reduced Water Supply: The 2009 Scenarios Project estimates a decrease in precipitation of 12% to 35% by 2050. Higher temperatures are also expected to increase evaporation and make for a generally drier climate. In addition, more precipitation will fall as rain rather than snow, which will cause snow to melt earlier in the year and not in the warmer, drier months when water is in higher demand.

- Public Health: Climate change could potentially threaten the health of residents of South San Francisco. Heat waves, a decline air quality, and an increase in mosquito breeding and mosquito-borne diseases are expected to have a major impact on public health. There is also expected to be an increase in allergenic plant pollen and an increase in the frequency of wildfires. The elderly, young, and other vulnerable populations will need assistance, as they will not have the resources to deal with the costs and adapt to the expected changes.

Although one city cannot resolve the issue of global climate change, local governments can make a positive impact through cumulative local action. Cities and counties have the ability to reduce GHG emissions through effective land use and transportation planning, wise waste management, and the efficient use of energy. The City can achieve multiple benefits including lower energy bills, improved air quality, economic development, reduced emissions, and better quality of life through:

- Energy efficiency in City facilities and vehicle fleet;

- Sustainable purchasing and waste reduction efforts;

- Land use and transportation planning; and

- Efficient management of water resources.

This Inventory serves as a baseline measurement for implementing and tracking the effectiveness of these efforts.

1.3 Governments and Climate Change

Federal Climate Action

The federal government has yet to enact legislation for GHG emissions reductions; however, in 2009, the United States Environmental Protection Agency (USEPA) released endangerment findings for carbon dioxide, officially bringing the enforcement capabilities of USEPA to the issue of GHG emissions. The federal government also adopted California's groundbreaking vehicle efficiency standards in 2010, creating a nationwide standard through 2016. Even without other mandates, new activity has been ushered in with the

approval of the American Reinvestment and Recovery Act (ARRA), also referred to as the federal stimulus package. Through the EECBG program, funded by ARRA, the Department of Energy is providing a total of $3.2 billion to cities and counties to reduce fossil fuel emissions; reduce total energy use; improve energy efficiency in the transportation, building, and other appropriate sectors; and create and retain jobs.[7] Using this money, jurisdictions across the United States are allocating funds to initiate climate change planning and achieve reductions in GHG emissions. In fact, this Inventory, along with several implementation projects, is funded with the City of South San Francisco's EECBG allocation.

California Climate Action

Currently, California is the 15th largest emitter in the world of GHG emissions, ultimately accounting for 2% of global emissions.[8] However, the State has been working proactively to reduce emissions. California has a long history of proven leadership in addressing these issues that spans the last 20 years. In 1988, Assembly Bill (AB) 4420 (Sher, Chapter 1506, Statutes of 1988) designated the California Energy Commission (CEC) as the lead agency for climate change issues in California.[9] Since that time, there has been steady development and adoption of initiatives to address climate change statewide. These initiatives have strengthened the ability of entities in California to engage in accurate assessment of potential contributions to climate change and the potential impacts of climate change locally and statewide. The State has created ambitious targets and regulations that will directly lead to local, regional, and statewide reductions in GHG emissions. California's efforts have earned it a role as the leader nationally and globally for climate change mitigation, adaptation, and planning strategies.

A brief history of California's landmark climate change legislation and actions is provided below.

1988 – AB 4420 (Sher, Chapter 1506, Statutes of 1988): Designated the CEC as the lead agency for climate change issues in California.

2000 – Senate Bill (SB) 1771 (Sher, Chapter 1018, Statutes of 2000): Created the California Climate Action Registry (CCAR), a nonprofit entity established to assist entities in California working to create GHG emissions baseline inventories.

2001 – SB 527 (Sher): Directed the CEC to provide specific guidance to the CCAR on issues including the development of GHG emissions protocols and the qualifications of third parties providing technical assistance and certification of inventories.

---

7 DOE 2010.

8 California Air Resources Board, CCAR, and ICLEI 2008.

9 California Energy Commission 2009.

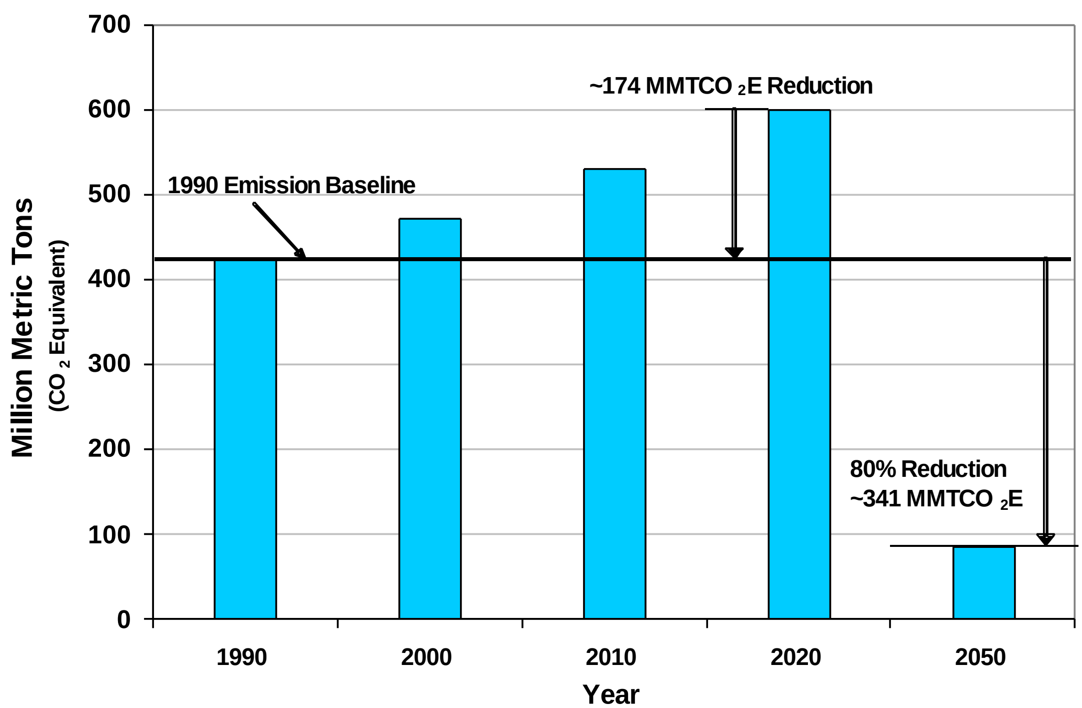
2002 – AB 1493 (Pavley, Chapter 200, Statutes of 2002): Directed the California Air Resources Board (CARB) to create regulations that would lead to reductions in GHG emissions from passenger vehicles, light-duty trucks, and noncommercial vehicles sold in California.

2005 – Executive Order (EO) S-3-05: Established progressive GHG emissions reduction targets for the state:

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

2006 – AB 32, the California Global Warming Solutions Act (Nunez): Required CARB to develop regulatory and market mechanisms that will reduce GHG emissions to 1990 levels by 2020 as shown in **Figure 1-3** below.

Figure 1-3: California Climate Change GHG Emissions and Targets



Source: California Energy Commission

2006 – SB 1368 (Perata, Chapter 598, Statutes of 2006): Established GHG emission performance standards for longer-term financial investments in base-load electricity generation to catalyze the transition to cleaner energy use.

2008 – SB 97 (Dutton, Chapter 185, Statutes of 2008): Clarified responsibilities for analyzing GHG emissions per the California Environmental Quality Act (CEQA).

2008 – AB 32 Scoping Plan: CARB approved the AB 32 Scoping Plan outlining regulatory and market mechanisms to achieve the goal of AB 32. The Scoping Plan identifies local governments as integral partners to achieve the State's goals.

2008 – SB 375 (Steinberg): Aims to reduce GHG emissions by linking transportation funding to land use planning. It requires Metropolitan Planning Organizations (MPOs) to create Sustainable Communities Strategies (SCSs) in their regional transportation plans (RTPs) for the purpose of reducing urban sprawl. Compliance is encouraged with new CEQA streamlining provisions and an allowance for an extended Regional Housing Needs Allocation (RHNA) cycle when assessments are coordinated with the regional transportation planning process.

2010 – State Resources Agency adopted guidelines developed by the Governor's Office of Planning and Research (OPR) to address climate change in CEQA documents, per SB 97.

The State is also preparing for climate change resiliency in order to adapt to the inevitable effects of climate change. In November 2008, Governor Schwarzenegger signed Executive Order S-13-08, which asked the Natural Resources Agency to identify how state agencies can respond to rising temperature, changing precipitation patterns, sea level rise, and extreme natural events. The order requires the Natural Resources Agency to develop a Climate Adaptation Strategy (CAS) to analyze climate change impacts to the state and recommend strategies to manage those threats. The Natural Resources Agency released a final draft of the CAS in December 2009. The scale and pace at which the State of California is addressing this issue necessitates that local governments accelerate efforts to combat climate change.

Bay Area Climate Action

The San Francisco Bay Area has been especially active in climate action and sustainability. On June 1, 2005, the Bay Area Air Quality Management District (BAAQMD) adopted a resolution establishing a Climate Protection Program and acknowledging the link between climate protection and air quality protection programs in the Bay Area. A central element of BAAQMD's Climate Protection Program is the integration of climate protection activities into existing district programs, including grant programs, CEQA commenting, regulations, inventory development, and outreach. In addition, the program emphasizes collaboration with ongoing climate protection efforts at the local and state level, in public education and outreach, and by offering technical assistance to cities and counties.

On June 2, 2010, BAAQMD's Board of Directors unanimously adopted new CEQA thresholds of significance and guidelines for GHG emissions. BAAQMD's CEQA Guidelines recommend air quality significance thresholds, analytical methodologies, and mitigation measures for cities and counties in the Bay Area to use when preparing air quality impact analyses under CEQA. These analyses are crucial to ensuring that new developments and improvements in the Bay Area do not adversely impact GHG emissions or the region's attainment of AB 32 targets.

BAAQMD's CEQA Guidelines include an option for completing a GHG emissions program, called a Qualified Greenhouse Gas Emissions Reduction Strategy, at the local government level. After meeting the specific criteria set forth by the district to create a strategy, future developments that are in the jurisdiction would be able to go through a streamlined environmental review process for those projects in compliance with the district's CEQA Guidelines.

This Inventory is structured to comply with the GHG quantification guidance dated May 2010 and included as part of the adopted BAAQMD CEQA Guidelines. This will allow South San Francisco to develop its Climate Action Plan as a Qualified Greenhouse Gas Emissions Reduction Strategy in the future.

In addition to BAAQMD, the Bay Area Joint Policy Committee (JPC) is working to coordinate the regional planning effort required by SB 375. The JPC is composed of the Association of Bay Area Governments (ABAG), BAAQMD, the BCDC, and the Metropolitan Transportation Commission. Among the JPC's current initiatives are focused growth, climate protection, and development of a sustainable communities strategy. The JPC serves as a coordinating body for these agencies to work together to address the challenges of climate change and other cross-agency issues.

California Local Governments and Climate Action

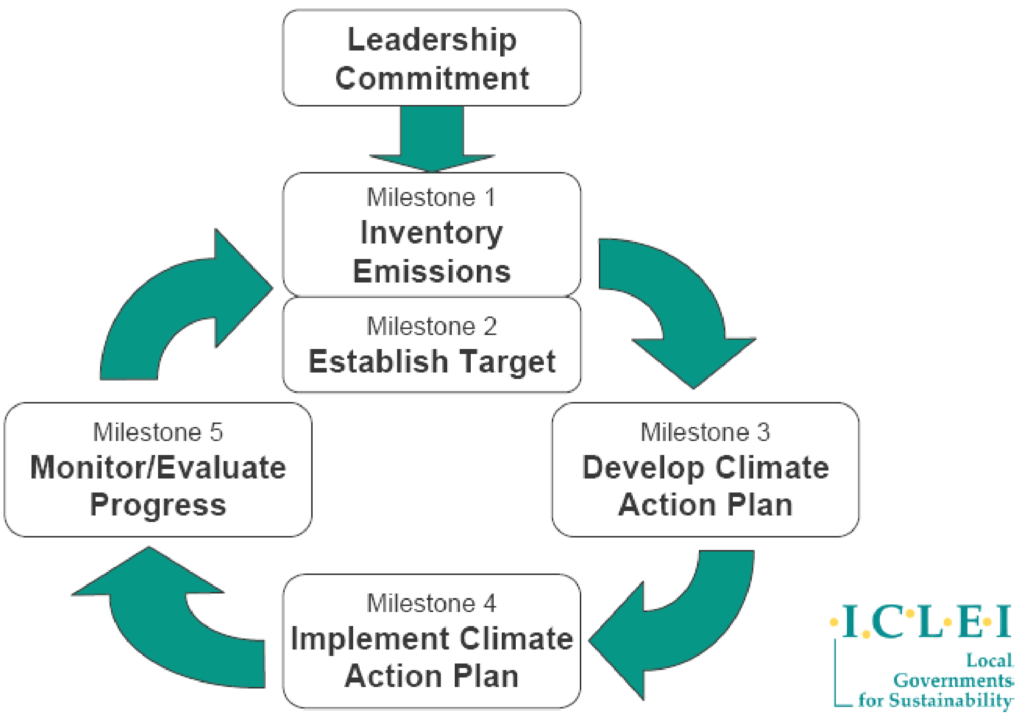
Local governments are better suited to reduce many sources of GHG emissions than larger forms of government. For instance, local governments have the most control over local land use and public transportation, which has a direct effect on transportation emissions. Local governments are now considering the greenhouse gas effect when approving or planning future developments. In California and especially the Bay Area, this process is formalized through preparation of GHG emissions baseline inventories, development and adoption of climate action plans and general plan updates to address climate change, and compliance with CEQA.

