County of San Mateo 2005 Community-Scale Greenhouse Gas Emissions Inventory

1. City of Foster City Community-Scale Greenhouse Gas Emissions Inventory

1.1 Background

The County of San Mateo RecycleWorks and City and County Association of Governments (C/CAG) have been working to support all the cities in San Mateo County through the process of completing both their government operations and community-scale greenhouse gas emission inventories. This community-scale inventory has been completed on behalf of the City of Foster City through CO_2 San Mateo County, a program funded in part by the Bay Area Air Quality Management District (BAAQMD).

In 2009, C/CAG contracted with ICLEI, Local Governments for Sustainability (ICLEI) to support this effort through trainings and technical support. ICLEI had previously been involved in the county, hosting two community-scale inventory trainings in 2007 and 2008 for San Mateo and Santa Clara County local governments. ICLEI has also supported a number of local governments in the county in performing community and government operations inventories. This inventory culminates all of that work and creates a standard emissions inventory for all local governments in the county.

Using the results of this community inventory, each of the San Mateo County local governments may now use these inventory results to move forward into the target setting and climate action planning milestones of ICLEI's Five-Milestone process (see Section 1.2).

1.2 Purpose of Inventory

The objective of this greenhouse gas emissions inventory is to identify the sources and quantify the volumes of greenhouse gas emissions resulting from activities taking place throughout the community of Foster City in 2005. This inventory serves two purposes:

- It creates an emissions baseline against which the City can set emissions reductions targets and measure future progress.
- It demonstrates the largest sources of emissions from community activities, and therefore allows the City to most effectively target its emissions reductions policy

While the City of Foster City has already begun to reduce greenhouse gas emissions through its actions, this inventory represents the first step in a systems approach to reducing the City's emissions. This system, developed by ICLEI, is called the Five-Milestone Process and is utilized by over 550 local governments in the U.S. to structure their climate protection efforts. The process is as follows:

- Milestone 1: Conduct a baseline emissions inventory and forecast
- Milestone 2: Adopt an emissions reduction target for the forecast year
- Milestone 3: Develop a local climate action plan
- Milestone 4: Implement the climate action plan
- Milestone 5: Monitor progress and report results

Figure 1.1 The Five-Milestone Process

2. Emissions Inventory Methodology

2.1 Methodology Standards

As local governments all over the world continue to rapidly join the climate protection movement, the need for a standardized approach to quantifying greenhouse gas (GHG) emissions is more pressing than ever. The community emissions inventory follows the standard outlined in the draft International Local Government GHG Emissions Analysis Protocol (IEAP). ICLEI has been developing this guidance since the inception of its Cities for Climate Protection Campaign in 1993, and has recently formalized version 1 of the IEAP as a means to set a common framework for all local government worldwide. Using this framework, ICLEI has worked with California Air Resources Board (ARB), the Bay Area Air Quality Management District, the Metropolitan Transportation Commissions, and other state and regional agencies to develop a common method for inventorying community emissions in the Bay Area. This method has been used by the majority of local governments in the Bay Area.

ARB is currently working to establish a community greenhouse gas methodology specifically for California local governments. This methodology will serve as a corollary to the recently adopted Local Government Operations Protocol (LGOP). The LGOP, which ARB adopted in 2008, serves as the national standard for quantifying and reporting greenhouse emissions from local government operations.

2.2 Baseline Years

An initial aspect of the emissions inventory process is the requirement to select a base year for emissions, which will be used to establish a baseline emissions inventory against which all future inventories will be compared. A good baseline year is the earliest year where there is accurate and complete data for all key emission sources. It is also preferable to establish a base year several years in the past to be able to account for the emissions benefits of recent actions. A local government's emissions inventory should comprise of all greenhouse gas emissions occurring during a selected *calendar* year.

For the reasons mentioned above, this inventory utilizes 2005 as the baseline year, as this year is increasingly becoming the standard for such inventories. This is in line with state guidance, which, while establishing its baseline year as 1990, has recognized that locla governments do not have complete data going back that far. Therefore, ARB recommended that local governments use a "current" or recent year as a baseline. .

