City of Menlo Park

Greenhouse Gas Emissions Analysis

2005 Community Emissions Inventory
&
2005 Municipal Operations Emissions Inventory

November 2007
(Revised February 2008)

Credits and Acknowledgements

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This report was prepared by Micah Lang, Program Officer at ICLEI–Local Governments for Sustainability U.S.A. The author gratefully acknowledges the dedication of the staff of the City of Menlo Park, who provided much of the insight and local knowledge necessary for the completion of this report.

ICLEI
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1 Introduction

On June 26, 2007, the Menlo Park City Council adopted a resolution committing the City to taking action for climate protection (see Appendix 1 for a copy of the resolution). Through this resolution, the City recognized the "profound effect" that greenhouse gases emitted by human activity are having on the Earth's climate, as well as the City's opportunity to reduce these emissions, both through its municipal operations and by inspiring change throughout the community. Through energy efficiency in its facilities and vehicle fleet, alternative clean energy sources, waste reduction efforts, land use and transit planning, and other activities, the City of Menlo Park can achieve multiple benefits, including saving energy and money, reducing emissions, and preserving quality of life in our community. With the assistance of ICLEI – Local Governments for Sustainability, the City has begun its efforts to identify and reduce greenhouse gas emissions.

This document represents completion of the first milestone in ICLEI's five milestone process: conducting an inventory of greenhouse gas emissions. Presented here are estimates of greenhouse gas emissions resulting from our community as a whole, as well as those resulting from the City's internal municipal operations. Due to data availability and the desire to conduct a baseline inventory for the same year as other Bay Area cities, both community activity and municipal operations data are presented for the year 2005. This data will provide a baseline against which we will be able to compare future performance, enabling us to demonstrate progress in reducing emissions.

1.1 Climate Change Background

A balance of naturally occurring gases dispersed in the atmosphere determines the Earth's climate by trapping solar radiation. This phenomenon is known as the greenhouse effect. Modern human activity, most notably the burning of fossil fuels for transportation and electricity generation, introduces large amounts of carbon dioxide and other gases into the atmosphere. Collectively, these gases intensify the natural greenhouse effect, causing global average surface temperature to rise, which is in turn expected to affect global climate patterns.

Overwhelming evidence suggests that human activities are increasing the concentration of greenhouse gases in the atmosphere, causing a rise in global average surface temperature and consequent climate change. In response to the threat of climate change, communities worldwide are voluntarily reducing greenhouse gas emissions. The Kyoto Protocol, an international effort to coordinate mandated reductions, went into effect in February 2005 with 161 countries participating. The United States is one of three industrialized countries that chose not to sign the Protocol.

In the face of federal inaction, many communities in the United States are taking responsibility for addressing climate change at the local level. The community of Menlo Park might be impacted by rising sea levels and resultant changes in the height, salinity and behavior of the San Francisco Bay, as well as other changes to local and regional weather patterns and species migration. Beyond our community, scientists also expect changing temperatures to result in more frequent and damaging storms accompanied by flooding and land slides, summer water shortages as a result of reduced snow pack, and disruption of ecosystems, habitats and agricultural activities.

1.2 The Cities for Climate Protection Campaign

By adopting a resolution committing the City to locally advancing climate protection, Menlo Park has joined an international movement of local governments. More than 800 local governments, including over 300 in the United States, have joined ICLEI's Cities for Climate Protection (CCP) campaign.[1] In addition to Menlo Park the neighboring towns of Palo Alto, San Jose, and San Francisco are all CCP participants.

The CCP campaign provides a framework for local communities to identify and reduce greenhouse gas emissions, organized along five milestones:

(1) Conduct an inventory of local greenhouse gas emissions;

(2) Establish a greenhouse gas emissions reduction target;

(3) Develop an action plan for achieving the emissions reduction target;

(4) Implement the action plan; and,

(5) Monitor and report on progress.

This report represents the completion of the first CCP milestone, and provides a foundation for future work to reduce greenhouse gas emissions in Menlo Park.

1.3 Sustainability and Climate Change Mitigation Activities in Menlo Park

Menlo Park got its start in environmental sustainability activities in the 1970s with the formation of the Environmental Beautification Commission. Over the years, the City has built a strong track record in its recycling, water conservation, and urban forestry programs. The efforts of the City's motivated Environmental Programs Coordinator and the strong response from residents have resulted in Menlo Park residents recycling more per pound than any of the 11 other cities in the South Bayside Waste Management Authority service area.[2] Another example of the success of the recycling and waste reduction promotional efforts of City staff is the high rate of participation among businesses and schools in the compost collection program. Beginning in 2004, this program has grown to include 70 businesses and schools that combine to divert about 3,200 tons of food waste annually from landfills.[3]

Menlo Park is known for its extensive tree canopy made possible through significant efforts of residents and the City to preserve heritage trees. The old Environmental Beautification Commission has evolved into the Environmental Quality Commission, which in addition to overseeing management of 20,000 City-owned trees, also supports broader environmental sustainability activities, including the annual Environmental Quality Awards.

[1] ICLEI was formerly known as the International Council for Local Environmental Initiatives, but the name has been changed to ICLEI – Local Governments for Sustainability.
[2] Dianne Dryer, Personal Communication, 09/2007.
[3] Dianne Dryer, Personal Communication, 09/2007.

In the area of energy conservation and efficiency, Menlo Park has been active in promoting PG&E's energy efficiency programs.[4]

Within the municipal government, in 2004 the City completed an energy audit and retrofit of the heating, ventilation, and air conditioning (HVAC) systems in the library and central administration building. Through upgrading these two HVAC systems the City saved $34,563 in 2005 over what was spent on electricity and natural gas on those two building groups in 2002/2003. Energy use has also been reduced through labeling essential vs. unessential lights, educating employees about energy conservation, and continuously replacing lamps with high efficiency fluorescent models.

In the area of renewable energy, before the end of 2007, the City will put out a request for proposals for a 35 kW solar photovoltaic system on the Maintenance Building roof.

2007 marks the beginning of Menlo Park's focused efforts on climate change mitigation work. In March, the Green Ribbon Citizens Committee (GRCC) formed and began working on a set of recommendations that will be proposed to the City Council for consideration for a climate action plan for both government and community activities. The GRCC has about 25 active members from different stakeholder groups that have been meeting monthly to finish their set of recommendations by November 2007. The greenhouse gas emissions inventory that is detailed in this report and points the way forward for future planning and actions is a necessary complement to the climate action plan.

2 Greenhouse Gas Emissions Inventory

The first step toward reducing greenhouse gas emissions is to identify baseline levels and sources of emissions in Menlo Park, as well as the sectors of community and government operations that are responsible for the bulk of these emissions. This information can later inform the selection of a reduction target and possible reduction measures.

2.1 Methods

ICLEI's Cities for Climate Protection campaign assists local governments to systematically track energy and waste related activities in the community, and to calculate the relative quantities of greenhouse gases produced by each activity and sector. The greenhouse gas inventory protocol involves performing two assessments: a community wide assessment and a separate inventory of municipal facilities and activities. The municipal inventory is a subset of the community inventory.

Once completed, these inventories provide the basis for the creation of an emissions forecast, and allow for the quantification of emissions reductions associated with proposed measures.

[4] Dianne Dryer, Personal Communication, 09/2007.