1.4 The Cities for Climate Protection Campaign

By adopting a resolution to join ICLEI – Local Governments for Sustainability and commit to ICLEI's milestones for climate change mitigation, the City of South San Francisco has joined an international movement of local governments. More than 1,000 local governments, including over 600 in the United States, have joined ICLEI's Cities for Climate Protection (CCP) campaign.

The CCP campaign provides a framework for local communities to identify and reduce GHG emissions, organized along five milestones as represented in **Figure 1-4** below.

Figure 1-4: The ICLEI Five-Milestone Process



This report represents the completion of the first CCP milestone and provides a foundation for future work to reduce GHG emissions in South San Francisco.

1.5 Local Sustainability and Climate Change Mitigation Activities

Given its size and the urban nature of the community, South San Francisco is already practicing sustainable development in a variety of ways in order to optimize use of limited resources. Notable among the City's recent programs are:[10]

Water Quality/Conservation

- Adoption of a water-efficient landscape ordinance
- Development of guidelines to "green" surface parking lots

Energy Use Reduction/Conservation

- Installation of photovoltaic (PV) systems on City-sponsored projects (Grand Oak Apartment project and Miller Ave. Parking Garage)
- Reduced permit fee for solar panel installation
- Use of energy-efficient light bulbs for City-owned rental housing

Transportation

- Transportation Demand Management (TDM) Plan requirements to reduce single-occupant vehicle trips to and from work for large employers

Recycling/Waste Reduction

- Adoption of a green food packaging ordinance
- Construction and demolition debris recycling requirements on demolition permits
- Use of recycled material content office products and kitchen utensils in City offices
- Refurbishment and reuse of street signs and traffic lights, where possible

The City will continue to build upon and expand its sustainability effort through preparation of a Climate Action Plan. The Climate Action Plan will use the results of this Inventory to calculate ways in which the City can reduce GHG emissions consistent with state-recommended targets.

---

[10] City of South San Francisco, October 2008 Update to City Council on Green Initiatives in the City of South San Francisco.

Inventory Methodology

CHAPTER 2

This section outlines the methodology used to calculate the community-wide inventory, including the data collection process, data sources, GHG emission scopes, data limitations, and means of calculation.

2.1 Baseline and Forecast Years

The City chose the year 2005 as the baseline year for the Inventory due to the availability of reliable data and consistency with the City's Government Operations Inventory and consistency with other cities in the Bay Area. The State uses 1990 as a baseline year to remain consistent with the Kyoto Protocol and because it has well-kept records of transportation trends and energy consumption. Cities and counties throughout California typically elect to use 2005 as a baseline year because of the more reliable recordkeeping from those years and because of the large amount of growth that has occurred since 1990.

This Inventory uses a forecast year of 2020 to be consistent with the State's GHG inventory forecast year and AB 32 target, both of which reference 2020.[11] Per ICLEI protocol, the City has completed an assessment of activities throughout the community consistent with BAAQMD recommendations for plan-level GHG quantification.[12]

This Inventory will provide the basis for future policy development, the quantification of emissions reductions associated with proposed measures, and the establishment of an informed emissions reduction target.

2.2 Data Collection and Methodology

Creating the community emissions inventory required the collection of information from a variety of sources. Sources for community data included the Pacific Gas and Electric Company (PG&E), Bay Area Rapid Transit (BART), Caltrain, Bay Area Water Supply and Conservation Agency (BAWSCA), and California Department of Resources Recycling and Recovery (CalRecycle). This Inventory relied on activity data from the 2005 calendar year, with the exception of BART trips and water use data from BAWSCA, which used 2010 and 2009 data as proxy years, respectively.

For community activities, emissions sources are categorized by scope. Scopes identify where emissions originate and what entity retains regulatory control and the ability to implement efficiency measures. The scopes are illustrated in **Figure 2-1** and defined as follows:

---

[11] California Greenhouse Gas Inventory, http://www.arb.ca.gov/cc/inventory/inventory.htm.

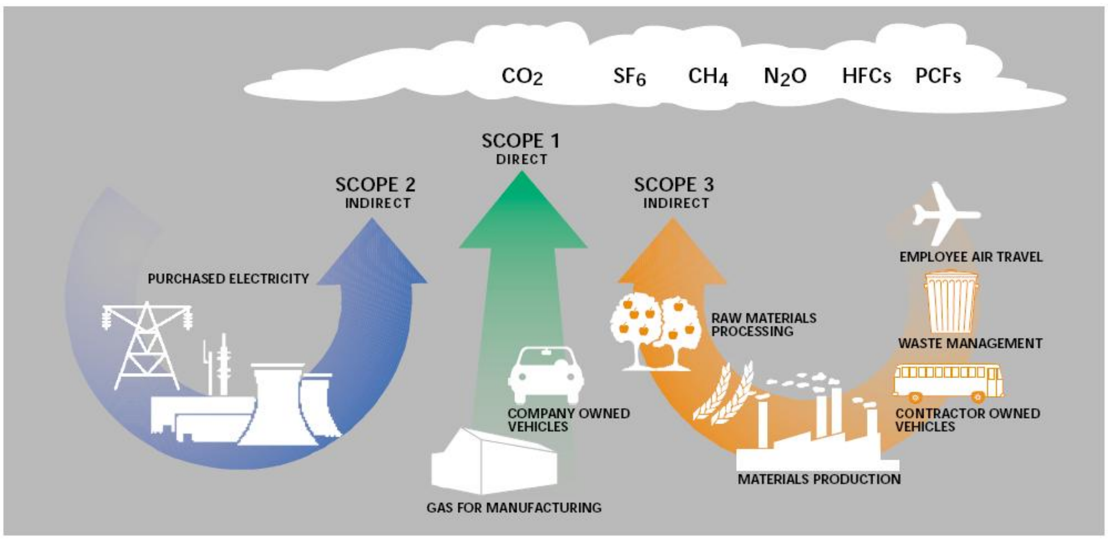
[12] BAAQMD provides plan-level GHG quantification guidance as part of their proposed California Environmental Quality Act (BAAQMD) guidance dated May 2010 and available for download at http://www.baaqmd.gov/Divisions/Planning-and-Research/CEQA-GUIDELINES.aspx.

- **Scope 1.** Direct emissions caused by activities in South San Francisco in 2005 and emitted within South San Francisco. Examples of Scope 1 sources include the combustion of fuels such as gasoline and natural gas.

- **Scope 2.** Indirect emissions caused by activities within South San Francisco in 2005 but emitted outside of the city. Examples of Scope 2 sources include electricity generated outside of the community and used within the community. These emissions should be included in the community-wide analysis, as they are the result of the community's electricity consumption.

- **Scope 3.** All other indirect emissions that occur as a result of activity within the community. An example of Scope 3 is methane emissions from solid waste generated in the community in 2005 yet released over the lifetime of the waste.

Figure 2-1: GHG Emissions Scopes



Source: NZBCSD (2002), The Challenge of GHG Emissions: The "why" and "how" of accounting and reporting for GHG emissions: An Industry Guide, New Zealand Business Council for Sustainable Development, Auckland.

2.3 Data Sources

The data used to complete this Inventory came from multiple sources, as summarized in **Table 2-1**. These data sources are further explained in the sector-specific discussions of this document and detailed in **Appendix A.**

Table 2-1: Data Sources for Community Analysis, 2005

Sector/Subsector		Source	Scope
Residential	Electricity	PG&E	1
	Natural Gas	PG&E	2
Commercial/ Industrial	Electricity	PG&E	1
	Natural Gas	PG&E	2
Transportation	On-Road VMT	Fehr & Peers	1
	BART	BART ridership data	3
	Caltrain	Caltrain ridership data	3
Waste	Community Waste	CalRecycle	3
	Community Alternative Daily Cover	CalRecycle	3
	Direct Landfill Emissions	Oyster Point Final Closure and Post-Closure Maintenance Plan	1
Water	Gallons	Bay Area Water Supply & Conservation Authority	3
Off-Road Equipment and Vehicles	Diesel	CARB OFF-ROAD2007	1
	Gasoline	CARB OFF-ROAD2007	1
Stationary Sources	Major Industry	CARB & BAAQMD	1

2.4 Data Limitations

The Inventory was developed with the best-available tools, data, and methodology; however, as with any GHG inventory, there are limitations to representing all sources of emissions in a local jurisdiction. The main factors that limit GHG inventories include (1) data availability, (2) privacy laws, and (3) a lack of a reasonable methodology. The following sections highlight emissions that cannot be included in a GHG inventory due to the factors listed above.

Data Availability

Lack of available data prevented the calculation of emissions from the following sources for the following reasons:

- Off-road vehicles and equipment (aside from lawn/garden and construction equipment) – The CARB OFFROAD 2007 software provides emissions from a range

of activities. These numbers are aggregated for the entire San Mateo County area, including incorporated, unincorporated, and state- or federally owned land. BAAQMD has provided guidance on attributing countywide off-road equipment emissions from lawn and garden equipment as well as construction equipment to each jurisdiction, but at this time, there is not a method to disaggregate the remaining data by jurisdiction. Examples of remaining off-road emissions sources include watercraft, recreational vehicles, and mining equipment.

- Rail (aside from Caltrain and BART) – The federal government does not release information regarding the efficiency, fuel consumption, or mileage of locomotives traveling through South San Francisco.
- Propane use – Propane is essentially an unregulated fuel in California (except for storage and safety issues, which are regulated). Because it is an unregulated commodity, no data is collected by the State on propane sales or usage.
- Refrigerants – Similar to propane, above, the amount of fugitive refrigerant emissions cannot be calculated because sales are not tracked.

Privacy Laws

Commercial and industrial electricity and natural gas were combined into one section due to the California 15/15 rule. The 15/15 rule was adopted by the California Public Utilities Commission in the Direct Access Proceeding (CPUC Decision 97-10-031) to protect customer confidentiality.

Lack of a Reasonable Methodology

A lack of a reasonable methodology prevents estimation of life-cycle emissions for the community. Life-cycle emissions are emissions associated with the production and disposal of items consumed by a community (i.e., "cradle-to-grave"). For instance, a life-cycle assessment of vehicle emissions would include those from designing, extracting raw materials, producing, delivering, and disposing of each car in the city. In contrast, this analysis only captures how much that car is driven in the city consistent with standard protocol.

As GHG inventories become more common, it is likely that methodology and accessibility to data will improve. The emissions identified in this report are primarily GHGs that the community has directly caused and has the ability to reduce through implementation of conservation actions, a climate action plan, or corresponding efforts.

Review of similar inventories, including the California Greenhouse Gas Inventory prepared by the California Air Resources Board (CARB), indicates that those sources not included in the Inventory for the reasons stated above comprise less than 5.0% of total emissions in the county. Once CARB adopts a community-wide protocol, it is likely that methodology and accessibility to data will improve.

2.5 Emissions Methodology

GHG emissions are calculated by multiplying the amount of activity by the amount of emissions resulting from each unit of activity. For example, if a community consumed 1 million kilowatt-hours (kWh) of electricity and each kWh of electricity results in 0.0004 metric tons (MT) of CO_2, the CO_2 emissions calculation would be as follows:

$$1 \text{ million kWh} * .0004 \text{ MTCO}_2/\text{kWh} = 400 \text{ MTCO}_2$$

The amount of emissions per unit of activity is commonly known as an emissions coefficient or emissions factor. The community-wide inventory uses activity data and coefficients for the three primary GHGs (CO_2, CH_4, and N_2O) according to the type and nature of the activity. Activity data is typically provided as energy or water consumed, vehicle miles traveled, or waste generated. The coefficients used for calculating emissions from each activity follow international inventory standards and are utility-, county-, or California-specific, when available.

The three main GHG emissions (CO_2, CH_4, and N_2O) are converted to equivalent carbon dioxide units, or CO_2e. Equalizing the three main GHG emissions as CO_2e allows for the consideration of different GHGs in comparable terms. For example, methane (CH_4) is 21 times more powerful than carbon dioxide on a per weight basis in its capacity to trap heat, so 1 metric ton of methane emissions is converted to 21 metric tons of carbon dioxide equivalents.[13]

[13] The potency of a given gas in heating the atmosphere is defined as its global warming potential, or GWP. For more information on GWP, see IPCC Fourth Assessment Report, Working Group I, Chapter 2, Section 2.10.