After setting a base year and conducting an emissions inventory for that year, local governments should make it a practice to complete a comprehensive emissions inventory on a regular basis to compare to the baseline year. ICLEI recommends conducting an emissions inventory at least every five years.

2.3 Boundaries of Greenhouse Gas Inventory Analysis

Any inventory is a subset of measurable emissions based upon a certain boundary. The boundary of this community inventory is emissions that result from activities taking place within the geopolitical boundary of the local government's community, over which the local government has direct control.[1] This boundary is used because activities that occur within the community boundary can be controlled or influenced by jurisdictional policies and programs. Though a local government cannot maintain direct control of all emissions sources within its boundaries, it is still important to inventory these emissions as local government policies and programs can still have an indirect

[1] Sphere of Influence areas are generally not considered in community-scale inventories since a local government maintains only indirect control over these areas.

influence on these emissions. For example, although much of the traffic on state highways within a jurisdiction can be pass-through, inventorying emissions from this source encourages a local govenment to collaborate in regional transportation planning and further examine its own transportation and land use policies.

Within the boundaries of this inventory, emissions are organized according to sectors.

2.4 Emissions Sectors

ICLEI recommends that local governments examine their emissions in the context of the sector that is responsible for those emissions. Many local governments will find a sector-based analysis more directly relevant to policy making and project management, as it assists in formulating sector-specific reduction measures and climate action plan components.

Community Sectors

The IEAP outlines the following sectors, in accordance with the Intergovernmental Panel on Climate Change (IPCC):

Stationary Combustion: Including utility delivered fuel consumption at stationary sites , utility delivered electricity / heat consumption at stationary sites, decentralized fuel consumption at stationary sites (e.g. propane, kerosene, stationary diesel from small vendors), utility consumed fuel for electricity / heat generation, etc.

Mobile Combustion: Including tailpipe emissions from vehicles traveling on roads within the geopolitical boundary of the local government, tailpipe emissions from off-road vehicles operating within the geographical boundaries, rail traffic occurring within geographical boundaries, marine transportation occurring between two jurisdictions, etc.

Fugitive and Other Energy Emissions: Including leaked natural gas from distribution infrastructure located within geopolitical boundaries, leaked refrigerants from residential and commercial / industrial facilities, etc.

Industrial Processes and Product Use: Including non-energy related emissions generated in the production of cement, in the refining of fuels, in the processing of coal, etc.

Agriculture, Forestry and Other Land Use: Including emissions from the use of nitrogenous fertilizers, methane emissions from livestock farms, negative net biogenic carbon flux, etc.

Waste: Including fugitive methane emissions at landfills, fugitive methane and nitrous oxide emissions at waste water treatment facilities, estimated future emissions associated with base 2005 waste disposal, etc.

In most cases, a local government can enhance this inventory by further subdividing these sectors in a manner consistent with the way that the local government is accustomed to considering their community (for example, splitting stationary combustion into residential, commercial and industrial sectors) . It is not mandatory that a local government conduct an analysis of all sectors listed by the IPCC, and this emissions inventory contains the sectors indicated in Table 2.1.

Table 2.1. Emissions Inventory Sectors

Sector	Description
Residential	Electricity and natural gas usage in homes
Commercial/Industrial	Electricity and natural gas usage in businesses
Transportation	Fuel consumption in on-road vehicles and off-road equipment
Waste Generation	Future emissions from the expected decomposition of waste generated by the community in the base year

2.5 Units Used in Reporting Greenhouse Gas Emissions

In this narrative report, emissions from all gases released by an emissions source (e.g. stationary combustion of natural gas in facilities) are combined and reported in metric tons of carbon dioxide equivalent (CO_2e). This standard is based on the Global Warming Potential (GWP) of each gas, which is a measure of the amount of warming a greenhouse gas may cause, measured against the amount of warming caused by carbon dioxide. See Table 2.2 below for the GWPs of the gases discussed in this section.