2.1.1 CACP Software

To facilitate community efforts to reduce greenhouse gas emissions, ICLEI developed the Clean Air and Climate Protection (CACP) software package in partnership with the State and Territorial Air Pollution Program Administrators (STAPPA), the Association of Local Air Pollution Control Officials (ALAPCO)[5], and Torrie Smith Associates. This software calculates emissions resulting from energy consumption and waste generation. The CACP software determines emissions using specific factors (or coefficients) according to the type of fuel used. Greenhouse gas emissions are aggregated and reported in terms of equivalent carbon dioxide units, or CO_2e. Converting all emissions to equivalent carbon dioxide units allows for the consideration of different greenhouse gases in comparable terms. For example, methane is twenty-one times more powerful than carbon dioxide on a per weight basis in its capacity to trap heat, so the CACP software converts one metric ton of methane emissions to 21 metric tons of carbon dioxide equivalents. The CACP software is also capable of reporting input and output data in several formats, including detailed, aggregate, source-based and time-series reports.

The emissions coefficients and quantification method employed by the CACP software are consistent with national and international inventory standards established by the Intergovernmental Panel on Climate Change (1996 Revised IPCC Guidelines for the Preparation of National Inventories) and the U.S. Voluntary Greenhouse Gas Reporting Guidelines (EIA form1605).

The CACP software has been and continues to be used by over 160 U.S. cities and towns to reduce their greenhouse gas emissions. However, it is worth noting that, although the software provides Menlo Park with a sophisticated and useful tool, calculating emissions from energy use with precision is difficult. The model depends upon numerous assumptions, and it is limited by the quantity and quality of available data. With this in mind, it is useful to think of any specific number generated by the model as an approximation of reality, rather than an exact value.

2.2.2 Creating the Inventory

The greenhouse gas emissions inventory consists of two distinct components: one for the Menlo Park community as a whole defined by its geographic borders, and the second on emissions resulting from the City of Menlo Park's municipal operations. The municipal inventory is effectively a subset of the community-scale inventory (the two are not mutually exclusive). This allows the municipal government, which has formally committed to reducing emissions, to track its individual facilities and vehicles and to evaluate the effectiveness of its emissions reduction efforts at a more detailed level. At the same time, the community-scale analysis provides a performance baseline against which we can demonstrate progress being made throughout Menlo Park.

Creating this emissions inventory required the collection of information from a variety of sources, including the Pacific Gas and Electric Company (PG&E), the Metropolitan Transportation Commission, the California Integrated Waste Management Board, CalTrans, and internal City records. Data from the year 2005 was used for the community inventory, with the exception of a

[5] Now the National Association of Clean Air Agencies (NACAA)

subset of the waste data, which utilizes a California statewide waste characterization study conducted in 2003-2004. Data collected for the municipal inventory is from calendar year 2005. Due to data gaps, fuel usage for Menlo Park's municipal fleet for calendar year 2005 was estimated using fuel usage and odometer readings data from fiscal year 2006-2007 and other proxies.

For both the inventory of community activities and government operations, emissions sources are categorized as *Key* and *Secondary*. Key emissions sources are those sources which ICLEI considers essential components of a local greenhouse gas analysis. This determination is based on significance of the category in terms of the total emissions profile of most local governments, applicability of data to policy relevant climate protection solutions available to local governments, and availability of data at the local government scale. When conducting an emissions inventory, all Key categories must be included.

Secondary emissions sources are those which are generally challenging to gather reliable data for at a local level, and/or which are usually minimal in magnitude. ICLEI encourages local governments to conduct as complete an analysis as is practicable, but distinguishes secondary emissions sources so that local governments can prioritize their efforts. Examples of secondary emission sources include decentralized fuel consumption (e.g., propane, kerosene, fuel oil, stationary diesel); tailpipe emissions from rail, sea, pass-through highways, airplanes; and methane emissions from wastewater treatment.[6] In general, it is acceptable to rely on less specific data sources for estimating secondary emissions sources.

ICLEI categorizes community emissions sources in terms of where they occur in relationship to the geographic boundaries of a place and the timescale of an inventory. *Scope 1* emissions are those which occur within the boundaries of a community. *Scope 2* emissions occur outside of the community boundaries, but are a direct result of community activities. *Information Items* are emissions from up-stream processes or lifecycle/lifetime energy embodiment and process emissions. Scope definitions are similar for government operations inventories, where degree of local government control defines the scope categories rather than geographic boundaries. The emissions inventory that was conducted for community activities and the government operations of Menlo Park primarily contains Key Emission Sources falling within Scope 1 and Scope 2. Data availability, as well as time and budget constraints meant that most Secondary Emissions Sources and Information Items were not included in the Menlo Park emissions inventory.

[6] See Table 1 and Table 2 for a more complete list of secondary emissions sources.

Table 1 - Community-Scale Emissions Inventory Protocol Summary

Macro Sector (IPCC)		Community Sector (ICLEI)	Key Emission Sources	Secondary Emission Sources	Scope 1	Scope 2	Information Item
Energy	Stationary Combustion	Residential Commercial Industrial	**Utility-delivered fuel consumption (e.g., natural gas)**	Decentralized fuel consumption (e.g., propane, kerosene, fuel oil, stationary diesel, biofuels, coal) Utility-consumed fuel for electricity / heat generation	**Utility-delivered fuel consumption** Decentralized fuel consumption Utility-consumed fuel for electricity / heat generation	n/a	Up-stream process emissions (e.g., mining/transport of coal)
	Electricity / Heat Consumption	Residential Commercial Industrial	**Utility-delivered electricity / heat consumption (e.g., steam)**	Decentralized electricity / heat consumption not accounted for under stationary combustion (e.g., solar, geothermal)	n/a	**Utility-delivered electricity / heat consumption** Decentralized electricity / heat consumption	Up-stream process emissions (e.g., mining/transport of coal)
	Transportation	Transportation	**Tailpipe emissions from on-road vehicles and local transit systems**	Tailpipe emissions from rail, sea, pass-through highways, airports	**Tailpipe emissions from on-road vehicles** Tailpipe emissions from rail, sea, pass-through interstate, airports	**Electricity consumption (e.g., light rail)**	Up-stream process emissions (e.g., mining/transport of oil)
	Other Energy	Other	n/a	Fugitive emissions not already accounted for	Fugitive emissions not already accounted for	n/a	Lifecycle and/or embodied energy from material procurement
Industrial Processes and Product Use		Other	n/a	Decentralized process emissions (e.g., CO_2 from cement manufacture)	Decentralized process emissions	n/a	Lifecycle process emissions
Agriculture, Forestry and Other Land Use		Agricultural Emissions	n/a	Livestock methane, managed soils, fertilizer/pesticides	Livestock methane, managed soils	n/a	Up-stream emissions from fertilizer/pesticide manufacture
		Land use sources and sinks	n/a	Net biogenic carbon Flux	n/a	n/a	Net biogenic carbon flux
Waste		Waste	**Landfill, incineration and compost facilities** **Lifetime decomposition associated with waste generated**	Wastewater methane	**Landfill, incineration and compost facilities** Wastewater methane	n/a	**Lifetime decomposition associated with waste generated** Lifecycle process emissions (e.g., transport to the landfill)