Community-Wide GHG Inventory Results

The City of South San Francisco contains a mix of residential, commercial, and industrial land uses. In the 2005 baseline year, there were approximately 61,700 people, 42,240 jobs, and 20,130 households in the city.[14] The following section provides an overview of the emissions caused by activities within the jurisdictional boundary of the city and analyzes the emissions in terms of scope, sector, source, and population.

3.1 Community-Wide Emissions and Stationary Sources

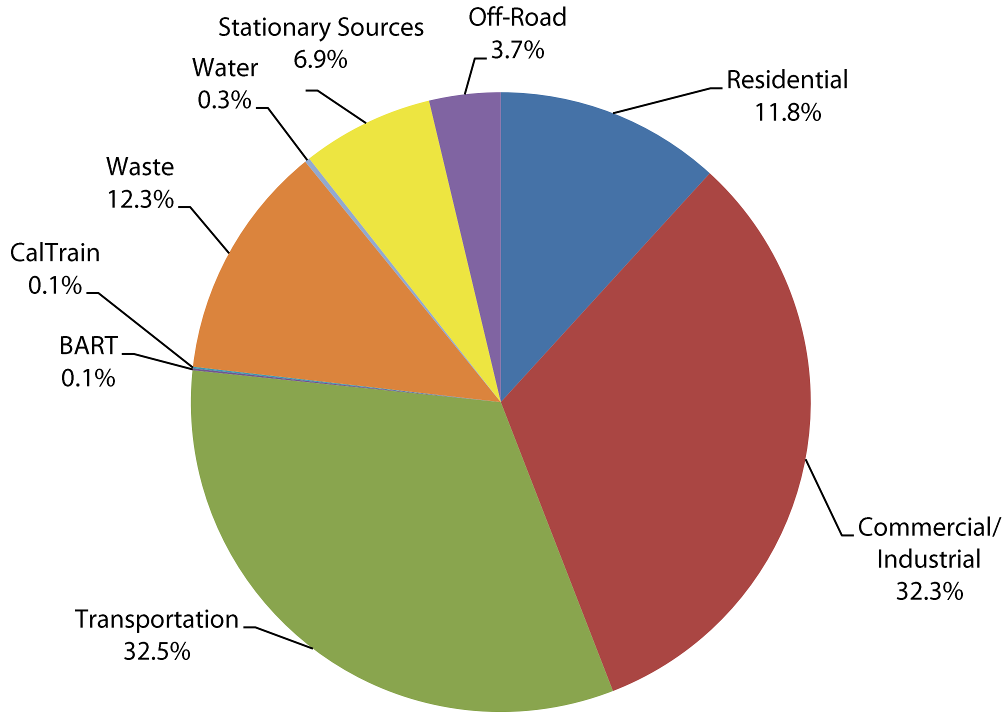
With stationary sources included, South San Francisco emitted approximately 601,847 $MTCO_2e$ in calendar year 2005. Stationary sources are any fixed emitter of air pollutants, such as power plants, petroleum refineries, petrochemical plants, food processing plants, and other heavy industrial sources.[15] **Figure 3-1** below shows each sector's contribution to the total community-wide emissions. Stationary sources emitted 41,434 metric tons CO_2e in 2005, or roughly 6.9% of total community-wide emissions. These emissions are classified as Scope 1 emissions, meaning that they are released directly into the atmosphere and do not include indirect emissions sources such as electricity consumption.

At the recommendation of the Bay Area Air Quality Management District (BAAQMD), stationary source emissions are shown here for informational purposes but will not be included in the Inventory from this point forward. Stationary source emissions are influenced by market forces beyond the City's local control and are best addressed and regulated by the BAAQMD or through federal and state programs. This Inventory is intended to guide future local policy decisions that relate to emissions in the City's control; therefore, the discussion from this point forward excludes the stationary source emissions shown in **Figure 3-1**.

[14] ABAG Projections 2009.

[15] USEPA, Civil Enforcement, http://www.epa.gov/oecaerth/civil/caa/caaenfprog.html.

Figure 3-1: 2005 Community GHG Emissions by Sector and Stationary Sources



3.2 Community-Wide Emissions by Sector

Sorting emissions by sector demonstrates the amount of emissions contributed by type of activity rather than fuel or scope, which are explored later in this chapter. As depicted in **Figure 3-2** and **Table 3-1** below, the transportation and nonresidential sectors are the largest contributors of emissions. The transportation sector produced approximately 195,788 $MTCO_2e$, representing 34.9% of total emissions in 2005. The majority of emissions from the transportation sector were the result of gasoline consumption in private vehicles. Combined emissions from the commercial and industrial sectors accounted for 34.7% of the total emissions, approximately 194,562 $MTCO_2e$. The residential sector contributed 12.7% of the total emissions (70,892 $MTCO_2e$), and emissions from solid waste comprised 13.2% of the total (74,073 $MTCO_2e$).

GHG emissions from the waste sector are both the estimated future emissions that will result from the decomposition of waste generated by city residents and businesses in the base year 2005, and the direct landfill gas emissions during 2005 from the closed Oyster Point Landfill. Off-road emissions from lawn, garden, and construction equipment accounted for 4.0% of total emissions, approximately 22,399 $MTCO_2e$, while emissions from electricity use to treat and distribute water used by the community made up 0.3% of total emissions, or 1,578 $MTCO_2e$. Emissions from BART and Caltrain trips to and from South San

Francisco totaled 0.1% each, with BART contributing 612 $MTCO_2e$ and Caltrain contributing 508 $MTCO_2e$ to the community-wide total.

Figure 3-2: 2005 Community GHG Emissions by Sector

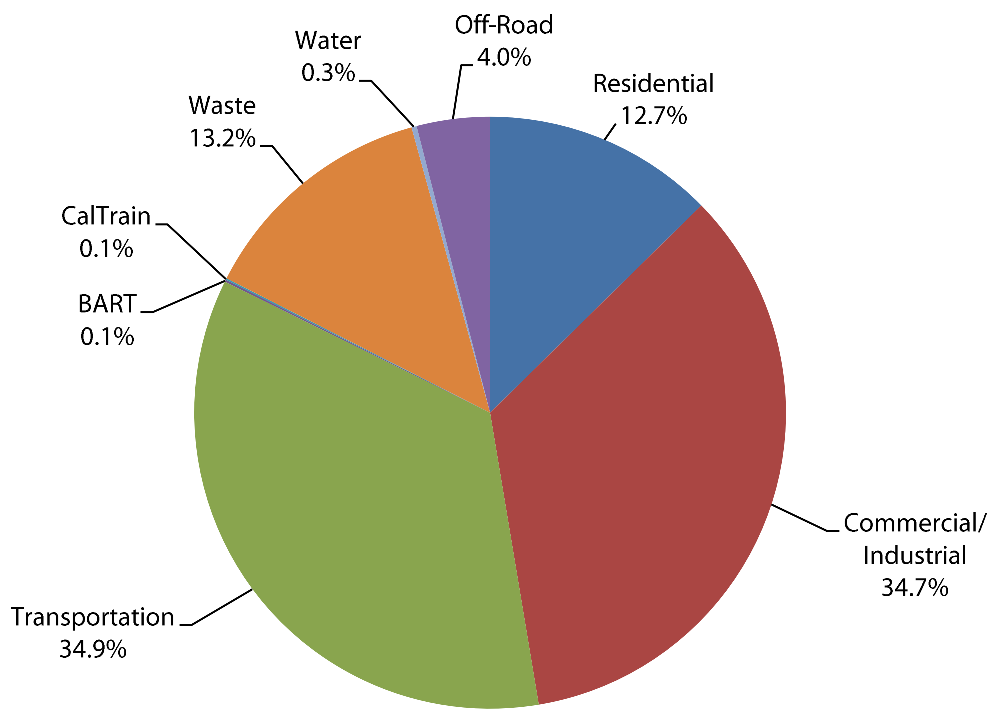


Table 3-1: Community GHG Emissions by Sector (Metric Tons of CO_2e)

Community Emissions 2005 by Sector	CO_2e (metric tons)	Percentage of Total
Residential	70,893	12.7%
Commercial/Industrial	194,562	34.7%
On-Road Transportation	195,788	34.9%
BART	612	0.1%
Caltrain	508	0.1%
Waste	74,073	13.2%
Water	1,578	0.3%
Off-Road	22,399	4.0%
Total	**560,414***	**100.0%**

** Due to the rounding of decimals to whole number, the sum of all sectors may be less than the total by 1 $MTCO_2e$.*

3.3 On-Road Transportation

Travel by on-road motorized vehicles constitutes the greatest percentage of GHG emissions in the city (34.9%) by a small margin. On-road daily vehicle miles traveled (VMT) were analyzed by Fehr & Peers, a transportation engineering firm, for the base year of 2005 using a model provided by the San Mateo City/County Association of Governments (C/CAG). Fehr & Peers modeled VMT and emissions by speed bin for the east and west areas of Highway 101.[16] The two areas were accounted for separately due to the unique development patterns and transportation demand management (TDM) measures implemented in the east of the Highway 101 area.[17] Extensive travel data has been collected for this region, and the model results were checked for reasonableness.

Using select link analysis, three types of vehicle trips were tracked separately for morning (AM) and evening (PM) peak periods for the two subareas of the city:

1) Vehicle trips with an origin and a destination in South San Francisco (I-I trips)

2) Vehicle trips with either an origin or a destination outside of South San Francisco (IX-XI trips).

3) Vehicle trips with neither an origin nor a destination in South San Francisco (X-X trips).

As part of SB 375 implementation (see Chapter 1), CARB appointed the Regional Targets Advisory Committee (RTAC) to develop consistent VMT accounting methods for local governments across the state. The RTAC released its recommendation in September 2009. It recommends including 100%, 50%, and 0% of vehicle types 1, 2, and 3 above, respectively. The RTAC methodology is recommended by BAAQMD and by the State. **Tables 3-2** and **3-3** below summarize VMT by area and by fuel source, respectively.

Table 3-2: 2005 Vehicle Miles Traveled by Trip Type

Source	Annual VMT	Percentage of Total
East of Highway 101	154,807,110	38.68%
West of Highway 101	245,437,611	61.32%
Total	**400,244,721**	**100.00%**

[16] Speed bin refers to a range of speeds, usually in 5 mile per hour increments, such as 0–5 mph, 5–10 mph, etc.

[17] Transportation Demand Management refers to trip reduction efforts by employers and the City. For more information, visit http://www.vtpi.org/tdm/.

Table 3-3: On-Road Transportation GHG Emissions by Fuel Source

	2005 $MTCO_2e$	Percentage of Total
Gasoline	179,196	91.53%
Diesel	16,592	8.47%
Total	**195,788**	**100.00%**

Further discussion of the transportation sector methodology is included in **Appendix A**.

3.4 Bay Area Rapid Transit (BART)

Community-wide emissions in 2005 from BART trips to or from South San Francisco accounted for 612 $MTCO_2e$, or 0.1% of total emissions. Emissions from BART operations are a result of electricity and natural gas consumption to operate the agency's facilities and transit fleet.

The total number of trips and trip lengths that begin or end in South San Francisco were determined using BART monthly ridership reports for August 2010 and multiplying each trip by the distance between stations. Weekday, Saturday, and Sunday trips were summed to determine a weekly and annual number of trips and annual passenger miles traveled to or from South San Francisco. Total annual passenger miles traveled were multiplied by $MTCO_2e$ per passenger mile coefficient. Half of each trip was attributed to South San Francisco as the methodology assumes that the other half of the trip would be attributed to the origin or destination outside of the city.

The metric tons of CO_2e per passenger mile were determined by using 2008 BART GHG emissions, as reported in the BART GHG inventory, and dividing by the total number of passenger miles on the BART system in 2008.[18]

3.5 Caltrain

Emissions in 2005 from trips taken to or from South San Francisco by Caltrain are a result of the combustion of diesel fuel on the locomotive fleet. The total number of trips and trip lengths that begin or end in South San Francisco were determined using 2005 annual weekday Caltrain ridership counts. Weekday trips were summed to determine a weekly and annual number of trips and annual passenger miles traveled to or from South San Francisco. Total annual passenger miles traveled were multiplied by $MTCO_2e$ per passenger mile coefficient. As with the BART emissions, half of each trip was attributed to South San Francisco as the other half of the trip would be attributed to the origin or destination

[18] National Transit Database (11/2009). San Francisco Bay Area Rapid Transit District 2008 Agency Profile.

outside of the city. Emissions coefficients for locomotives are provided by the Local Government Operations Protocol (LGOP).

Table 3-4 below compares emissions per mile of passenger travel based on the type of transportation used. This means that each time someone chooses to make a trip by BART or Caltrain rather than in a passenger vehicle, their emissions for each mile traveled would be 429 grams per mile less. Additionally, as BART and Caltrain passenger capacities are reached, the emissions per passenger per mile would be lower because the trains are making the same trip with more people on it without significantly increasing the emissions from diesel or electricity use.