2.6 Quantification Methods

It is important to understand that all emissions inventories are almost always a sum of *estimated,*and not actual , emissions. Emissions are quantified using the best available methods and best available data, and are subject to change as better data or estimation methods become available. Emissions can be quantified in two ways:

Table 2.2: Greenhouse Gases

Gas	Chemical Formula	Activity	Global Warming Potential (CO_2e)
Carbon Dioxide	CO_2	Combustion	1
Methane	CH_4	Combustion, Anaerobic Decomposition of Organics (Landfills, Wastewater), Fuel Handling	21
Nitrous Oxide	N_2O	Combustion, Wastewater Treatment	310
Hydrofluorocarbons	Various	Leaked Refrigerants, Fire Suppressants	43-11,700
Perfluorocarbons	Various	Aluminum Production, Semiconductor Manufacturing, HVAC Equipment Manufacturing	6,500-9,200
Sulfur Hexafluoride	SF_6	Transmission and Distribution of Power	23,900

Measurement-based methodologies refer to the direct measurement of greenhouse gas emissions (from a monitoring system) emitted from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility. This methodology is not generally available for most types of emissions and will only apply to a few local governments that have these monitoring systems.

The majority of the emissions recorded in this inventory have been calculated using **calculation-based methodologies** to calculate emissions using activity data and emission factors. To calculate emissions accordingly, this basic equation is used:

Activity Data x Emission Factor = Emissions

Activity Data

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

Emission Factors

Emission factors are used to convert energy usage or other activity data into associated emissions quantities. They are usually expressed in terms of emissions per unit of activity data (e.g. lbs CO_2/kWh). Please see Appendix B for a listing of emissions factors used in this report. Table 2.3 demonstrates an example of common emission calculations that use this formula.

Table 2.3: Basic Emissions Calculations

Activity Data	Emissions Factor	Emissions
Electricity Consumption (kWh)	CO_2 emitted/kWh	CO_2 emitted
Natural Gas Consumption (therms)	CO_2 emitted/therm	CO_2 emitted
Gasoline/Diesel Consumption (gallons)	CO_2 emitted /gallon	$CO_2$2 emitted
Vehicle Miles Traveled	CH_4, N_2O emitted/mile	CH_4, N_2O emitted

3 Community Inventory Summary

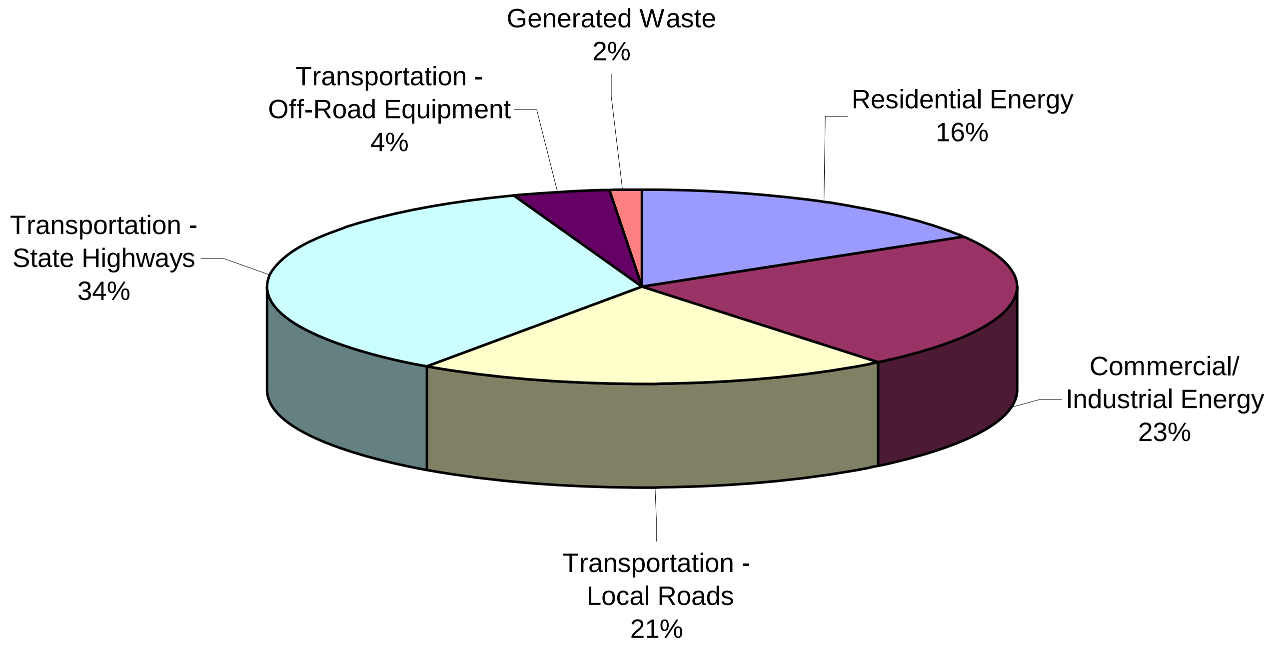
In 2005, activities and operations taking place within the City of Foster City's boundary resulted in approximately 274,933 metric tons of CO_2e. This number includes emissions from the combustion of fuels in the residential, commercial / industrial, and transportation sectors within the County's boundaries. In addition, this number contains emissions associated with community electricity consumption (emissions that occur as a result of electricity consumption within the geopolitical boundary of the City, but that occur at sources located outside of the City's jurisdiction), and future emissions from waste generated by the community.[2]