Table 2 - Government Operations Emissions Inventory Protocol Summary Chart

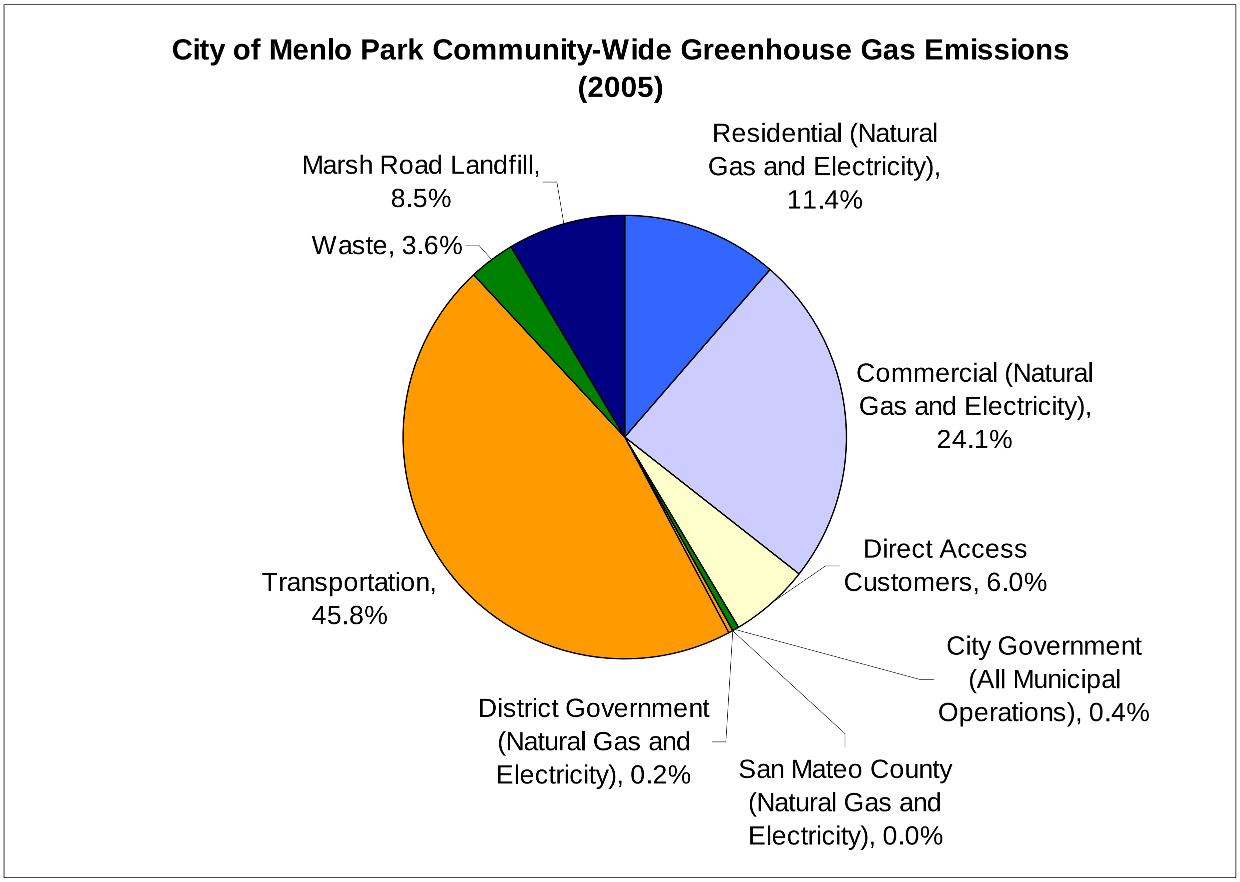
Macro Sector (IPCC)		Government Sector (ICLEI)	Key Emission Sources	Secondary Emission Sources	Scope 1	Scope 2	Information Item
Energy	Stationary Combustion	Buildings and Facilities Water/Sewer System	**Utility-delivered fuel consumption (e.g., natural gas)** **Decentralized fuel consumption (e.g., propane, kerosene, fuel oil, stationary diesel, biofuels, coal)**	Utility-consumed fuel for electricity / heat generation	**Utility-delivered fuel consumption** **Decentralized fuel consumption** Utility-consumed fuel for electricity / heat generation	n/a	**Stationary Emissions from facilities operated by municipally contracted businesses performing essential municipal services** Up-stream process emissions (e.g., mining/transport of coal)
Energy	Electricity / Heat Consumption	Buildings and Facilities Street lights and traffic signals Water/Sewer	**Utility-delivered electricity / heat consumption (e.g., steam)**	Decentralized electricity / heat consumption not accounted for under stationary combustion (e.g., solar, geothermal)	n/a	**Utility-delivered electricity / heat consumption** Decentralized electricity / heat consumption	**Emissions from facilities operated by municipally contracted businesses performing essential municipal services** Up-stream process emissions (e.g., mining/transport of coal)
Energy	Mobile Combustion	Vehicle Fleet	**Tailpipe emissions from municipally owned and operated vehicles**		**Tailpipe emissions from municipally owned and operated vehicles**	n/a	**Tailpipe emissions from vehicles operated by municipally contracted businesses performing essential services** Up-stream process emissions
Energy	Mobile Combustion	Employee Commute	n/a	Tailpipe emissions from vehicles operated by municipal employees traveling to and from work	n/a	n/a	Tailpipe emissions from vehicles operated by municipal employees traveling to and from work
Energy	Fugitive emissions	Other	n/a	Fugitive emissions from energy	Fugitive emissions not already accounted for	n/a	Lifecycle and/or embodied energy from material procurement
Industrial Processes and Product Use		Other	n/a	Fugitive emissions from industrial processes	Fugitive emissions from industrial processes	n/a	Lifecycle process emissions
Agriculture, Forestry and Other Land Use		Other	n/a	methane from government owned livestock	n/a	n/a	n/a
Agriculture, Forestry and Other Land Use		Other	n/a	Net biogenic carbon Flux on municipally owned land	Net biogenic carbon flux	n/a	n/a
Waste		Waste	**Municipally operated Landfill, incineration and compost facilities** **Lifetime decomposition associated with waste generated by municipality**	Wastewater methane	**Landfill, incineration and compost facilities** Wastewater methane	n/a	**Lifetime decomposition associated with waste generated** Lifecycle process emissions (e.g., transport to the landfill)

2.2 Inventory Results

2.2.1 Community Emissions Inventory

In the base year 2005, the community of Menlo Park emitted approximately 491,054 metric tons [7] [8] of CO_2e. As shown in Table 3, and illustrated in Figure 1 below, the transportation (45.8%) and commercial (24.1%) sectors were the largest sources of greenhouse gas emissions. Emissions from the Residential sector, Waste, and the closed Marsh Road Landfill (at Bayfront Park) contributed 12.7%, 3.6%, and 8.5% respectively. [9] (See Appendix 1 and 2 for sector-specific emissions data.) Table 4 breaks down greenhouse gas emissions by energy source. The burning of gasoline, electricity, and natural gas was responsible for most of the greenhouse gas emissions in Menlo Park with 35.8%, 23.7%, and 23.1%. "Methane" in Table 4 is the methane emissions from Marsh Road Landfill. The remaining categories, with the exception of diesel, are landfilled materials that also emitted methane and carbon dioxide.

Figure 1. Community-Wide Greenhouse Gas Emissions



[7] This total includes estimated energy use for direct access utility customers and vehicle miles traveled on state highways in Menlo Park.