Table 3-4: GHG Emissions Factors by Transportation Type

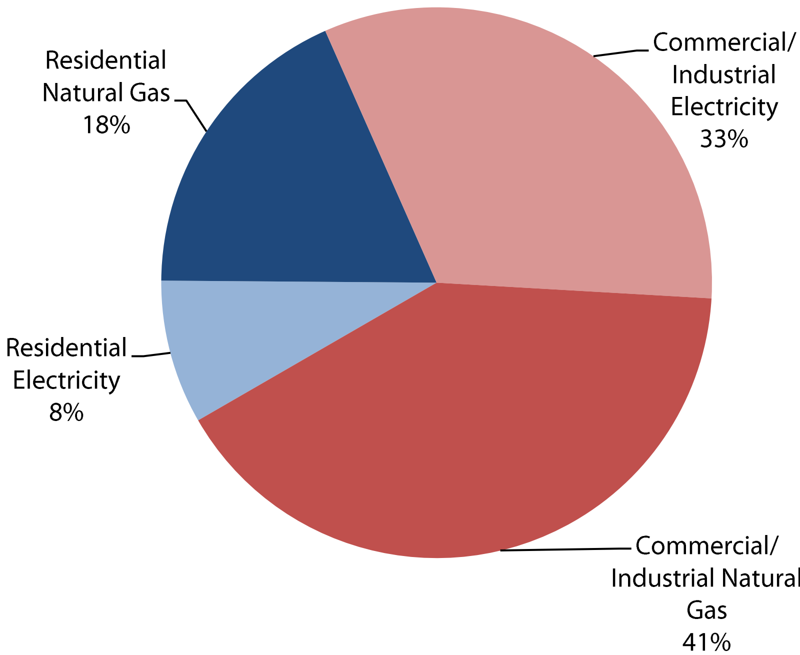
Vehicle Type	Emissions (grams/mile/passenger)	Emissions ($MTCO_2e$/mile/passenger)
Passenger Car	489	0.000489
BART	60	0.000060
Caltrain	133	0.000133

3.6 The Built Environment (Residential, Commercial, Industrial)

With electricity and natural gas use aggregated, 47.4% of total community-wide emissions in 2005 came from the "built environment." The built environment comprises residential, commercial, and industrial natural gas and electricity consumption. This Inventory does not include emissions from other types of energy such as propane, solar, and wind due to lack of reliable sales, construction, or consumption data. As noted previously, the commercial and industrial sectors are combined in this Inventory due to the 15/15 privacy rule. Direct access electricity was not used by any commercial or industrial facilities during the 2005 baseline year.

In 2005, 74% of emissions from the built environment were from the commercial/industrial sectors, with the remaining emissions (26%) resulting from the residential sector (see **Figure 3-3**). All of the emissions calculated from the built environment were the result of local natural gas consumption (Scope 1) and local consumption of electricity generated outside of the city (Scope 2). Overall, natural gas consumption caused the majority of emissions from the built environment in 2005, as shown in **Figure 3-3**.

Figure 3-3: Built Environment GHG Emissions by Source and Sector



Approximately 41% of energy emissions resulted from commercial and industrial natural gas consumption (see **Figure 3-3** and **Table 3-5**), while 18% of energy emissions came from residential natural gas usage (see **Figure 3-3** and **Table 3-6**). Approximately 33% of energy emissions resulted from commercial/industrial electricity consumption (see **Figure 3-3** and **Table 3-5**), while 8% came from residential electricity use (see **Table 3-6**).

Table 3-5: Commercial/Industrial GHG Emissions Sources

Commercial/Industrial Emissions Sources 2005	Electricity	Natural Gas	TOTAL
CO_2e (metric tons)	86,371	108,191	194,562
Percentage of Total Energy CO_2e	32.5%	40.8%	73.3%

Table 3-6: Residential GHG Emissions Sources

Residential Emissions Sources 2005	Electricity	Natural Gas	TOTAL
CO_2e (metric tons)	22,435	48,458	70,893
Percentage of Total Energy CO_2e	8.5%	18.3%	26.7%

3.7 WASTE

Solid waste emissions are separated into two sources, direct emissions from closed landfills within the city during the baseline year and future emissions from community-generated waste sent to landfills outside of the city.

Direct Landfill Emissions. South San Francisco's Oyster Point Landfill was in operation between 1956 and 1969 and holds approximately 1.4 million tons of waste. Although the landfill is closed, it continues to emit methane gas and will continue to do so for generations to come. Emissions from the Oyster Point Landfill were 13,216 $MTCO_2e$ in 2005 and are a measurement of the direct methane gas emitted by the landfill. Methane emissions from the closed landfill are considered Scope 1 emissions as they are a release of fugitive emissions.

Community Waste Emissions. Community waste includes solid waste and alternative daily cover (ADC) produced by the community in 2005 and sent to managed landfills or dumps. Solid waste disposed of by the community in 2005 will contribute 60,857 $MTCO_2e$ over the next 100 years as the waste decomposes. Methane generation from waste sent to landfills in 2005 was calculated using the CARB Landfill Emissions Calculator and an average methane recovery or capture factor of 75.0%. For more information, please see detailed methodology in **Appendix A**. Emissions from community waste are considered Scope 3 emissions because they are not generated in the base year but will result from the decomposition of waste generated in 2005 over the full 100-year cycle of its decomposition. In 2005, the community sent approximately 95,920 tons of waste to landfills, including 105 tons of green waste and 10,724 tons of sludge, which are considered recycled materials and used for daily cover. The 2004 California Statewide Waste Characterization Study provides standard waste composition for the State of California, which allows us to account for the different emission rates of various materials.[19]

3.8 WATER

Water-related emissions include the electricity use required to convey, treat, distribute, collect, and dispose of water used by residences, businesses, and institutions in the City of South San Francisco. To clarify, these emissions include those necessary for wastewater treatment. In 2005, these emissions accounted for 0.3% of total emissions, or 1,578 $MTCO_2e$. The City of South San Francisco's water is provided by California Water Service and the Westborough Water District. The city's water supply originates in the Hetch Hetchy Water Project from Yosemite Valley. The City operates the water treatment plant and the pumps to distribute the water to users. The South San Francisco Water Quality Control Plant collects and treats the wastewater from South San Francisco before discharging the water into the San Francisco Bay.

---

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

3.9 Off-Road Equipment

Off-road equipment emissions for this Inventory are separated into lawn or garden equipment and construction equipment. While other types of off-road equipment, including maritime, rail, airport ground services, and recreational equipment, may be used in South San Francisco, there is not currently a reasonable methodology for attributing the use of these equipment types to an individual jurisdiction, as they are reported at the countywide level. Construction equipment produced 21,302 $MTCO_2e$ in 2005, while lawn and garden equipment produced 1,098 $MTCO_2e$. Construction emissions were attributed to South San Francisco by determining the proportion of new homes built within the city compared to the total new homes built in the county in 2005. Lawn and garden equipment use in South San Francisco was determined by the total number of housing units within the city as compared to the county. Further discussion of the sources and methodology used to attribute off-road equipment emissions to the city can be found in **Appendix A.**

Table 3-7: Off-Road GHG Emissions Sources

Fuel Type	Construction	Lawn & Garden	TOTAL
Gasoline ($MTCO_2e$)	261	772	1,034*
Diesel ($MTCO_2e$)	21,040	325	21,366*
Total	21,302*	1,098*	22,398*

** Due to the rounding of decimals to whole numbers, the sum of all sectors may be less than the total by 1 $MTCO_2e$.*

WHAT ARE SCOPES?

The key principles to remember are that Scope 1 emissions are caused by activities within the city and emitted within the city (fuel combustion), while Scope 2 emissions are caused by activities within the city, but most likely are emitted outside of the city (electricity). Scope 3 emissions are indirect emissions, such as from waste decomposition.

3.10 Community-Wide Emissions by Scope

Representing community-wide emissions by scope is an effective way to distinguish between the level of local control over emissions sources. This Inventory includes Scope 1, Scope 2, and Scope 3 sources consistent with state protocol.

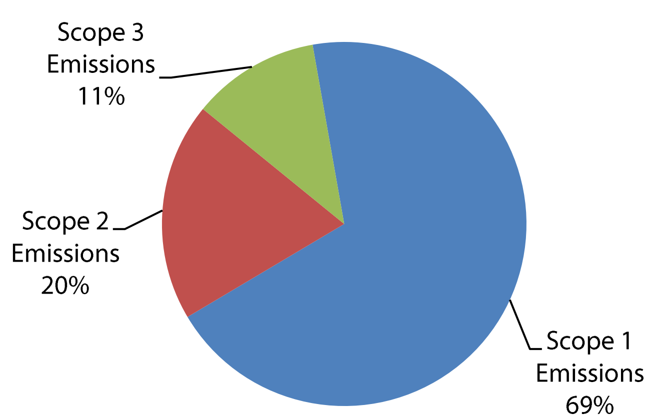
Table 3-8 summarizes the scopes of each sector in this analysis.

Table 3-8: Emission Sources Included in 2005 Community Inventory by Scope and Sector

Sector	Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions
Residential	Natural Gas	Electricity	–
Commercial/ Industrial	Natural Gas	Electricity	–
Transportation	Diesel & Gasoline Use	–	–
BART	–	–	Electricity
Caltrain	–	–	Diesel Use
Waste	Baseline Year Methane	–	Future Year Methane
Water	–	–	Electricity
Off-Road Equipment	Diesel & Gasoline Use	–	–

Including all sectors and scopes, the community emitted approximately 560,414 $MTCO_2e$ in 2005. As shown in **Figure 3-4** and **Table 3-9,** the majority of community GHG emissions (69%) were from Scope 1 sources. Scope 2 (20%) and Scope 3 (11%) sources constituted the remainder.

Figure 3-4: 2005 Community GHG Emissions by Scope



The largest portion of Scope 1 emissions came from the transportation sector (refer to **Table 3-9**). These emissions qualify as Scope 1 because they involve the direct combustion of fuel within the jurisdictional boundary of the city. The second largest source of Scope 1 emissions was commercial/ industrial natural gas use, with off-road equipment and direct landfill emissions making up the remainder of Scope 1 emissions. Commercial and industrial uses also generated the largest percentage of Scope 2 emissions. Emissions from waste operations account for the majority of Scope 3 emissions, with water-related, BART, and Caltrain emissions contributing a minor portion.

Table 3-9: Community GHG Emissions per Sector per Scope ($MTCO_2e$)

Sector	Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions	Total Emissions
Residential	48,458	22,435	–	70,893
Commercial/Industrial	108,191	86,371	–	194,562
Transportation	195,788	–	–	195,788
BART	–	–	612	612
Caltrain	–	–	508	508
Waste	13,216	–	60,857	74,073
Water	–	–	1,578	1,578
Off-Road Equipment	22,399	–	–	22,399
Total	**388,052**	**108,806**	**63,555**	**560,414***
Percentage of Total	**69.24%**	**19.42%**	**11.34%**	**100.0%**

** Due to the rounding of decimals to whole numbers, the sum of all sectors may be less than the total by 1 MTCO2e.*

3.11 Community Emissions by Source

In addition to viewing emissions by sector and by scope, policy and program development can benefit from an analysis of emissions according to their raw fuel. **Figure 3-5** and **Table 3-10** below demonstrate that more than 32% of all community emissions come from the consumption of gasoline. Natural gas (28%) and electricity (20%) consumption from the built environment are the next most significant figures, with the remainder coming from diesel fuel (7%) and waste (13%) emissions.

Figure 3-5: Community GHG Emissions by Source

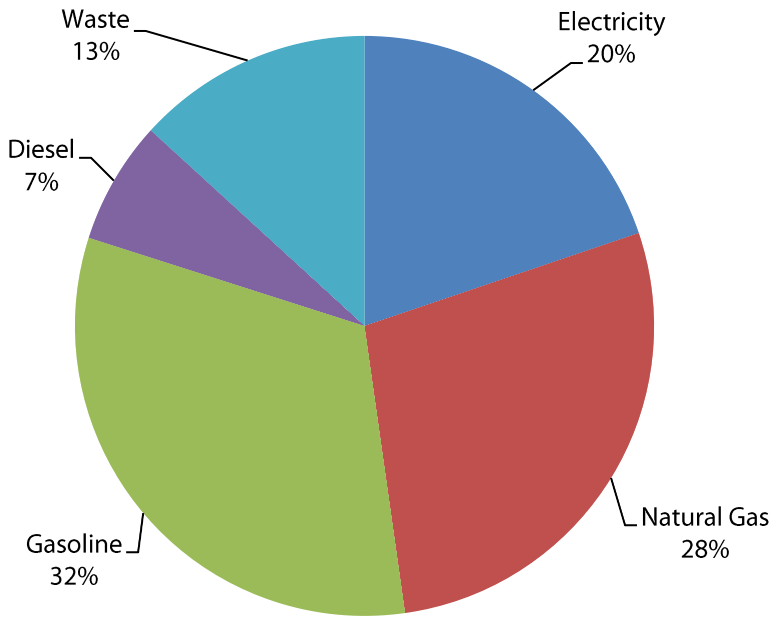


Table 3-10: Community GHG Emissions by Source

Community Emissions 2005 by Source	CO_2e (metric tons)
Electricity	110,996
Natural Gas	156,649
Gasoline	180,230
Diesel	38,465
Waste	74,073
Total	**560,414***

** Due to the rounding of decimals to whole numbers, the sum of all sectors may be less than the total by 1 $MTCO_2e$.*

3.12 Per Capita Emissions

Per capita emissions can be a useful metric for measuring progress in reducing GHGs and for comparing one community's emissions with neighboring cities and against regional and national averages. Currently, it is difficult to make meaningful comparisons between local inventories because of variations in the scope of inventories conducted. Only when ICLEI, the California Air Resources Board (CARB), and other organizations adopt universal

WHAT IS 560,414 METRIC TONS OF CO_2E EQUIVALENT TO?