3.1 Summary by Sector

By better understanding the relative scale of emissions from each primary sector, the City can more effectively focus emissions reductions strategies to achieve the greatest emission reductions. For this reason, an analysis of emissions by sector is included in this report, based on the total of 274,933 metric tons of CO_2e.

As visible in Figure 3.1 and Table 3.1, the largest source of emissions in 2005 is transportation on state highways, which accounts for 34% of total emissions. Commercial and industrial energy use is the next largest source of emissions at 23%. Transportation on local roads generates 21% of total emissions, while residential energy use makes up 16% of total emissions. Smaller emissions-generating sources include transportation on off-road equipment (4%) and generated waste (2%). Please see detailed sector emissions analyses below for more detail.

Figure 3.1 2005 Jurisdiction Emissions by Sector



[2] For more information, please see Appendix A: International Local Government GHG Emissions Analysis Protocol Community Scopes Framework

Table 3.1: 2005 Community Emissions by Sector

Sector	Greenhouse Gas Emissions (metric tons CO_2e)	Percentage of Greenhouse Gas Emissions
Residential	44,742	16%
Commercial / Industrial	62,737	23%
Transportation-Local Roads	56,890	21%
Transportation-State Highways	94,976	34%
Transportation - Off-Road Equipment	11,435	4%
Generated Waste	4,153	2%
TOTAL	274,933	

Table 3.2: 2005 Community Emissions by Sector and Source

Sector	Source	Greenhouse Gas Emissions (metric tons CO_2e)	Percentage of Greenhouse Gas Emissions
Residential	Electricity	16,407	6%
	Natural Gas	28,335	10%
Commercial/Industrial	Electricity	26,164	10%
	Natural Gas	16,741	6%
Direct Access	Electricity	10,676	4%
(Non-PG&E Industrial Customers)	Natural Gas	9,156	3%
Transportation	Local Roads-Gasoline	52,127	19%
	Local Roads-Diesel	4,763	2%
	State Highways-Gasoline	87,025	32%
	State Highways-Diesel	7,951	3%
	Off-Road Equipment (Residential)	659	Less than 1%
	Off-Road Equipment (Commercial/Industrial)	10,776	4%
Generated Waste	Paper Products	2,311	Less than 1%
	Food Waste	910	Less than 1%
	Plant Debris	244	Less than 1%
	Wood or Textiles	679	Less than 1%
	All Other Waste	0	Less than 1%
Waste – Landfill Cover	Plant Debris	9	Less than 1%
	All Other Waste	0	Less than 1%
TOTAL		274,933	

3.3 Per Capita Emissions

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

As detailed in Table 3.3, dividing the total community-wide GHG emissions by population yields a result of *approximately 9 metric tons of* CO_2e *per capita*. It is important to understand that this number is not the same as the carbon footprint of the average individual living in the City of Foster City, as the per capita number includes emissions from activities by people who work or drive through Foster City, not only those who live in the community.