[8] All emissions estimated using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

[9] The emissions for the Waste sector are explained in more detail in preceding sections and in the Appendices.

Table 3: Community-Wide Greenhouse Gas Emissions in 2005

Sector	Greenhouse Gas Emissions (%)	Greenhouse Gas Emissions (metric tons CO_2e)	Energy Equivalent (MMBtu)
Residential [10] (Electricity and Gas)	11.4%	55,782	987,696
Commercial [12] (Electricity and Gas)	24.1%	118,382	2,009,799
Direct Access Electricity (estimate) [13]	6.0%	29,516	450,610
City Government (All Municipal Operations)	0.4%	2,183	25,657
San Mateo County (Electricity and Gas)[14] [15]	0.0%	15	245
District Government (Electricity and Gas)[16] [17]	0.2%	968	15,979
Transportation [18]	45.8%	224,974	2,180,928
Waste [19]	3.6%	17,486	--
Marsh Road Landfill	8.5%	41,748	
Total	**100.0%**	**491,054**	**5,670,914**

Other Sectors	Green-house Gas Emissions (%)	Green-house Gas Emissions (metric tons CO_2e)
Wastewater Treatment [11]	0.6%	2,718

[10] Data Source: Pacific Gas and Electric Company

[11] Estimated emissions from electricity use (based on data provided by the South Bayside System Authority Wastewater Treatment Plant) and methane and nitrous oxide emissions (based on national estimates from the US Greenhouse Gas Inventory). See the Water/Wastewater "Notes" section in Appendix 2 for specific assumptions and calculations.

[12] Data Source: Pacific Gas and Electric Company

[13] In 2005, Direct Access customers (those electricity customers that purchase electricity directly from power generation facilities, which is delivered through the transmission lines of public or private utility) accounted for 11.9% of the total electricity load for the state of California. 11.9% of the combined load of the residential and commercial sectors has been included here to account for direct access electricity that is not included in the data that we received from PG&E.
Source: CPUC Direct Access Service Request Report, December 2005;
http://www.cpuc.ca.gov/static/energy/electric/electric+markets/direct+access/00thru05.htm

[14] Data Source: Pacific Gas and Electric Company

[15] This category is comprised of PG&E customer accounts that contain "county" in the account name and that have an address within incorporated Menlo Park.

[16] Data Source: Pacific Gas and Electric Company

[17] District accounts include any district government account within incorporated Menlo Park, such as the Menlo Park Fire Protection District, Bart Area Rapid Transit (BART), School Districts, Hospital Districts, Water or Sewer Districts, Jr College Districts, District Fairs, Public Utility Districts, Community Service Districts, Cemetery Districts, Mosquito Abatement Districts and Park Districts, plus a few others.

[18] See Table 5 for Transportation Sector breakdown. This number does not include emissions occurring from municipally owned vehicles, which are included in the "City Government" category. Total emissions were calculated for municipal vehicles and then subtracted from the total emissions occurring with Menlo Park's city limits.

[19] Does not include emissions from municipal waste. Municipal waste is included in the "City Government" category.

Table 4: Community-Wide Greenhouse Gas Emissions by Energy Source, 2005

Energy Source	CO_2e (%)	CO_2e (metric tons)	Energy (million BTU)
Gasoline	41.6%	204,158	2,830,801
Electricity	21.2%	104,164	1,590,238
Natural Gas	20.7%	101,589	1,909,387
Methane	8.5%	41,748	
Diesel	4.4%	21,437	253,200
Paper Products	2.1%	10,300	
Food Waste	0.7%	3,413	
Wood/Textiles	0.6%	2,730	
Plant Debris	0.3%	1,515	
Total	**100.0%**	**491,054**	**6,583,626**

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. Currently it is difficult to make meaningful comparisons between cities because of variation in the scope of inventories conducted, but in the near future a universal reporting standard will be developed and adopted through a process being driven by ICLEI, making this possible.

Dividing the total greenhouse gas emissions by population[20] yields a result of 16.37 metric tons 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 Menlo Park.[21] It is also important to note that the per capita emissions number for Menlo Park is not directly comparable to every per capita number produced by other emissions studies because of differences in emission inventory methods.

Transportation

The transportation sector's relative contribution to greenhouse gas emissions is highlighted in Table 5. As with other San Francisco Bay area cities, travel by motorized vehicle constitutes a significant percentage of greenhouse gas emissions. Nearly one-third of the emissions in the transportation sector came from travel on city roads. This number can be reduced dramatically by making it easier for residents to use alternative modes of transportation, including walking, bicycling, and riding public transportation. Because Menlo Park contains approximately 9.95

[20] In 2005, Menlo Park's population was approximately 30,000.
[21] Carbon footprint calculations include upstream lifecycle emissions, which were not included in this emissions inventory.

miles of heavily traveled State Highways that fall within its borders[22], more than 70 percent of the greenhouse gas emissions in the transportation sector is a result of highway travel.

Table 5: Transportation Sector Greenhouse Gas Emissions in 2005

Sector	Greenhouse Gas Emissions (% CO_2e)	Greenhouse Gas Emissions (metric tons CO_2e)	Vehicle Miles Traveled	Energy Equivalent (MMBtu)
City Roads (non-highway) [23]	27.9%	62,944	128,530,000	861,835
State Highways [24]	70.9%	159,869	327,427,158	2,188,937
CalTrain [25]	1.2%	2,782	272,333	33,228
Total	**100.0%**	**225,595**	**456,229,491**	**3,084,000**

Emissions that resulted from the air travel of Menlo Park residents were not included in the Transportation sector. With more time and the availability of suitable proxy data the greenhouse gas emissions from air travel could be estimated. Because there are no airports located within the geographic boundaries of Menlo Park and the fact that air travel is a form of transportation that the municipal government of Menlo Park has no influence or control over, it is reasonable to exclude air travel from this inventory.

Waste

The waste sector's relative contribution to greenhouse gas emissions is highlighted in Tables 6, 7, and 8. Because of the large amount of waste in the closed landfill (5 million metric tons) and the inherent difficulty in containing and capturing gases in a large heterogeneous landfill, the Marsh Road Landfill emitted nearly 2,000 metric tons of methane in 2005. This is despite being closed for more than two decades and the use of a sophisticated landfill gas capture and one-megawatt electricity generation station at the landfill site.[26] Overall, the Marsh Road Landfill was responsible for 9.5% (41,748 metric tons CO_2e) of Menlo Park's greenhouse gas emissions in 2005. The emissions from waste generated by Menlo Park residents and businesses that was landfilled in other locations in 2005 emitted 17,486 metric tons of CO_2e, accounting for 4.0% of the City's total emissions.

The waste sector of both the community and municipal inventories deserves additional explanation because of the particular challenges in measuring the amount of methane that is

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[22] A section of El Camino Real that falls on the Border of Menlo Park and Atherton was divided between the cities.

[23] Source: 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

[24] Source: 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
See Appendix 1 for a detailed description of the calculations made in estimating VMT on State Highways that run through Menlo Park.

[25] See Appendix 1 for a detailed description of the assumptions made in estimating emissions from CalTrain.

[26] The Marsh Road Landfill facility captures and burns methane that is off-gassing from the landfill. Four turbines convert the methane into electricity, which allowed Gas Recovery Systems Inc. (the company that operates the facility) to sell 12,254 MWh to the grid in 2005.

released from landfills. The CACP Software is designed to be used in communities with a variety of waste disposal methods including managed landfills, open dumps, and incineration.