The city's GHG production in 2005 (560,414 metric tons CO_2e) is equivalent to the air volume of about 112,083 hot air balloons under standard conditions of pressure and temperature. The same amount of emissions is also equivalent to one year of electricity use in 108,160 California residences.

Source: California Air Resources Board, "Conversion of 1 MMT CO2 to Familiar Equivalents," Oct. 2007.

reporting standards will local inventories be prepared in a consistent manner and therefore be comparable.

Simply dividing total community GHG emissions by city population in 2005 (61,700) yields a result of 9.08 $MTCO_2e$ per capita.[20] Dividing total community GHG emissions by the service population (residents plus employees or jobs) in 2005 (103,940) results in 5.2639 $MTCO_2e$ per capita.[21] It is important to understand that these numbers are not the same as the carbon footprint of the average individual living in the City of South San Francisco and that the per capita emissions number for the city is not directly comparable to every per capita number produced by other emissions studies because of differences in emissions inventory methods. For general comparison, in 2005 emissions were estimated to be 13.5 metric tons CO_2e per capita in California and 24.1 metric tons CO_2e per capita in the U.S.[22]

South San Francisco's per capita emissions are smaller than state and national averages for a variety of reasons. Urban areas like South San Francisco are typically dependent on agricultural or industrial resources created outside of the city and then imported for use, meaning that cities with large industrial or agricultural exports would see larger per capita emissions than the state or national average. Additionally, many local inventories are unable to account for refrigerants, electricity transmission, and some off-road vehicle and equipment use that are only tracked at the state or national level. For these reasons, local and state per capita emissions should not be compared on an equal basis.

---

[20] Population in 2005 derived from ABAG's 2009 projections.

[21] Employment in 2005 derived from the City's Housing Element.

[22] California year 2005 metric tons of CO_2e per capita estimate derived by dividing the total emissions reported in the California Greenhouse Gas Inventory for 2000–2005 prepared by the California Air Resources Board for the 2005 California Population Profile prepared by the U.S. Census Bureau. United States year 2005 metric tons of CO_2e per capita estimate compiled by the World Resources Institute (WRI) Climate Analysis Indicators Tool (registration required to access data).

Forecast

The Inventory provides a GHG emissions forecast for the year 2020 to illustrate the potential GHG emissions growth in the community if population and employment continue to grow. Forecasts also allow the City to evaluate the GHG emissions reduction potential of future sustainability efforts. Forecasting is completed by adjusting baseline levels of emissions consistent with household, population, employment, and transportation growth indicators. The forecast year 2020 is consistent with the State's GHG Inventory forecast year and the AB 32 target year.[23]

4.1 Business-As-Usual Growth Forecast

The basis for all growth scenarios is a business-as-usual (BAU) projection. A BAU projection identifies how GHG emissions will increase if behaviors and efficiencies do not change from baseline levels, yet population, households, employment, and VMT continue to increase. The BAU scenario utilizes the Association of Bay Area Governments' (ABAG) Projections (2009) data for 2020 population and household growth and an employment growth factor from the City's Housing Element. The Housing Element considers local economic development efforts more than the projections of ABAG. Vehicle miles traveled in 2020 were modeled based on the C/CAG model described in Chapter 3.

The growth indicators for both scenarios are provided in **Table 4-1** and will be the basis for the 2020 emissions forecast.

Table 4-1: GHG Inventory Growth Indicators

Growth Indicator	2005	2020	Percentage Change	Applied to…
Service Population*	103,940	119,830	15.3%	BART Caltrain Waste Water
Households	20,130	22,840	13.5%	Residential Energy Off-Road Equipment
Daily VMT	195,788	218,033	11.4%	On-Road Transportation
Employment	42,240	50,130	18.7%	Commercial & Industrial Energy

[23] California Greenhouse Gas Inventory, http://www.arb.ca.gov/cc/inventory/inventory.htm.

FORECAST

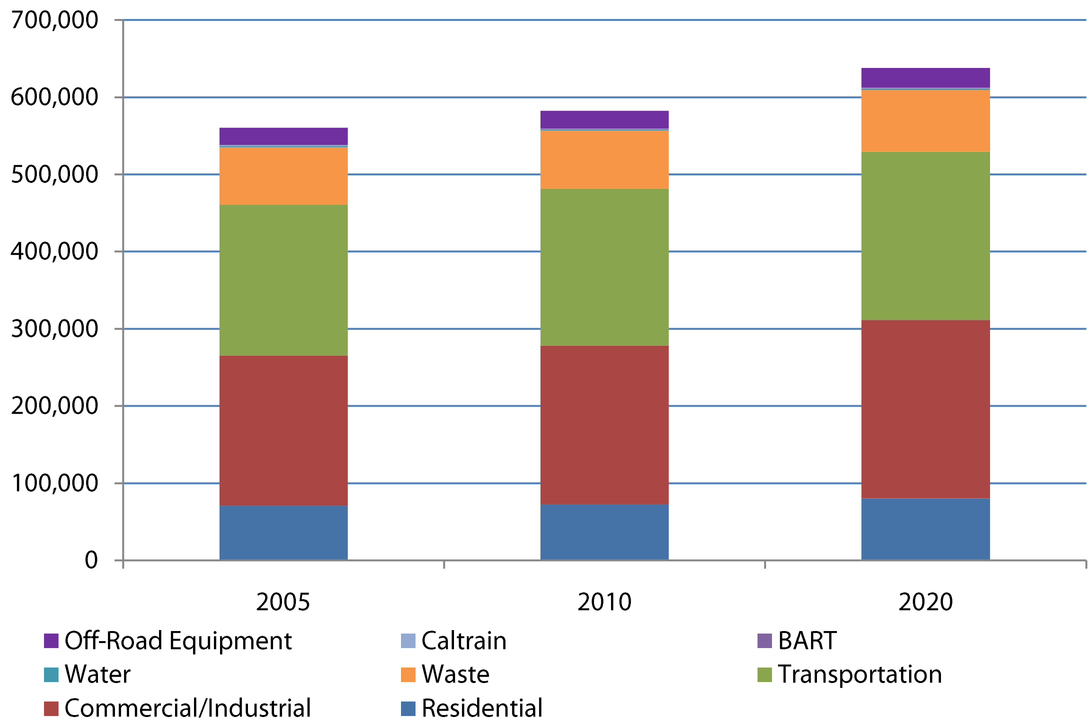
Under a business-as-usual scenario, the City of South San Francisco's emissions will grow by approximately 13.8% by the year 2020 to 644,079 $MTCO_2e$. The results of the BAU forecast are shown in **Table 4-2** and **Figure 4-1** below.

Table 4-2: Business-As-Usual Projected Growth in Community-Wide Emissions, 2005–2020

Sector/Source		2005	2020	Percentage Change
Residential (Electricity)	Electricity	22,435	25,455	13.5%
	Natural Gas	48,458	54,982	13.5%
Commercial/ Industrial	Electricity	86,371	102,504	18.7%
	Natural Gas	108,191	128,400	18.7%
Transportation	On-Road Vehicles	195,788	218,033	11.4%
	BART	612	706	15.3%
	Caltrain	508	586	15.3%
Waste	Community Waste	60,857	70,161	15.3%
	Direct Landfill Emissions	13,216	9,791	-25.9%
Water-Related	Gallons	1,578	1,819	15.3%
Off-Road Equipment	Gallons of Diesel and Gasoline	22,399	25,416	13.5%
Total		**560,414***	**637,852**	**13.8%**

** Due to the rounding of decimals to whole numbers, the sum of all sectors may be less than the total by 1 $MTCO_2e$.*

Figure 4-1: Business-As-Usual Projected Growth in Community-Wide Emissions, 2005–2020 (Metric Tons CO_2e)



4.2 ADJUSTED COMMUNITY-WIDE FORECAST WITH STATE ACTIONS

State-led or state-induced reduction strategies included in the AB 32 Scoping Plan are accounted for in the adjusted 2020 emissions forecast. Strategies include all state actions that are approved, programmed, and/or adopted. These programs require no additional local action. Incorporating them into the forecast and reduction assessment provides a more realistic forecast of future emissions growth and the responsibility of local governments once state measures to reduce GHG emissions have been implemented. A brief description of each of these items is provided below. The impact of these actions on the BAU forecast is shown in **Table 4-3**.

AB 1493 (Pavley). Signed into law in 2002, AB 1493 requires carmakers to reduce GHG emissions from new passenger cars and light trucks beginning in 2011. CARB adopted regulations in 2004 that took effect in 2009 after USEPA released a waiver granting California the right to implement the bill. CARB anticipates that the Pavley standards will reduce GHG emissions from California passenger vehicles by about 22 percent in 2012 and

about 30 percent in 2016, all while improving fuel efficiency and reducing motorists' costs.[24]

Renewable Portfolio Standard. Established in 2002 in Senate Bill 1078, the Renewable Portfolio Standard (RPS) directs utility providers to increase the portion of energy that comes from renewable sources to 20% by 2010 and to 33% by 2020. A June 2009 report from the California Public Utilities Commission indicated that it is unlikely that the State and its investor-owned utilities will be able to reach the RPS goal of 33% by 2020. According to state assessments, the forecast assumes that energy providers will achieve a 26% renewable portfolio by 2020.[25]

California Green Building Standards Code (CalGreen). The 2008 Title 24 update went into effect on January 1, 2010. The energy reductions quantified in the forecast are the mandatory improvements over the 2005 Title 24 code that were established by the 2010 update. These are statewide standards applied at the local level by city agencies through project review. The CalGreen standards that go into effect January 1, 2011, do not provide additional mandatory reductions in energy consumption that can be quantified as an anticipated alteration to business-as-usual trends. The new CalGreen establishes optional tiers for enhanced energy efficiency and conservation that can be implemented at the discretion of local governments. At this time, the City has not adopted or committed to the voluntary tiers.

4.3 Adjusted Community-Wide Forecast with Local Actions

South San Francisco has adopted a number of sustainability efforts since the baseline year of 2005. These efforts will reduce emissions between now and 2020, and therefore should be included similar to the state actions described above. Adopted local actions since 2005 included in this Inventory are presented below in **Table 4-3**.

Table 4-3: GHG Reductions from Existing Sustainability Efforts

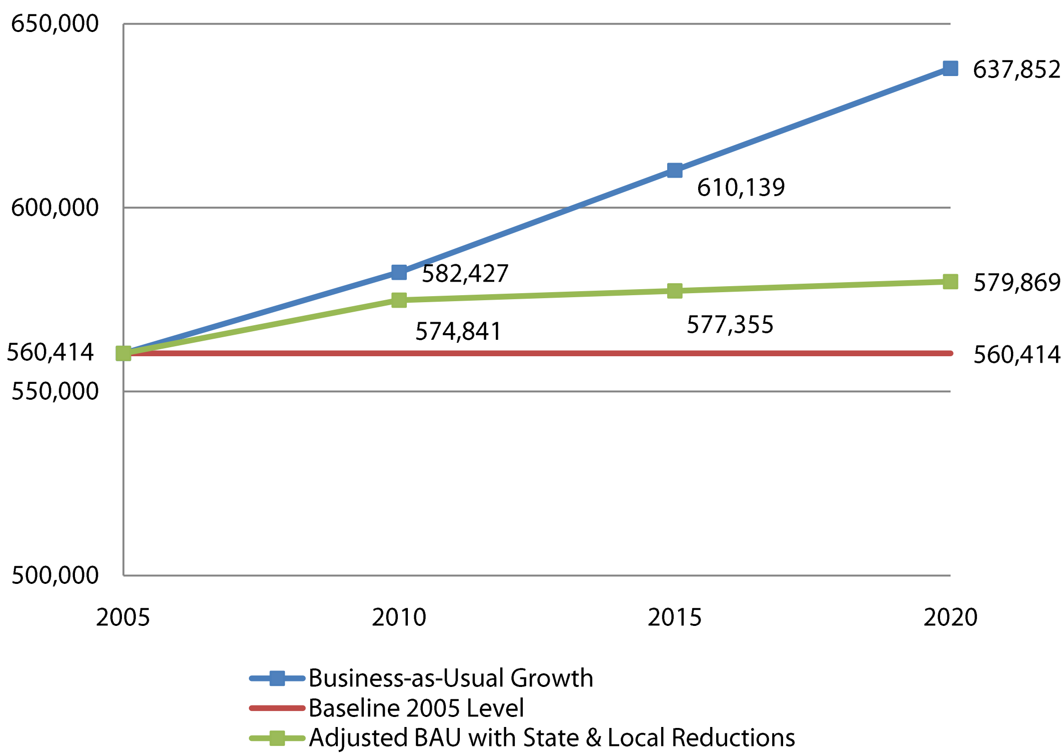
Sector	2010 GHG Reductions ($MTCO_2e/yr$)	2020 GHG Reductions ($MTCO_2e/yr$)
Construction & Demolition Waste Ordinance	-4,572	-5,079
Water-Efficient Landscape Ordinance	0	-3
Total	**-4,572**	**-5,082**

[24] California Air Resources Board 2010.