Table 3.3: 2005 Community Per Capita Emissions

Estimated 2005 Population[3]	29,854
Community GHG Emissions (metric tons CO_2e)	274,933
Per Capita GHG Emissions (metric tons (CO_2e)	~9.21

3.4 Recommendations

Based on the findings from this Inventory, the following are suggested steps for the City of Foster City:

- Set emissions-reduction targets.
- Continue to monitor progress and re-inventory emissions every five years.
- Near-term climate goals should be guided by the long-term goal of reducing emissions by 80 percent by 2050.
- Follow AB 32 suggestions of achieving at least 15 percent lower emissions by 2020.
- Consider sector-specific targets.
- Meet near-term targets by implementing simple actions for highest emitting sectors.

[3] State of California, Department of Finance, E-4 Population Estimates for Cities, Counties and the State, 2001-2007, with 2000 Benchmark. Sacramento, California, May 2007

Appendix A: International Local Government GHG Emissions Analysis Protocol (IEAP) Community Scopes Framework

Emissions sources can be categorized according to where they fall relative to the geopolitical boundary of the community. Using this method, emissions sources are categorized as direct or indirect emissions--Scope 1, Scope 2, or Scope 3-- in accordance with the World Resources Institute and the World Business Council for Sustainable Development's *Greenhouse Gas Protocol Corporate Standard.* This standard is important as it helps a local government better understand the sources of emissions and the extent to which they can directly control those emissions.

The Scopes framework identifies three emissions scopes for community emissions:

Scope 1: All direct emissions from sources located within the geopolitical boundary of the local government. Typical Scope 1 emissions include natural gas combustion emissions, emissions from fuel combustion by vehicles and off-road equipment, and methane emissions from biodegrading waste in landfills within community boundaries.

Scope 2: Indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating, and cooling. Scope 2 emissions occur as a result of activities that take place within the geopolitical boundary of the local government, but that occur at sources located outside of the government's jurisdiction.

Scope 3: All other indirect or embodied emissions not covered in Scope 2, that occur as a result of activity within the geopolitical boundary. Common Scope 3 emissions are future emissions from organic waste disposed of in the base year, emissions from air travel or ports, and "upstream" emissions (emissions generated in the production of materials used in the community).

Scope 1 and Scope 2 sources are the most essential components of a community greenhouse gas analysis. This is because these sources are typically the most significant in scale, and are most easily impacted by local policy making. The IEAP also includes, in its *Global Reporting Standard,* the reporting of Scope 3 emissions associated with the decomposition of solid waste and sewage waste-water produced within the geopolitical boundaries of the local government.

Scopes and Double Counting

One of the most important reasons for using the scopes framework for reporting greenhouse gas emissions at the local level is to prevent "double counting" for major categories such as electricity use and waste disposal. Double counting occurs if a set of emissions could be considered twice within an inventory. For example, if a local government produced its own power, it would be considered a Scope 1 emission at the point of generation and a Scope 2 emission at the point of consumption, and it would be inappropriate to add these emissions together. This may also occur if a local government has an active landfill within its boundaries to which community waste is sent. This report sums, or "rolls up" emissions from many scopes into one number, but is very clear to identify the types of emissions included in the rollup numbers. ICLEI strongly encourages local governments to do the same whenever they report a rollup number, as they can be very misleading and easily misquoted by policymakers or others when referring to the inventory.

Macro Sector (IPCC)		Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions
Energy	Stationary Combustion	Utility-delivered fuel consumption	n/a	Upstream/downstream emissions (e.g., mining/transport of coal)
		Decentralized fuel consumption		
		Utility-consumed fuel for electricity / heat generation		
	Electricity / Heat Consumption	n/a	Utility-delivered electricity / heat /steam consumption Decentralized electricity / heat /steam consumption	Upstream/downstream emissions (e.g., mining/transport of coal)
	Mobile Combustion	Tailpipe emissions from on-road vehicles Tailpipe emissions from rail, sea, airborne and non-road vehicles, operating within the community	Electricity consumption associated with vehicle movement within the community (e.g., light rail)	Tailpipe emissions from vehicles used by community residents
				Upstream/downstream emissions (e.g. mining/transport of oil)
				Tailpipe emissions from rail, sea, and airborne vehicles departing from or arriving into the community
	Other Energy	Fugitive emissions not already accounted for	n/a	Upstream/downstream emissions
Industrial Processes and Product Use		Decentralized process emissions	n/a	Upstream/downstream emissions
Agriculture, Forestry and Other Land Use		Livestock methane, managed soils	n/a	Upstream/downstream emissions from fertilizer/pesticide manufacture
		Net biogenic carbon flux	n/a	n/a
Waste	Solid Waste Disposal	Direct emissions from landfill, incineration and compost facilities located inside the community	n/a	Landfill, incineration and compost emissions occurring in present-year from waste produced to date inside the community Future emissions associated with waste disposed Upstream/downstream emissions (e.g. transport to the landfill)
	Wastewater Treatment and Discharge	Direct emissions from wastewater facilities located inside the community	n/a	Wastewater emissions occurring in present year from wastewater produced to date inside the community Future emissions associated with wastewater treated Upstream/downstream emissions