Emissions from the waste sector in Menlo Park came from two different types of sources:

1) *Methane Commitment* - Waste that was generated by residents and activities taking place within the City limits that was disposed of in landfills outside of the City; and
2) *Waste-in-Place* - Waste that is in the closed Marsh Road Landfill within the Menlo Park City Limits.[27]

In accordance with the inventory guidelines that are outlined in the Methods section above, both of these source types are categorized as "Key Emission Sources."

For Methane Commitment, greenhouse gas emissions were calculated using a version of the EPA's Waste Reduction Model (WARM), which is embedded within the CACP Software. WARM calculates the emissions that will occur during the lifetime of waste that is disposed of using a variety of waste disposal technologies, including landfilling, recycling, incineration, composting, and source reduction. These calculations are primarily based on the composition of the waste and the waste disposal technology employed, including methane capture.

Waste-in-place emissions were calculated using version of 3.02 of EPA's Landfill Gas Emissions Model (LandGEM). The model calculates emissions occurring in the inventory year based on the amount of decomposable waste in a landfill, the waste's methane generation potential, and an exponential time constant of decay.

It is also important to note that while waste-reduction through recycling does not overtly show-up in this inventory, recycling saves a substantial amount of energy by reducing the need for virgin inputs, and by diverting paper products from landfills, which reduces the amount of landfill gas that is produced. The emissions benefits of recycling can be quantified when analyzing recycling as an emissions reduction strategy relative to the base year.

[27] The waste in Marsh Road Landfill was generated by several cities, in addition to Menlo Park. In accordance with ICLEI's emissions inventory protocol, the entirety of the emissions from the Marsh Road Landfill was counted towards the community total because the waste is located within the geographic boundaries of Menlo Park and the Landfill is owned by the City.

Table 6. Waste Generated in Menlo Park, Greenhouse Gas Emissions in 2005

Waste Type	Quantity of Waste Generated (metric tons)	Greenhouse Gas Emissions (metric tons CO_2e)	Greenhouse Gas Emissions (% CO_2e)
Solid Waste	35,070	17,486 [28]	100.0%

Landfill Solid Waste Composition:[29]	
Paper Products	20.50%
Food Waste	12%
Plant Debris	9.30%
Wood/Textiles	19.20%
All Other Waste	39%

Table 7. Active Landfills that Received Waste Generated in Menlo Park

Landfill	Waste Category	Waste Received (Metric Tons)
OX MOUNTAIN SANITARY LANDFILL (San Mateo)	Solid Waste	32,248
POTRERO HILLS LANDFILL (Solano)	Solid Waste	1,235
ALTAMONT LANDFILL - RESOURCE RECV`RY (Alameda)	Solid Waste	416
Zanker Material Processing Facility (Santa Clara)	Solid Waste	574
All Other Landfills	Solid Waste	597

Table 8. Marsh Road Landfill Waste and Greenhouse Gas Emissions in 2005

CO_2e Generated (Metric Tons)	Methane Generated (Metric Tons)	Waste Acceptance		Decomposable Waste In Place (Metric Tons)	Average Landfill Gas Collected (scfm) [30]	Estimated Landfill Gas Generated (calculated scfm)	Landfill Gas Capture Rate (calculated)
		Began	Ceased				
41,748 [31]	1,988 [32]	1960	1984	5,000,000 [33]	760.9 [34]	1,167.0 [35]	65.20% [36]

[28] This total is based on a methane recovery factor of 33%. While Ox Mountain Landfill, the site where 97% of Menlo Park's waste is disposed, reports that they have a methane recovery rate of 99.61%, this number is overly optimistic for a number of reasons. The landfill gas accounting methodology approved by the IPCC specified that methane recovery "should only be reported when references documenting the amount of CH4 are available," and that "recovery based on metering of all gas recovered… is consistent with good practice" (IPCC 2006 Guidelines for National Greenhouse Gas Inventories, Volume 5, Chapter 3 pp.18). Such an analysis was conducted by ICLEI staff. The discrepancy is likely a result of the reported recovery factor being calculated based on recoverable CH4 emissions rather than total CH4 emissions. We chose to use 33% after using the LandGem 3.02 model, which allowed us to calculate the amount of landfill gas that should be generated by the amount of waste that is in place at the Ox Mountain landfill. The difference between the amount of landfill gas that was captured at Ox Mountain in 2005 (3,576.9 scfm) and the amount that is specified by the LandGem 3.02 model (10,880 scfm) equates to a methan recovery rate of 33%.

[29] California Integrated Waste Management Board, Waste Characterization Report, (2004) http://www.ciwmb.ca.gov/Publications/default.asp?pubid=1097

[30] Standard cubic feet per minute.

[31] Calculated with CACP software using a methane capture rate of 65.2% and 5 million metric tons of waste decomposable waste in place. For a detailed description of the "waste in place" method for calculating emissions, please see Appendix 1.

[32] Ibid

[33] Data provided by the Bay Area Air Quality Management District

[34] Ibid

[35] Data was calculated based on the amount of waste-in-place using the LandGEM 3.02 model.

[36] Capture Rate = (Landfill gas captured) / (Landfill gas generated)

Criteria Air Pollutants
Menlo Park community's consumption of electricity and other fuels in local buildings and vehicles is also responsible for the release of criteria air pollutants, including NO_X, SO_X, CO, VOCs, and PM_{10}. The transportation sector is responsible for the majority of NO_X, CO and VOC emissions, while energy used in buildings is primarily responsible for emissions of SO_X and PM_{10}.

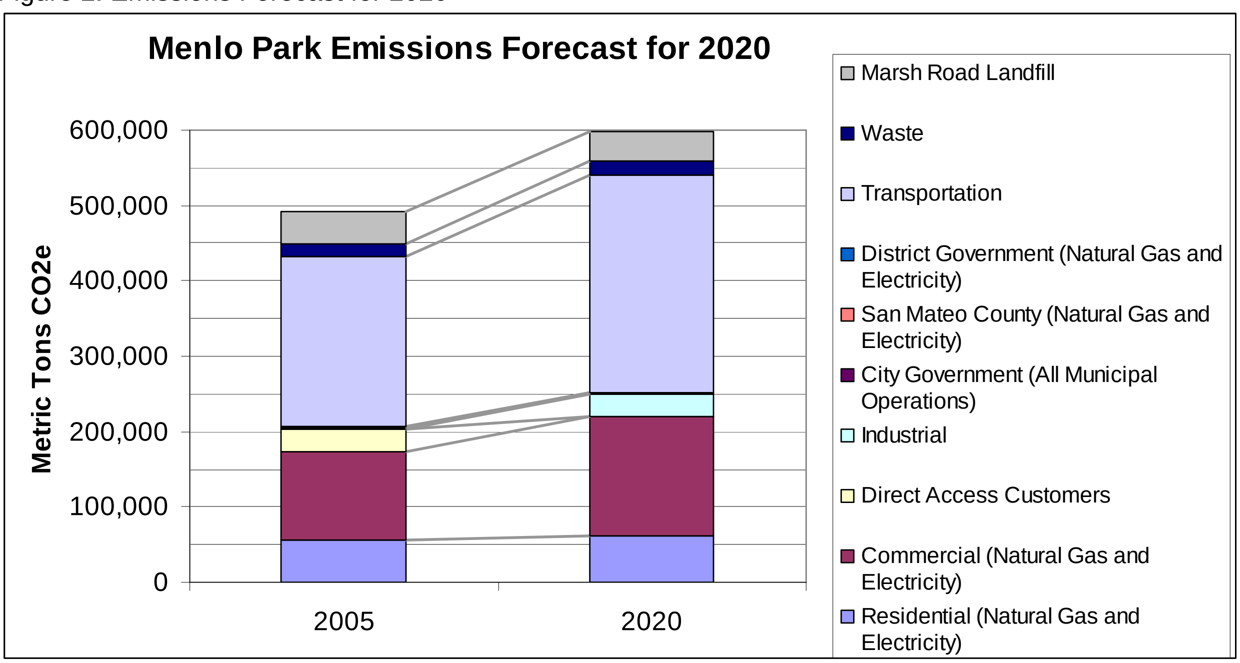
Table 9. Criteria Air Pollutant Emissions in 2005