[25] California Public Utilities Commission 2009.

Figure 4-2 compares the BAU GHG emissions forecast, the adjusted GHG emissions forecast, and baseline GHG emissions.

Figure 4-2: 2020 Community-Wide Emissions Growth Scenarios



Conclusion and Next Steps

By joining ICLEI's Climate Protection Campaign, the City of South San Francisco has made a formal commitment to reduce its GHG emissions. This report lays the groundwork for those efforts by estimating baseline emission levels against which future progress can be demonstrated.

This analysis found that the community was responsible for emitting 560,414 $MTCO_2e$ in the base year 2005, with the transportation and the nonresidential sectors contributing the most to this total. In addition to establishing the baseline for tracking progress over time, this report serves to identify the major sources of city emissions and therefore the greatest opportunities for emissions reductions. If no additional local actions are taken, this report found that emissions will likely increaseby 3.5% by 2020. To reach the AB 32 goal of 15% below present levels by 2020, South San Francisco would need to reduce emissions by an additional 103,940 metric tons CO_2e.

It is important to note that in order to remain consistent with GHG emissions reduction methodology, all future quantifications of reduction activities must be subtracted from this growth projection. Not doing so would be assuming that emissions remain at constant 2005 levels while reduction activities are under way. In reality, the City's climate action efforts are changing due to job, population, VMT, and household growth as well as implementation of state and federal efficiency mandates. **Figure 5-1** below shows the growth forecast in relation to 2005 baseline levels and the 15% reduction target recommended by the California Attorney General and CARB.[26] The difference between the growth forecast and the reduction targets is 33% in 2020, which makes the State's recommended reduction goal challenging but still feasible.

If the community reduced GHG emissions by 103,940 metric tons of CO_2e, what would that be equivalent to?

22,360 passenger cars not driven for one year

238,090 barrels of oil saved

2,691,450 tree seedlings grown over 10 years

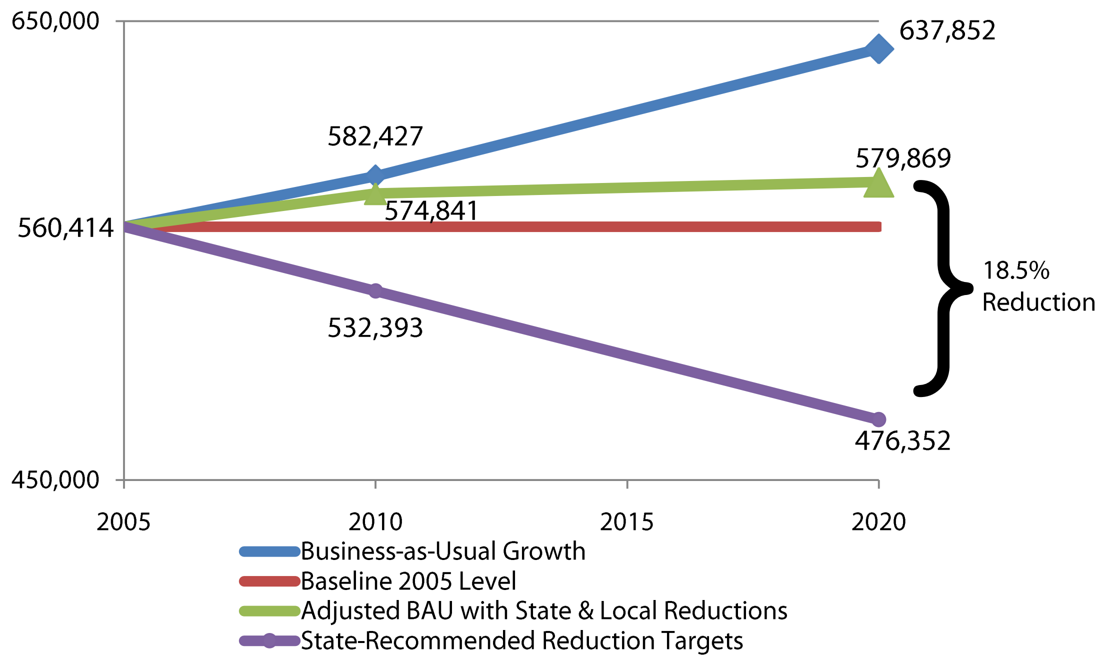
1,345,725 compact fluorescent bulbs used instead of standard light bulbs for one year

Source: California Air Resources Board, "Conversion of 1 MMT CO_2 to Familiar Equivalents," Oct. 2007.

[26] The AB 32 Climate Change Scoping Plan Document prepared by the California Air Resources Board recommends that local governments adopt a 15% reduction goal from present emissions levels, which they state is equivalent to reducing emissions to 1990 levels consistent with AB 32.

Conclusion and Next Steps

Figure 5-1: South San Francisco GHG Forecast in Relation to Reduction Targets



As the City moves forward to the next milestones in the process, the City will build upon projects that have already been implemented since 2005, as well as the emissions reduction benefits of existing General Plan policies. The benefits of both existing strategies can be tallied against the baseline established in this Inventory to inform development of a climate action plan and progress toward the City's GHG emissions reduction target.

Appendix A

Appendix A:
Detailed Methodology for Community-Wide Emissions, 2005

Appendix A: Detailed Methodology

The purpose of this appendix is to provide transparency to the Inventory, outline data limitations, and provide guidance for future City inventories to maintain methodological consistency. Emission factors (also referred to as emission coefficients) and activity level data, typically framed as the amount of energy consumed or waste generated, are needed to calculate emissions resulting from that activity. Emission factors describe the quantity of a pollutant emitted for every unit of activity.

Activity Level Data x Emissions Factor = Emissions Generated from Activity

The following is a detailed explanation of data sources and methodology for calculating activity level data and emissions factors, and thus greenhouse gas (GHG) emissions, per sector.

ELECTRICITY AND NATURAL GAS

Activity Level Data

John Joseph of Pacific Gas and Electric Company (PG&E) provided electricity and natural gas consumption on August 26, 2010.

The raw data received from PG&E is summarized in **Table 1** below. This raw data, kilowatt-hours (kWh) and therms, was multiplied by electricity and natural gas coefficients. The PG&E data did not include direct access (DA) electricity.

Table 1: Residential and Commercial Energy Use

2005 Energy Emissions	Source	Quantity	Unit	Output Metric Tons CO2e per Year
Residential	Electricity	100,353,343	kWh	22,435
	Natural Gas	9,007,346	Therms	48,458
Commercial/ Industrial	Electricity	386,348,360	kWh	86,371
	Natural Gas	20,110,712	Therms	108,191

Commercial and industrial electricity are combined by PG&E due to the California 15/15 Rule. The California Public Utilities Commission (CPUC) adopted the 15/15 Rule in the Direct Access Proceeding (CPUC Decision 97-10-031) to protect customer confidentiality. The 15/15 Rule requires that any aggregated information provided by the utilities must include of at least 15 customers and that a single customer's load must be less than 15% of an assigned category. If the number of customers in the complied data is below 15, or if a single customer's load is more than 15% of the total data, categories must be combined before the information is released. The rule further requires that if the 15/15 Rule is

triggered for a second time after the data has been screened already using the 15/15 Rule, the customer must be dropped from the information provided.

Electricity and Natural Gas Coefficients

PG&E provided a carbon dioxide equivalent (CO_2e) coefficient for electricity and a carbon dioxide (CO_2) coefficient for natural gas. Emissions coefficients for methane (CH_4) and nitrogen dioxide (N_2O) emissions were provided by the California Air Resources Board's (CARB) Local Government Operations Protocol (LGOP) v1.1 and were converted into carbon dioxide equivalents and added to the CO_2 coefficient to create a CO_2e coefficient. Sources and coefficient values are summarized in **Table 2** below.

Table 2: PG&E Emission Coefficients

Coefficient Set	GHG	Emission Factor	Source
Electricity	CO_2	0.489155 lbs/kWh	The "PG&E California" electricity coefficient set is based on the 2005 PG&E CO_2 emission factor of 0.492859 lbs/kWh of delivered electricity. This emissions factor is certified by the California Climate Action Registry and was reported to ICLEI in January 2007 by Greg San Martin. Criteria air pollutant emission factors for electricity are derived from the NERC Region 13 - Western Systems Coordinating Council/CNV Average Grid Electricity Set.
	CO_2e	0.492859 lbs/kWh	
Natural Gas	CO_2	53.050 kg/MMBtu	The "California Coefficients for Natural Gas" coefficient set is based on a PG&E CO_2 emissions factor of 53.05 kg/MMBtu of delivered natural gas, certified by the California Climate Action Registry and the California Energy Commission. Criteria air pollutant emissions factors for natural gas are derived from the California Air Resources Board's Local Government Operations Protocol, version 1.1.
	CH_4	0.0059 kg/MMBtu	
	N_2O	0.001 kg/MMBtu	

Appendix A: Detailed Methodology

On-Road Transportation

Activity Level Data

Fehr & Peers, a transportation engineering consulting firm, calculated community on-road vehicle miles traveled (VMT) in the fall of 2010. Fehr & Peers used a traffic model provided by the San Mateo City/County Association of Governments (C/CAG) to model VMT by speed bin for the east and west areas of Highway 101. The two areas were accounted for separately due to the unique development patterns and transportation demand management (TDM) measures implemented in the east of the Highway 101 area.[1] Extensive travel data has been collected for this region, and the model results were checked for reasonableness.

Using select link analysis, three types of vehicle trips were tracked separately for AM and PM peak periods for the two subareas in South San Francisco:

1) Vehicle trips with an origin and a destination in South San Francisco (I-I trips)

2) Vehicle trips with either an origin or a destination outside of South San Francisco (IX-XI trips).

3) Vehicle trips with neither an origin nor a destination in South San Francisco (X-X trips).

As part of SB 375 implementation (see Chapter 1), CARB appointed the Regional Targets Advisory Committee (RTAC) to develop consistent VMT accounting methods for local governments across the state. The RTAC released its recommendation in September 2009. It recommends including 100%, 50%, and 0% of vehicle types 1, 2, and 3 above, respectively. The RTAC methodology is recommended by BAAQMD in their CEQA Guidelines and recommended by the state for GHG inventories.

The C/CAG model is calibrated to AM and PM peak period conditions. These volumes were then converted into daily trips based on analysis of District 4 PeMS data, which indicates that 50% of the daily traffic on state highways in the Bay Area travels during the AM and PM peak periods. An estimate for daily volumes was calculated with the following equation: daily VMT = (AM VMT + PM VMT) * 2. Daily and annual VMT per location is shown in **Table 3.**

[1] Transportation Demand Management (TDM) refers to trip reduction efforts by employers and the City. For more information, visit http://www.vtpi.org/tdm/.

[2] Bay Area Rapid Transit (2010). BART Monthly Ridership Reports. Retrieved from

Table 3: South San Francisco Vehicle Miles Traveled Data (VMT), 2005

Source	Daily VMT	Annual VMT	Percentage of Total
East of Highway 101	446,130	154,807,110	38.68%
West of Highway 101	707,313	245,437,611	61.32%
Total	1,153,443	400,244,721	100.00%

TRANSPORTATION COEFFICIENTS

Transportation coefficients were obtained from CARB's Emissions Factors (EMFAC) software. The EMFAC2007 model calculates emission rates from all motor vehicles, such as passenger cars and heavy-duty trucks, operating on highways, freeways, and local roads in California per speed bin. In the EMFAC model, the emission rates are multiplied by vehicle activity data to calculate the statewide or regional emissions inventories.

The EMFAC model run assumed an average temperature of 61 degrees Fahrenheit and an average humidity of 64%. The model also assumed San Mateo County's average vehicle fleet mix, which EMFAC determines through historical and projected Department of Motor Vehicle registrations and Caltrans-reported travel behavior. Fehr & Peers determined speed bin distribution using the C/CAG model.

Previous research by Fehr & Peers had shown some error in the EMFAC factors for speeds in excess of 65 mph. These results must be interpreted cautiously. USEPA factors were utilized to convert from CO_2 to CO_2e emissions (1.0505). **Table 4** shows the estimated annual CO_2 transportation coefficients for base year 2005.