Appendix B: Community Inventory Methodology Summary

Residential, Commercial, Industrial Energy Sector Notes

Data Inputs / Outputs Summary:

Sector	Fuel	Quantity	Units	Emissions (metric tons CO2e)
Residential	Electricity	73,389,689	(kWh)	16,407
	Natural Gas	5,297,949	(therms)	28,335
TOTAL				**44,742**
Commercial / Industrial	Electricity	117,035,770	(kWh)	26,164
	Natural Gas	3,129,995	(therms)	16,741
	Direct Access Electricity	24,454,518	(kWh)	10,676
	Direct Access Natural Gas	1,723,863	(therms)	9,156
TOTAL				**62,737**

Emission Factors:

Emission Source	GHG	Emission Factor	Emission Factor Source
PG&E Electricity	CO_2	489.16 lbs/MWh	California Climate Action Registry Power/Utility Protocol Public Reports; http://www.climateregistry.org/CARROT/public/reports.aspx; also see Local Government Operations Protocol, Table G.5
	CH_4	0.029 lbs/MWh	Local Government Operations Protocol, Table G.6
	N_20	0.011 lbs/MWh	Local Government Operations Protocol, Table G.6
Natural Gas	CO_2	53.06 kg/MMBtu	U.S. EPA, Inventory of Greenhouse Gas Emissions and Sinks: 1990-2005; see also Local Government Operations Protocol, Table G.1
	CH_4	5.0 g/MMBtu (residential & commercial sectors) 1.0 g/MMBtu (industrial sector)	EPA Climate Leaders, Stationary Combustion Guidance (2007), Table A-1, based on U.S. EPA, Inventory of Greenhouse Gas Emissions and Sinks: 1990-2005 (2007),Annex 3.1; see also Local Government Operations Protocol, Table G.3
	N_20	0.1 g/MMBtu	
Default Direct Access Electricity	CO_2	958.49 lbs/MWh	Calculated from total in-state and imported electricity emissions divided by total consumption in MWh. Emissions from California Air Resources Board, Greenhouse Gas Inventory, 1990-2004 (November 17, 2007 version), available at http://www.arb.ca.gov/cc/inventory/data/data.htm Consumption data from California Energy Commission, http://www.energy.ca.gov In Local Government Operations Protocol, Appendix G, Table G.6, pages 174
	CH_4	0.029 lbs/MWh	
	N_20	0.011 lbs/MWh	

Data Sources:

1. PG&E electricity and natural gas: GHGDataRequests@pge.com

2. Direct access electricity estimates: California Energy Commission (CEC): Andrea Gough, agough@energy.state.ca.us

Additional Notes:

Estimations of electricity purchased through Direct Access (DA) contracts are derived from county level DA consumption figures, provided by the California Energy Commission. The countywide ratio of DA to utility-supplied-electricity is multiplied by a community's utility-supplied energy use to determine the amount of DA in a given community. According to the CEC, DA was 20.89% of "non-residential" electricity consumption and 55.08% of "non-residential" natural gas consumption in San Mateo County in 2005.