Sector	NO_X (metric tons)	SO_X (metric tons)	CO (metric tons)	VOCs (metric tons)	PM_{10} (metric tons)
Residential	31	23	34	5	19
Commercial [37]	194	73	89	12	60
Direct Access [38]	53	35	34	4	29
Transportation	660	43	8121	757	17
Total	**938**	**174**	**8278**	**778**	**125**

2.2.2 Community Emissions Forecast

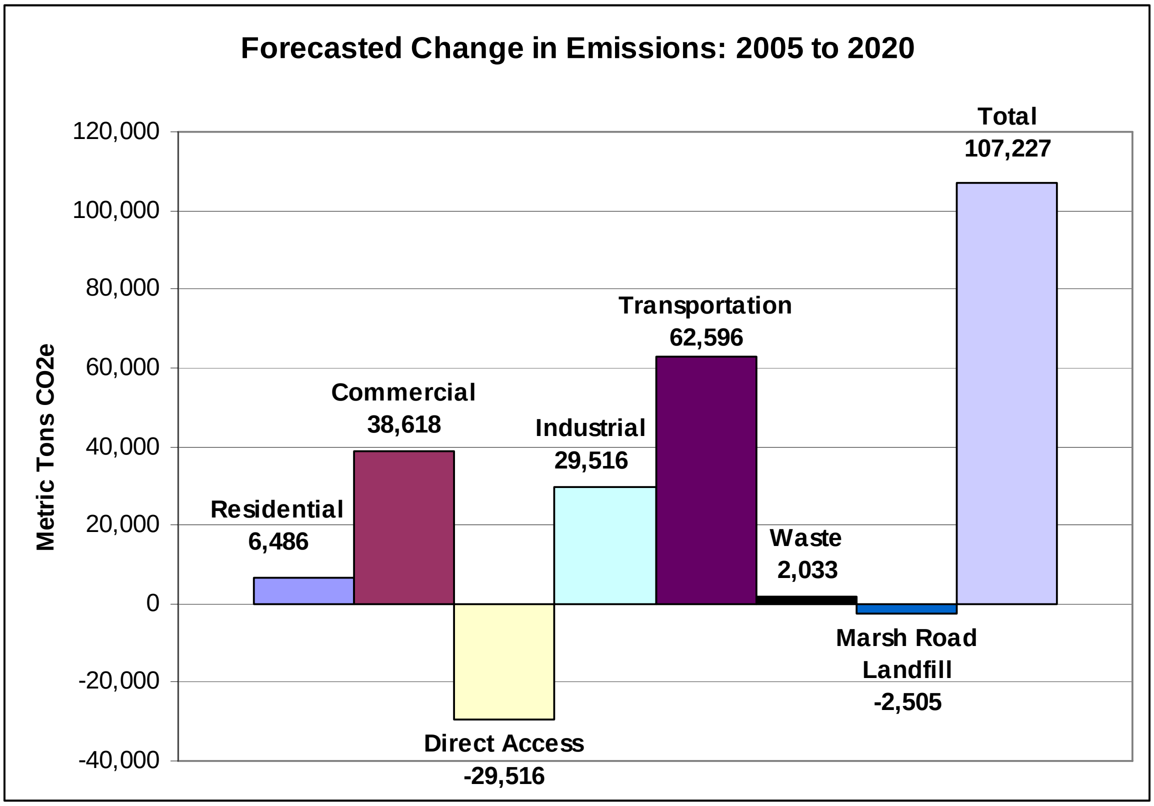
Under a business-as-usual scenario, the city of Menlo Park's emissions will grow over the next decade and a half. To illustrate the potential emissions growth based on projected trends in energy use, driving habits, job growth, and population growth from the baseline year going forward, we conducted an emissions forecast for the year 2020. Figures 2 and 3 show the results of the forecast.

Figure 2. Emissions Forecast for 2020



[37] Includes City, County, and District Gov. Buildings.
[38] Estimate, based on electricity usage that is 11% of the total of residential, and commercial/industrial sectors.

Figure 3. Forecasted Change in Emissions[39]



A variety of different reports and projections were used to create the emissions forecast.

Residential - For the residential sector, a population projection for the City of Menlo Park that was conducted by the Association of Bay Area Governments (ABAG) was used to estimate average annual growth in energy demand (0.736 %).[40]

Commercial – Analysis contained within "California Energy Demand 2008-2018: Staff Revised Forecast," a report by the California Energy Commission (CEC), shows that commercial floor space and the number of jobs have closely tracked the growth in energy use in the commercial sector. Using job growth projections for the City of Menlo Park from ABAG, it was calculated that the average annual growth in energy use in the commercial sector between 2005 and 2020 will be 1.901%.[41]

Transportation – For the transportation sector, projected growth in energy demand was obtained from the CEC. The recently passed federal Corporate Average Fuel Economy standards and the state of California's pending tailpipe emission standards could significantly reduce the demand for transportation fuel in Menlo Park. An analysis of potential fuel savings from these measures at a scale that would be useful for the purpose of this report has not been conducted, nor was it

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[39] Sectors that were not projected to experience emission increases or decreases were excluded from this figure.
[40] This growth rate was calculated based on annual growth projections from 2005 to 2020. Association of Bay Area Government "Projections" data can be ordered online at: http://data.abag.ca.gov/p2005/#
[41] Ibid

within the scope of this project to conduct such an analysis. Regardless of future changes in the composition of vehicles on the road as a result of state or federal rulemaking, emissions from the transportation sector will continue to be largely determined by growth in vehicle-miles-traveled (VMT). In their report, “Forecast of the Transportation Energy Demand, 2003-2023,” the CEC projects that on-road VMT will increase at an annual rate of 1.65% per year through 2023. This is the number that was used to estimate emission growth in the transportation sector for the Menlo Park forecast.

Waste – As with the residential sector, the primary determinate for growth in emission in the waste sector is population. Therefore, the average annual population growth rate for 2005 to 2020 (0.736 %)[42] as calculated by ABAG was used to estimate future emissions in the waste sector.