Table 4: Transportation Emission Coefficients

Speed (mph)	CO2 Emission Factor (g/mi)
5	1,123.48
10	854.701
15	676.143
20	555.864
25	474.848
30	420.601
35	385.886
40	366.394

Speed (mph)	CO2 Emission Factor (g/mi)
45	359.833
50	365.463
55	383.949
60	417.499
65	470.304

BART

Activity Level Data

Emissions from BART operations are a result of electricity and natural gas consumption to operate the agency's facilities and transit fleet. The total number of trips and trip lengths that begin or end in South San Francisco were determined using BART monthly ridership reports for August 2010 and multiplying each trip by the distance between stations.[2] Weekday, Saturday, and Sunday trips were summed to determine a weekly and annual number of trips and annual passenger miles traveled to or from South San Francisco. A summary of entry and exit trips and equivalent passenger miles is shown in **Table 5.**

Table 5: BART Activity Data

	Annual Passenger Trips	Annual Passenger Miles
Entries (Origin)	817,504	10,337,203
Exits (Destination)	813,539	10,002,647
Total	1,631,043	20,339,850

Emission Coefficients

Total annual passenger miles traveled were multiplied by $MTCO_2e$ per passenger mile coefficient. Half of each trip was attributed to South San Francisco (the other half of the trip would be attributed to the origin or destination outside of the city). The metric tons of CO_2 per passenger mile were determined by using 2008 BART GHG emissions,[3] as reported in

[2] Bay Area Rapid Transit (2010). BART Monthly Ridership Reports. Retrieved from http://www.bart.gov/about/reports/ridership.aspx.

[3] Bay Area Rapid Transit (2008). BART 2007 Greenhouse Gas Emissions Inventory. Retrieved from http://www.bart.gov/docs/BART_Greenhouse_Gas_Inventory_Report.pdf.

the BART GHG Inventory, and dividing by the total number of passenger miles on the BART system in 2008 as shown in **Table 6**.[4]

Table 6: BART Emission Coefficients

Unit	Coefficient
Pounds per Passenger Mile	0.132675159
$MTCO_2$ per Passenger Mile	0.00006

Caltrain

Activity Level Data

Emissions in 2005 from trips taken to or from South San Francisco by Caltrain are a result of the combustion of diesel fuel on the locomotive fleet. The total number of trips and trip lengths that begin or end in South San Francisco were determined using 2005 annual weekday Caltrain ridership counts.[5] Weekday trips were summed to determine a weekly and annual number of trips and annual passenger miles traveled to or from South San Francisco as shown in **Table 7**.

Table 7: Caltrain Activity Data

Annual Passenger Trips	Annual Passenger Miles
254,540	7,612,514

Emission Coefficients

Total annual passenger miles traveled were multiplied by $MTCO_2e$ per passenger mile coefficient. Half of each trip was attributed to South San Francisco (the other half of the trip would be attributed to the origin or destination outside of the city) consistent with the methodology used in the transportation sector. Emissions coefficients for locomotives are provided by LGOP. The $MTCO_2e$ per passenger mile was calculated using the following assumptions:

- Overall, trains run at 38.1% of their capacity

---

[4] National Transit Database (11/2009). San Francisco Bay Area Rapid Transit District 2008 Agency Profile.

5 Caltrain (5/13/2005). February 2005 Caltrain Annual Ridership Counts. http://www.caltrain.com/Assets/Stats+and+Reports/ Ridership/2005_Caltrain_Ridership_Counts.pdf.

- The average number of passenger cars per train is 4.7
- The average car capacity is 135 people.
- The average capacity for a train is 634.5 people
- 634.5 x 38.1% = 242 people are on each train on average
- On average, Caltrain engines use 3.13 gallons of diesel per mile traveled
- Caltrain fuel efficiency = (1 mile/3.13 gallons) x (242 passengers) = 77.3 passenger miles/gallon

Table 8 shows the resulting Caltrain emission coefficient.

Table 8: Caltrain Emission Coefficients

Unit	Coefficient
MTCO2 per Passenger Mile	0.000133343

Water and Wastewater

Activity Level Data

The City of South San Francisco's water is provided by California Water Service (CWS) and Westborough Water District (WWD). The city's water supply originates in the Hetch Hetchy Water Project from Yosemite Valley. The City operates the water treatment plant and the pumps to distribute the water to users. The South San Francisco Water Quality Control Plant collects and treats the wastewater from South San Francisco before discharging the water into the San Francisco Bay. **Table 9** presents the total amount of water used by each sector as provided by the Bay Area Water Supply and Conservation Agency.[6] Unaccounted water is the water that was delivered to the jurisdiction by the San Francisco Public Utilities Commission (SFPUC,) but was not accounted for in the residential, commercial, or government/institutional water use and is likely a result of leaks thoroughout the distribution and collection system.

[6] Bay Area Water Supply and Conservation Agency (January 2010). Annual Survey and Water Conservation Report. Retrieved from http://bawsca.org/docs/BAWSCA_Survey_08_09_FINAL_rev_ 5_3.pdf on September 1, 2010.

Appendix A: Detailed Methodology

Table 9: South San Francisco Water Use, 2005

Sector	CWS Use (MG)	WWD Water Use (MG)	Total Water Use (MG)
Residential	1,266	214	1,479
Commercial	1,368	45	1,413
Government/ Institutional	146	53	199
Unaccounted Water	388	32	420
Total	1,902	344	3,511

MG = million gallons

Emissions Coefficients

Water-related emissions include the electricity use required to supply, convey, treat, distribute, collect, and dispose of water used by residences, businesses, and institutions in the City of South San Francisco. The emissions coefficients in **Table 10** use California averages provided by the California Energy Commission to determine the number of kilowatt-hours used per million gallons (MG) of water used.[7]

Table 10: Water Emissions Coefficients, 2005

Water Process	Source	kWh/MG
Supply	Surface Water	0
Conveyance	Hetch Hetchy to Bay Area	0
Treatment	EPRI Average	100
Distribution	EPRI Average	1,200
Wastewater Treatment	Activated Sludge	1,322
Wastewater Disposal	Gravity Discharge	0

[7] California Energy Commission. (November 2005). California's Water-Energy Relationship. Retrieved from http://www.energy.ca.gov/2005publications/CEC-700-2005-011/CEC-700-2005-011-SF.PDF on September 2, 2010.

APPENDIX A: DETAILED METHODOLOGY

WASTE

Activity Level Data

The waste sector takes into account both the future emissions from community-generated waste sent to landfills in 2005 and the direct landfill emissions from the release of methane during 2005 from any closed landfills within the city limits. Community-generated waste emissions are considered Scope 3 emissions because they are not generated in the base year, but will result from the decomposition of waste generated in 2005 over the full 100-year cycle of its decomposition, while methane released from the landfills during 2005 is considered a Scope 1 fugitive emission. **Table 11** presents South San Francisco's community-generated waste tonnage, alternative daily cover (ADC) tonnage, and ADC waste share provided by the CalRecycle Disposal Reporting System.[8]

Since the composition of waste sent to landfill in 2005 is unknown for the city, a statewide average waste composition study was utilized.[9]

Table 11: South San Francisco Waste Tonnages, 2005

Waste Type		Tons Landfilled	Source
Municipal Solid Waste	All Waste	85,091	CalRecycle DRS
Alternative Daily Cover	Compost or Green Waste	105	CalRecycle DRS
Alternative Daily Cover	Sludge	10,724	CalRecycle DRS

LGOP provides default methane capture rates of 75%. Methane emissions generated over the 100-year cycle from the city's waste was calculated using CARB's Landfill Emissions Tool.[10] The Landfill Emissions Tool uses the Intergovernmental Panel on Climate Change (IPCC) first-order decay model to calculate methane emissions. The tool defaults to a anaerobically degradable organic carbon (ANDOC) value of 6.72% based on California statewide waste composition in 2005 as shown in **Table 12**.

---

[8] CalRecycle. Local Government Central Disposal Reporting System. http://www.calrecycle.ca.gov/lgcentral/drs/.

[9] CalRecycle (2004). Statewide Waste Characterization Study, http://www.ciwmb.ca.gov/Publications/default.asp?pubid=1097.

[10] California Air Resources Board (March 2010). Landfill Emissions Tool Version 1.2. http://www.arb.ca.gov/cc/landfills/landfills.htm.

Appendix A: Detailed Methodology

Table 12: Waste Composition, 2005

Waste Type	Description	Waste Share (State Average)
Paper Products	All paper types	21.0%
Food Waste	Food	14.6%
Plant Debris	Leaves and Grass, Prunings and Trimmings, Branches and Stumps, Agricultural Crop Residues, and Manures	6.9%
Wood/Textiles	Textiles, Remainder/Composite Organics, Lumber, and Bulky Items	21.8%
All Other Waste	Inorganic Material such as Glass, Metal, Electronics, Plastics, Non-organic C&D, and Hazardous Waste	35.8%
ADC Plant Debris	Organic Portion of ADC (cover material placed on top of landfills at the end of each operating day to control vectors, fires, odors, blowing litter, and scavenging)	N/A

Direct landfill emissions were calculated for the Oyster Point Landfill in the City of South San Francisco by determining the total tonnage of waste deposited into the landfill between 1956 and 1969. Although some direct landfill gas measurement data was available, it was measured over a continuous period for each monitoring station of the landfill. The Oyster Point Closure and Post Closure Maintenance Plan indicated that there is approximately 1.4 million tons of waste in the landfill.[11] Since there was not an available record of how much waste was deposited into the landfill during each year of operation, the total deposited waste of 1.4 million tons was evenly distributed to each of the 14 operational years and entered into the CARB landfill emissions tool.[12]

---

11 Gabewell, Inc. with Harding Lawson Associates. (September 2000). Final Closure and Post-Closure Maintenance Plan Oyster Point Landfill. Section 3, page 10 section 3.5 Site Capacity and Service.

12 California Air Resources Board (March 2010). Landfill Emissions Tool Version 1.2. http://www.arb.ca.gov/cc/landfills/landfills.htm.

Off-Road Equipment

Activity Level Data

The Inventory includes emissions from lawn and garden as well as construction equipment sources. While there are several other off-road equipment uses with emissions in San Mateo County, currently there is no reasonable methodology to attribute marine, recreational, airport, or other equipment and vehicles to each individual jurisdiction within the county. Emissions from construction and lawn and garden equipment for San Mateo County were determined using CARB's OFFROAD 2007 program and are presented in **Table 13**. Per BAAQMD guidance, county-level emissions for off-road equipment were attributed to South San Francisco using the following indicators:

- Total county construction equipment emissions were attributed to South San Francisco using the proportion of new housing units (see **Table 14**) built within South San Francisco compared to the entire county using HUD's State of the Cities Data Systems building permit reporting system.[13]

- Total county lawn and garden emissions were attributed to South San Fracisco using the proportion of existing households within South San Francisco compared to the entire county using ABAG housing projection figures and are presented in **Table 15**.[14]

Table 13: San Mateo County 2005 Off-Road Emissions

Equipment Type	Emissions ($MTCO_2e$)
Construction	151,182
Lawn & Garden	14,181

Table 14: South San Francisco & San Mateo County New Housing Units, 2005

Jurisdiction	Housing Units Built
South San Francisco	102
San Mateo County	724
Percentage of new housing in South San Francisco	14.1%

13 Department of Housing and Urban Development (2010). State of the Cities Data Systems Building Permits Database . http://socds.huduser.org/permits/.

14 Association of Bay Area Governments (2009). ABAG Population, Housing, and Employment Projections.

Table 15: South San Francisco & San Mateo County Total Housing Units, 2005

Jurisdiction	Households
South San Francisco	20,130
San Mateo County	260,070
Percentage of Households in South San Francisco	7.7%

Stationary Sources

The Inventory includes stationary emissions sources from industrial operations in South San Francisco, mainly Genentech operations. As a major emitter in the state, Genentech is required to report emissions to CARB on an annual basis.[15] While these emissions, presented in **Table 16**, are important for informational purposes, the City has little regulatory authority over this source of emissions. Genentech's operations and efficiencies are largely regulated by CARB, which, as part of the AB 32 Early Action Items and Scoping Plan, has required or will require new industrial efficiency measures between 2005 and 2020.

Table 16: Stationary Sources

Stationary Source	Emissions (MTCO2e)
Genentech, Inc.	41,434

2020 Business-as-usual Forecast

The 2020 forecast calculates emissions growth based on population, job, VMT, and household growth rates. Household and population data was obtained from the 2009 ABAG Projections. Employment figures were obtained from the City's Housing Element. City staff believes these projections provide a more realistic representation of local economic development activities. On-road VMT was calculated by Fehr & Peers per the baseline methodology using the C/CAG model. These growth indicators and their sources are summarized in **Table 17.** Additional detail for the transportation forecast by Fehr & Peers is presented in **Table 18**.

[15] California Air Resources Board (2009). 2008 Facility Emissions. http://www.arb.ca.gov/cc/reporting/ ghg-rep/ghg-reports.htm.