Formula: $DA_c / (DA_c + u_{c)} = DA / (DA + u)$

Transportation Sector Notes

On-Road Emissions

Data Inputs / Outputs Summary:

Sector	Sub Sector	Quantity (millions)	Units	Emissions (metric tons CO2e)
Transportation	Local Roads	117	(vehicle-miles traveled)	56,890
	State Highways	195	(vehicle-miles traveled)	94,976
TOTAL				**151,866**

Emission Factors:

County	CH_4 Rates (grams/mile)		N_2O Rates (grams/mile)		VMT Mix		CO_2 Rates- (grams/gallon)		Fuel Efficiency (miles/gallon)	
	Gas	Diesel	Gas	Diesel	Gas	Diesel	Gas	Diesel	Gas	Diesel
San Mateo County	0.058	0.030	0.070	0.050	96.8%	3.2%	8,609	10,216	19.6	8.1

Emission Factors Source: Bay Area Air Quality Management District (BAAQMD), using EMFAC 2007

Data Sources:

1. Local Roads Vehicle Miles Traveled (VMT) 2005 data: 2005 California Public Road Data, Highway Performance Monitoring System, State of California, Department of Transportation, http://www.dot.ca.gov/hq/tsip/hpms/datalibrary.php

2. State Highways Vehicle Miles Traveled (VMT) 2005 data: Data was created using GIS, by dividing a GIS file of Caltrans road segments for State Highways into jurisdictions using a jurisdictional boundary layer. VMT was divided proportionally between each segment, and VMT was split equally between jurisdictions for areas where the highway was on the border of two jurisdictions.

Additional Notes:

Local Road and state highway VMT data provided by MTC is in Daily VMT (DVMT); Annual VMT = DVMT x 365.

VMT is converted into gas and diesel, based on VMT mix. Then it is converted into gallons of fuel using fuel efficiency. CO2 is calculated from resulting fuel consumption.

Methane and nitrous oxide is calculated directly from VMT by fuel type. It is separated into fuel by VMT mix.

Off-Road Emissions

Category (see Additional Notes below)	Unit of Measure	Total Countywide Emissions	Total Units Countywide	Emissions Per Unit	Units in Jurisdiction	Jurisdiction's Emissions (metric tons CO2e)
Lawn and Garden Equipment	Households	14,182	260,000	~0.055	12,090	659
Construction, Industrial, and Light Commercial Equipment	Jobs	255,468	337,350	~0.757	14,230	10,776
Total						**11,435**

Data Sources:

Total countywide emissions: “Source Inventory of Bay Area Greenhouse Gas Emissions,” Bay Area Air Quality Management District. Report base year: 2007. http://www.baaqmd.gov/Divisions/Planning-and-Research/Emission-Inventory-and-Air-Quality-Related/Emission-Inventory/~/media/64A8751292F44BEEAD56B7569B68DB27.ashx

(Table Q, pg. 25)

2. Jobs and households data: Projections 2007 report, Association of Bay Area Governments, Jason Munkres, Regional Planner, ABAG, jasonm@abag.ca.gov, (510) 464-7929

Additional Notes

Data on total countywide emissions from off-road equipment came from the BAAQMD’s report with a base year of 2007, as there is no report for 2005 and no other reliable way to quantify off-road emissions in 2005 (the California Air Resources Board’s Off-Road Calculator is not currently functioning - http://www.arb.ca.gov/msei/offroad/offroad.htm). Emissions were divided into two categories – emissions from lawn and garden equipment and emissions from construction, industrial, and light commercial equipment.

Emissions per household were calculated using BAAQMD’s data on countywide emissions from lawn and garden equipment and the total amount of households countywide. To calculate emissions from lawn and garden equipment generated in the County, emissions per household were multiplied with the number of households in the unincorporated community.

Emissions per job were calculated using BAAQMD’s data on countywide emissions from construction, industrial, and light commercial equipment and the total amount of jobs countywide. To calculate emissions from construction, industrial, and light commercial equipment generated in the County, emissions per job were multiplied with the number of jobs in the unincorporated community.