Marsh Road Landfill – As methane, carbon dioxide, and other gasses are released from the Marsh Road Landfill, the amount of solid decomposable “waste-in-place” is decreasing. As the feedstock diminishes, so will the amount of landfill gasses that will be released. Using the EPA’s Landfill Gas Emissions Model (LandGEM) version 3.02, emissions were estimated for the Marsh Road Landfill for the year 2020. Using 4,700,000 metric tons of decomposable waste-in-place for the year 2020, a methane recovery factor of 68.5%, a time constant of decay of 0.05, and a methane generation potential of 0.17 cubic meters of methane per kilogram of waste, it was calculated that in 2020 Marsh Road Landfill will generation 6% less methane emissions than in the 2005 baseline year.

District Government, County Government, and Municipal Operations – Data was not available for the projected growth of District, County, and City operations within the jurisdictional boundaries of Menlo Park. It was therefore assumed that annual emissions from these sectors would remain unchanged between 2005 and 2020.

Direct Access and Industrial Electricity – By 2020 all of the direct access electricity contracts that existed in 2005 will have expired. To account for this, the emissions that were estimated to be occurring from direct access users in 2005 was transferred to a new category, “industrial,” for the year 2020.

[42] Ibid

2.2.3 Municipal Operations Emissions Inventory

In the year 2005, the City of Menlo Park's municipal operations generated 2,183 metric tons of CO_2e, in addition to 41,748 metric tons of CO2e from Marsh Road Landfill.[43] Electricity and natural gas use in the City's buildings contributed 33.0%, the vehicle fleet contributed 28.4% of this total, and the remainder came from waste, streetlights, and electricity for pumping water and stormwater.

During 2005, the Menlo Park municipal government spent approximately $790,000 on electricity, natural gas, and fuel for its buildings, streetlights and vehicles, and waste disposal. Beyond reducing harmful greenhouse gases, any future reductions in municipal energy use have the potential to reduce this expense, enabling Menlo Park to reallocate limited funds toward other municipal services. Table 10, Figure 4, and Figure 5 below illustrate the breakdown of municipal emissions by source type.

Municipal emissions in Menlo Park constitute 0.4% of the community's total greenhouse gas emissions (or 8.9% if Marsh Road Landfill is included). This is not unusual; local government emissions typically account for around two percent of community levels. As a minor contributor to total emissions, actions to reduce municipal energy use will have a limited impact on the Menlo Park community's overall emissions levels. However, as previously mentioned, municipal action has symbolic value that extends beyond the magnitude of emissions actually reduced.

Table 10: Municipal Operations Emissions Summary 2005, City of Menlo Park

Sector	Greenhouse Gas Emissions (% CO_2e)	Greenhouse Gas Emissions (metric tons CO_2e)	Energy Equivalent (million Btu)	Cost ($)	Cost (%)
Buildings	33.0%	720	11,749	$323,990	41.0%
Vehicle Fleet	28.4%	621	8,009	$168,816	21.3%
Streetlights	11.9%	259	3,948	$130,783	16.5%
Water/Storm Water [44]	5.9%	128	1,951	$70,418	8.9%
Waste[45]	20.8%	455	-	$96,845	12.2%
TOTAL	**100.0%**	**2,183**	**25,657**	**790,852**	**100.0%**
Marsh Road Landfill	-	41,748	-	-	-

[43] Marsh Road Landfill and the Bayfront Park Methane Capture Station are owned by the City of Menlo Park. The Methane Capture Station is operated by Gas Recovery Systems Inc.
[44] See Appendix 2 for a detailed description of how Water/Storm Water numbers were calculated.
[45] See Appendix 2 for a detailed description of how Waste numbers were calculated.

Figure 4. Municipal Operations Greenhouse Gas Emissions in 2005

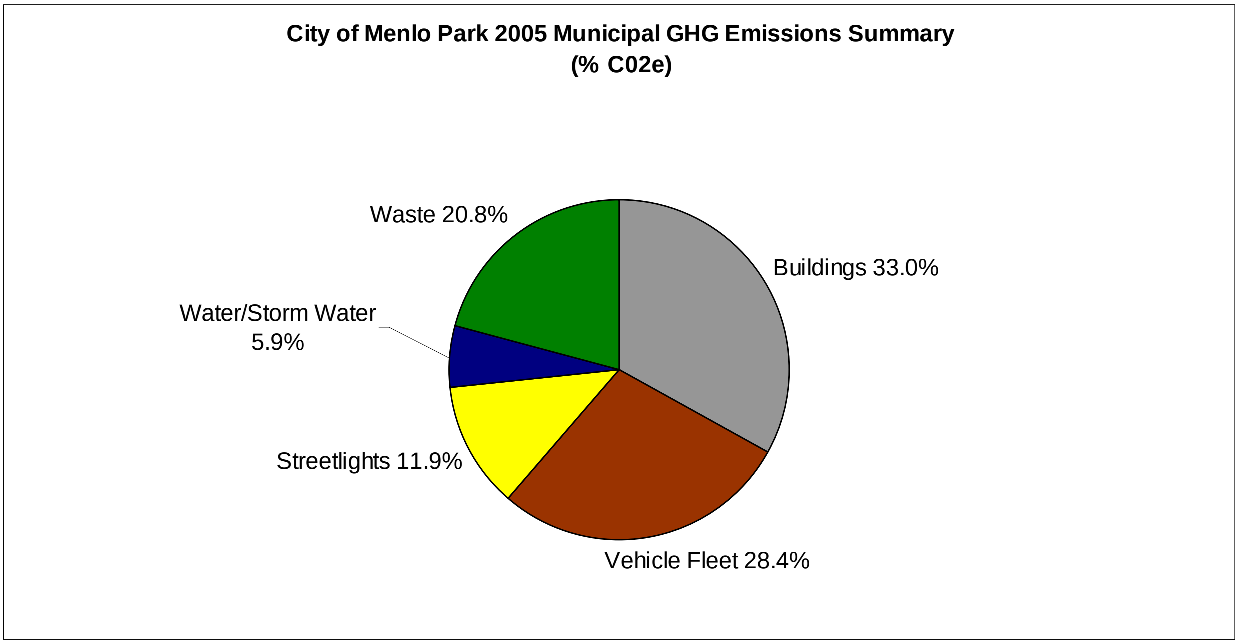
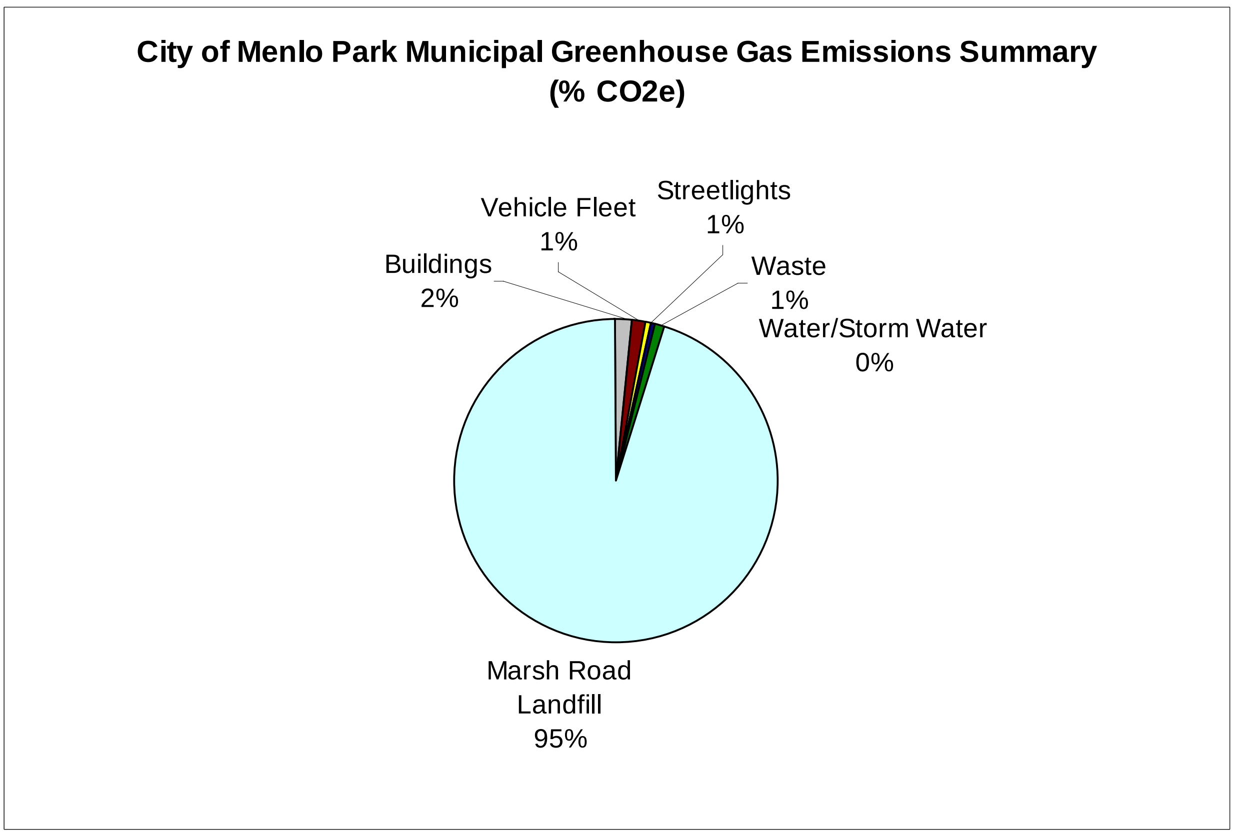