Appendix A: Detailed Methodology

Table 17: 2020 Growth Indicators

Growth Indicator	Source	2005	2020	% growth	Applied to…
Population	ABAG	61,700	69,700	13.0%	–
Service Population	ABAG	103,940	119,830	15.3%	BART Caltrain Waste Water
Households	ABAG	20,130	22,840	13.5%	Residential Energy Off-Road Equipment
Daily VMT	Fehr & Peers	1,153,443	1,314,394	13.5%	On-Road Transportation
Employment	City Housing Element	42,240	50,130	18.7%	Commercial & Industrial Energy

Table 18: 2020 On-Road Transportation Growth Detail

Source	2020 Daily VMT	2020 Annual VMT	Percentage of Total	Percentage Increase from 2005
East of Highway 101	455,263	157,976,261	35.28%	2.05%
West of Highway 101	835,009	289,748,123	64.72%	18.05%
Total	**1,290,272**	**447,724,384**	**100.00%**	**20.10%**

With the exception of transportation, the growth rates from these figures were applied to 2005 baseline emissions to achieve a business-as-usual (BAU) growth projection as shown in **Table 19**. Transportation emissions were forecast using the EMFAC2007 software described in the baseline methodology. The software accounts for the increase in newer, more efficient vehicles within the San Francisco Air Basin and San Mateo County.

Table 19: 2020 BAU Growth Forecast

Sector/Source		2005	2020	Percentage Change
Residential (Electricity)	Electricity	22,435	25,455	13.5%
	Natural Gas	48,458	54,982	13.5%
Commercial/ Industrial	Electricity	86,371	102,504	18.7%
	Natural Gas	108,191	128,400	18.7%
Transportation	On-Road Vehicles	195,788	218,033	11.4%
	BART	612	706	15.3%
	Caltrain	508	586	15.3%
Waste	Community Waste	60,857	70,161	15.3%
	Direct Landfill Emissions	13,216	9,791	-25.9%
Water-Related	Gallons	1,578	1,819	15.3%
Off-Road Equipment	Gallons of Diesel and Gasoline	22,399	25,416	13.5%
Total		**560,414***	**637,852**	**13.8%**

** Due to the rounding of decimals to whole numbers , the sum of all sectors may be less than the total by 1 $MTCO_2e$.*

2020 Forecast Adjustment

The BAU forecast was adjusted to include three mandated efficiency measures being implemented at the state and federal levels. Their incorporation into the growth forecast is recommended by BAAQMD in their plan-level GHG quantification guidance. These state and federal reductions, when applied to South San Francisco's emissions forecast, result in a net decrease in emissions by 2020 as shown in **Table 20** below.

AB 1492 (Pavley). California's Pavley regulations were established by AB 1493 in 2002. They require new passenger vehicles to reduce tailpipe GHG emissions from 2009 to 2020. Reductions from the Pavley regulations were calculated using the methodology included in an EMFAC2007 post-processing tool provided by CARB and supported by BAAQMD.[16] Emissions reductions per model year and vehicle class were applied to South San Francisco's transportation emissions.

---

[16] CARB (2010). Pavley I and Low Carbon Fuel Standard Postprocessor Version 1.0. http://www.arb.ca.gov/cc/sb375/tools/postprocessor.htm.

California's Renewable Portfolio Standard (RPS) mandates that utility providers procure 33% of their energy from renewable sources by 2020. It was become clear to the California Public Utilities Commission that energy providers are not likely to meet this target; therefore the calculation included in this report relies on a more realistic scenario modeled by the CPUC in their June 2009 RPS Implementation Analysis Report.[17] The report indicates that a more realistic estimate of renewable energy in 2020 is 26% by 2020.

California Green Building Standards Code (CalGreen). The 2008 Title 24 update went into effect on January 1, 2010. The energy reductions quantified in the forecast are the mandatory improvements over the 2005 Title 24 code that were established by the 2010 update. These are statewide standards applied at the local level by city agencies through project review. The CalGreen standards that go into effect January 1, 2011, do not provide additional mandatory reductions in energy consumption that can be quantified as an anticipated alteration to business-as-usual trends..

The calculation of CalGreen energy reductions assumes that all development between 2010 and 2025 will meet Title 24 2008 minimum efficiency standards. It also assumes that all growth in natural gas and electricity sectors is from new construction. The 2008 Title 24 Energy Efficiency Improvements in comparison to 2005 baseline Title efficiency standards are provided by the California Energy Commission (CEC).[18]

Table 20: 2020 Forecast Emissions Reductions & Target

State Reductions Summary	2005	2010	2020
Growth Projection ($MTCO_2e$)	560,414	582,427	637,852
Pavley I Reductions ($MTCO_2e$)	n/a	n/a	-31,703
RPS Reductions ($MTCO_2e$)	n/a	-3,014	-18,429
Title 24 Reductions ($MTCO_2e$)	n/a	n/a	-2,769
Total State Reductions ($MTCO_2e$)	n/a	-3,014	-52,900
Total Local Reductions	n/a	-4,572	-5,082
Adjusted Growth Projection ($MTCO_2e$)	n/a	574,841	579,869
Percentage Change from 2005	n/a	2.57%	3.47%
$MTCO_2e$/SP	5.39	5.33	4.84

---

[17] CPUC (2009). 33% Renewable Portfolios Standard Implementation Analysis Report. http://www.cpuc.ca.gov/NR/rdonlyres/1865C207-FEB5-43CF-99EB-A212B78467F6/0/33PercentRPSImplementationAnalysisInterimReport.pdf.

[18] California Energy Commission, Impact Analysis: 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings, November 2007.

Appendix B

Appendix B:
South San Francisco Transportation Baseline and Future Year Inventory

FEHR & PEERS
TRANSPORTATION CONSULTANTS

MEMORANDUM

Date: October 26, 2010

To: Michael McCormick & Jillian Rich, PMC

From: Ben Larson & Tien-Tien Chan, Fehr & Peers

Subject: ***South San Francisco Transportation Baseline and Future Year Inventory***

SF10-0514

This technical memorandum documents the base year and future year VMT estimated by Fehr & Peers as part of the South San Francisco Greenhouse Gas Inventory. The C/CAG (San Mateo County) Travel Demand Model was used to develop the VMT estimates. This memo consists of the following sections:

1. Base Year (2005) VMT Estimates
2. Future Year (2020) Business as Usual (BAU) VMT Estimates
3. Future Year (2020) General Plan Buildout VMT Estimates

Base Year (2005) VMT Estimates

Fehr & Peers conducted a model run to calculate base year daily VMT by speed bin estimates. Separate calculations were conducted for the east of 101 area and the west of 101 area. This was done due to the unique development and TDM measures implemented in the east of 101 area. Extensive travel data has been collected for this region and the model results were checked for reasonableness.

Using select link analysis, three types of vehicle trips were tracked separately for AM and PM peak periods for the two subareas in South San Francisco:

1. Vehicle trips that remained internal to the location.
2. Vehicle trips with one end in the location and one end outside of location (IX/XI trips).
3. Vehicle trips with neither end in the location (XX trips).

Using the set of “accounting rules” recommended for VMT inventories in Climate Action Plans by the Bay Area Regional Transportation Advisory Committee (RTAC), VMT from trips of type 1, 2 and 3 were counted 100%, 50%, and 0% respectively towards jurisdiction-generated VMT.

The C/CAG model is calibrated to AM and PM peak period conditions. These volumes were then converted into daily trips based on analysis of District 4 PeMS data which indicates that 50% of the daily traffic on state highways in the Bay Area travel during the AM and PM peak periods. An estimate for daily volumes was calculated with the following equation: daily VMT = (AM VMT + PM VMT) * 2. Table 1 shows the 2005 Baseline VMT estimates by speed bin.

Table 1
2005 Baseline Daily VMT Estimates by Speed Bin

Speed From	Speed To	East of 101	West of 101	Total
0	5	5,633	26	5,659
5	10	797	899	1,696
10	15	5,930	3,820	9,750
15	20	3,673	4,148	7,822
20	25	1,788	8,861	10,649
25	30	11,920	18,965	30,886
30	35	41,097	74,746	115,843
35	40	54,116	114,589	168,705
40	45	3,101	11,968	15,070
45	50	2,743	9,372	12,116
50	55	3,111	9,466	12,578
55	60	51,080	79,133	130,213
60	65	127,205	191,601	318,805
65	+	133,933	179,719	313,652
Total		**446,130**	**707,313**	**1,153,443**

Fehr & Peers, 2010.

In addition, initial results from the C/CAG model showed unusual speed distributions for the internal trips, concentrating all VMT on only a few speed bins. To more accurately represent internal trip speed distribution, we pulled the speed distribution from the EMFAC model and applied those percent allocations to the internal VMT output by the C/CAG model.

FEHR & PEERS
TRANSPORTATION CONSULTANTS

Future Year (2020) Business as Usual VMT Estimates

Fehr & Peers ran the 2030 C/CAG model and obtained a Year 2030 BAU VMT estimate, representing the future VMT without any additional specific greenhouse gas-reduction measures. The 2020 forecast was subsequently calculated by linearly interpolating between the 2005 base year results and the 2030 BAU results. Table 2 shows the result of this run:

Table 2
2020 Business as Usual Daily VMT Estimates by Speed Bin

Speed		East of 101	West of 101	Total
From	To			
0	5	3,896	230	4,126
5	10	1,479	1,741	3,221
10	15	3,782	3,828	7,610
15	20	3,324	5,609	8,933
20	25	2,699	12,632	15,331
25	30	12,627	21,772	34,399
30	35	40,202	83,904	124,106
35	40	53,335	129,148	182,484
40	45	2,681	12,243	14,924
45	50	3,027	10,543	13,571
50	55	3,289	9,639	12,928
55	60	52,097	86,353	138,450
60	65	153,054	257,049	410,103
65	+	135,606	208,601	344,208
Total		**471,101**	**843,293**	**1,314,394**

Fehr & Peers, 2010.

Table2 shows that in the absence of any additional greenhouse gas reduction strategies, VMT for the City would increase by 14% from 2005 to 2020.

Future Year (2020) General Plan Buildout VMT Estimates

Per the General Plan employment forecasts, Fehr & Peers increased the ABAG projections in the model approximately 2% and reran the 2030 C/CAG model to obtain a Year 2030 General Plan Buildout VMT estimate, representing the future VMT without any additional specific greenhouse gas-reduction measures. The 2020 forecast was subsequently calculated by linearly interpolating between the 2005 base year results and the 2030 General Plan buildout results. Table 3 shows the result of this run:

FEHR & PEERS
TRANSPORTATION CONSULTANTS

Table 3
2020 General Plan Buildout Daily VMT Estimates by Speed Bin

Speed		East of 101	West of 101	Total
From	To			
0	5	3,775	468	4,243
5	10	1,466	1,266	2,732
10	15	3,775	4,136	7,911
15	20	3,139	5,650	8,788
20	25	2,868	12,732	15,600
25	30	12,888	21,765	34,653
30	35	39,192	83,978	123,170
35	40	52,701	128,836	181,537
40	45	2,666	12,366	15,032
45	50	3,048	10,617	13,665
50	55	3,208	9,645	12,853
55	60	48,427	84,790	133,216
60	65	140,359	251,002	391,361
65	+	137,753	207,758	345,512
Total		**455,263**	**835,009**	**1,290,272**

Fehr & Peers, 2010.

Table 3 shows that in the absence of any additional greenhouse gas reduction strategies, VMT for the City would increase by 10% from 2005 to 2020.

Future Year (2020) Business as Usual and General Plan Buildout VMT Comparison

The results from the General Plan Buildout run indicated a slight decrease in VMT compared to the BAU scenario, even though there were more jobs assumed in the city. A closer examination of the results showed that the internal to internal VMT did increase slightly (as expected), however, the external-internal and internal-external (IX/XI) VMT dropped. A potential reason for the decrease in external-internal trips could be related to the population to jobs ratio for South San Francisco. Under the BAU scenario the population to jobs ratio changes from 1.23 persons per job to 1.20 for the increased employment scenario. This increase in employment translates into more people living and working in South San Francisco, which could explain some of the external-internal VMT reduction. However, the overall decrease is larger than what we typically observe in similar areas, which may suggest that the model is overly aggressive related to its assumptions about how many residents will live and work within South San Francisco.

FEHR & PEERS
TRANSPORTATION CONSULTANTS

GHG Analysis

After obtaining VMT estimates by speed bin, we post-processed the numbers to convert to estimated CO_2 emissions. Emissions factors were obtained from EMFAC for year 2005 and year 2020 for San Francisco Bay Area Air Basin. Our previous research with the emissions factors has also shown some error in the EMFAC factors for speeds in excess of 65mph. These results must be interpreted cautiously. EPA factors were utilized to convert from CO_2 to CO_2e emissions. Table 4 shows the estimated annual CO_2e emissions for base year 2005, business-as-usual year 2020, and general plan year 2020.

Table 4
Metric Tons CO_2e Estimates

	2005 Baseline	2020 BAU	2020 General Plan
East of 101	77,560	81,128	78,392
West of 101	118,228	141,073	139,641
Total	**195,788**	**222,201**	**218,033**

Fehr & Peers, 2010.