Waste Sector Notes

Generated Waste Emissions

Data Inputs / Outputs Summary:

Sector	Sub Sector	Quantity	Units	Emissions (metric tons CO2e)
Waste	Landfilled Solid Waste	22,698	(tons)	4,144
	Alternative Daily Cover	86	(tons)	9
TOTAL				**4,153**

Emission Factors:

Waste Type	Methane Emissions (metric tons CH4 / metric ton of waste)	Emission Factor Source
Paper Products	2.138	US EPA, provided by the CACP Software
Food Waste	1.120	US EPA, provided by the CACP Software
Plant Debris	0.686	US EPA, provided by the CACP Software
Wood / Textiles	0.605	US EPA, provided by the CACP Software
All Other Waste	0.000	US EPA, provided by the CACP Software

Data Sources:

1. Landfilled Waste: California Integrated Waste Management Board Disposal Reporting System (DRS) - Jurisdiction Disposal and Alternative Daily Cover (ADC) Tons by Facility

http://www.ciwmb.ca.gov/LGcentral/Reports/DRS/Destination/JurDspFa.aspx

2. Alternative Daily Cover: California Integrated Waste Management Board Disposal Reporting System (DRS)- Alternative Daily Cover (ADC) by Jurisdiction of Origin and Material Type

http://www.ciwmb.ca.gov/LGCentral/Reports/DRS/Origin/ADCMatlType.aspx

3. Waste characterization: CIWMB 2004 Statewide Waste Characterization Study. This state average waste characterization accounts for residential, commercial and self-haul waste. http://www.ciwmb.ca.gov/Publications/default.asp?pubid=1097

Additional Notes:

ICLEI CACP software categories correlate with the CIWMB's waste categories according to the following guidelines:

CACP	CIWMB	% of Total
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	The other category includes all inorganic material types reported: Glass, Metal, Electronics, Plastics, Non-organic C&D, and Special/Hazardous Waste.	35.7

Emissions from the waste sector are an estimate of methane (CH_4) generation that will result from the anaerobic decomposition of all waste sent to landfill in the base year (2005). It is important to note that although these emissions are attributed to the inventory year in which the waste is generated, the emissions themselves will occur over the approximately 100 year timeframe that the waste will decompose. This frontloading of emissions is the approach taken by EPA's Waste Reduction Model (WARM). Attributing all future emissions to the year in which the waste was generated incorporates all emissions from actions taken during the inventory year into that year's greenhouse gas inventory. This facilitates comparisons of the impacts of actions taken between inventory years and between jurisdictions. It also simplifies analysis of the impact of actions taken to reduce waste generation or divert it from landfills.

While the WARM model often calculates upstream emissions, as well as carbon sequestration in the landfill, these dimensions of the model were omitted for this particular study for two reasons: (1) this inventory functions on an end-use analysis, meaning from disposal to decomposition, rather than a life-cycle analysis, meaning from mining to disposal, which would calculate upstream emissions. (2) This inventory solely identifies emissions sources, and not potential sequestration 'sinks'.

As some types of waste (e.g., paper, plant debris, food scraps, etc.) generate methane within the anaerobic environment of a landfill and others do not (e.g., metal, glass, etc.), it is important to characterize the various components of the waste stream. Waste characterization was estimated using the California Integrated Waste Management Board's 2004 statewide waste characterization study (http://www.ciwmb.ca.gov/Publications/default.asp?pubid=1097). Please see above table for a summary of this study according to the waste categories of the Clean Air and Climate Protection Software. This summary was conducted by staff at ICLEI-Local Governments for Sustainability.

Most landfills in the Bay Area capture methane emissions either for energy generation or for flaring. The US EPA estimates that 60%-80%[1] of total methane emissions are recovered at the landfills. Following the recommendation of the LGOP, the County adopted a 75 percent methane recover factor, which has been used in this inventory.

Recycling and composting programs are reflected in the CACP software model as reduced total tonnage of waste going to the landfills. The CACP model, however, does not capture the associated emissions reductions in “upstream” energy use from recycling as part of the inventory (“upstream” emissions include emissions that may not occur in your jurisdiction resulting from manufacturing or harvesting virgin materials and transportation of them). This is in-line with the “end-user” or “tailpipe” approach taken throughout this inventory. It is important to note that, *recycling and composting programs can have a significant impact on GHG emissions when a full lifecycle approach is taken*. Manufacturing products with recycled materials avoids emissions from the energy that would have been used during extraction, transporting and processing of virgin material.

[1] EPA AP 42 Emission Factors, Solid Waste Disposal, pg. 2, 4-6 (1998), http://www.epa.gov/ttn/chief/ap42/index.html