Figure 5. Municipal Operations Greenhouse Gas Emissions (Including Marsh Road Landfill) in 2005



Municipal Buildings

The municipal buildings' relative contribution to greenhouse gas emissions is highlighted in Table 11. The Administration / City Hall building complex, the Onetta Harris Community Center, and the Library were responsible for a combined 73% of the emissions from the City's buildings. In 2003 the City of Menlo Park hired a firm to perform an energy audit and retrofit of the heating, ventilation, and air conditioning (HVAC) systems in the Administration / City Hall Buildings and the Library. The new HVAC systems that were installed saved the city $34,563 in 2005 compared to electricity and gas bills from 2002/2003, and reduced greenhouse gas emissions by 319 metric tons of CO_2e.

Table 11. Municipal Operations Building Energy Use Greenhouse Gas Emissions in 2005 [46]

Site[47]	Greenhouse Gas Emissions (% CO_2e)	Greenhouse Gas Emissions (metric tons CO_2e)	Electricity Use (kWh)	Electricity Cost ($)	Natural Gas Use (therms)	Natural Gas Cost ($)	Energy Equivalent (MMBtu)
Administration / City Hall	43.1%	310	1,009,800	$134,536	15,075	$18,467	4,954
Onetta Harris Community Center	14.4%	103	277,760	$37,081	7,360	$9,265	1,684
Library	13.2%	95	320,420	$46,207	4,213	$5,267	1,515
Belle Haven Pool	7.4%	54	-	-	9,599	$10,713	960
Burgess Recreation Center	6.8%	49	-	-	8707	$10,469	871
Senior Center	4.8%	34	127,520	$19,213	1,010	$1,295	536
Corporation Yard	4.2%	30	86,720	$12,839	1,850	$2,396	481
Burgess Gym	3.3%	24	-	-	4167	$5,929	417
Belle Haven CDC	2.0%	15	35,040	$5,369	1,231	$1,618	243
Belle Haven Police Station	0.5%	4	14,685	$1,883	n/a	n/a	50
Methane Burning Station (Bayfront Park)	0.3%	2	8,619	$1,197	-	-	29
CNG Station at Cust Premises	0.1%	1	-	-	91	246	9
Buildings Total	**100.0%**	**720**	**1,880,564**	**$258,325**	**53,303**	**$65,665**	**11,749**

Street Lights

Municipal lighting's contribution to greenhouse gas emissions is highlighted in Table 12. Street lights, parking lights, and parking lot lights are all sub-sectors where significant emission reductions could be realized through switching to light emitting diodes (LEDs) and /or using renewable energy to power them.

[46] Data from Pacific Gas and Electric Company; provided by John McGirr, City of Menlo.
[47] The Administration / City Hall Complex feeds electricity to the Burgess Recreation Center, and the Burgess Gym. The Belle Haven Pool receives electricity from the Onetta Harris Community Center.

Table 12. Street and Traffic Lighting Greenhouse Gas Emissions in 2005

Site	Greenhouse Gas Emissions (metric tons CO_2e)	Electricity Use (kWh)	Electricity Cost ($)	Energy Equivalent (MMBtu)
Street Lights	235	954,547	$101,289	3,258
Traffic Signals	28	114,200	$16,829	390
Park Lighting	18	74,763	$10,947	255
Decorative Lights	3	12,522	$1,430	43
Parking Lot Lights	0.3	872	$288	3
Street & Traffic Total	**284**	**1,156,904**	**$130,783**	**3,949**

Waste

The relative contribution of landfilled waste from municipal operations to greenhouse gas emissions is highlighted in Table 13. Emissions were calculated with the CACP software using the same method as for the waste generated by residents and businesses in the City.[48]

Table 13. Municipal Operations Waste Greenhouse Gas Emissions in 2005

Waste Source	Greenhouse Gas Emissions (% CO_2e)	Greenhouse Gas Emissions (metric tons CO_2e)	Quantity of Waste (metric tons)	Waste Disposal Costs
Regular Pick-up Containers [49]	66.6%	303	408	$51,092
Roll-off Boxes [50]	28.1%	128	172	$26,848
Public Bins [51]	5.3%	24	47	$18,904
TOTAL	**100.0%**	**455**	**628**	**$96,844**

Water and Storm Water

The relative contribution of energy from pumping water and wastewater to greenhouse gas emissions is highlighted in Table 14. This analysis excludes energy used for wastewater pumping, which is done by the West Bay Sanitary District. It also excludes pumping and treatment of wastewater that is carried out by the South Bayside System Authority. [52]

[48] See Appendix 1 for a detailed description of the waste emissions calculation method.
[49] Waste bins used by municipal employees that were picked up by Allied Waste Services on a regular schedule.
[50] Waste containers used by municipal employees that were picked by Allied Waste Services as needed.
[51] Waste bins in parks and on the street used predominantly by the public.
[52] Data on emissions from the electricity use at the South Bayside System Authority is included in Appendix 2.

Table 14. Water and Storm Water Greenhouse Gas Emissions in 2005, City of Menlo Park

Site	Greenhouse Gas Emissions (metric tons CO_2e)	Electricity Use (kWh)	Electricity Cost ($)	Energy Equivalent (MMBtu)
Pump Stations[53]	123	550,720	$66,020	1880
Irrigation Controllers	5	20,839	$4,399	71
Water and Storm Water Total	**128**	**571,559**	**$70,419**	**1,951**

Vehicle Fleet

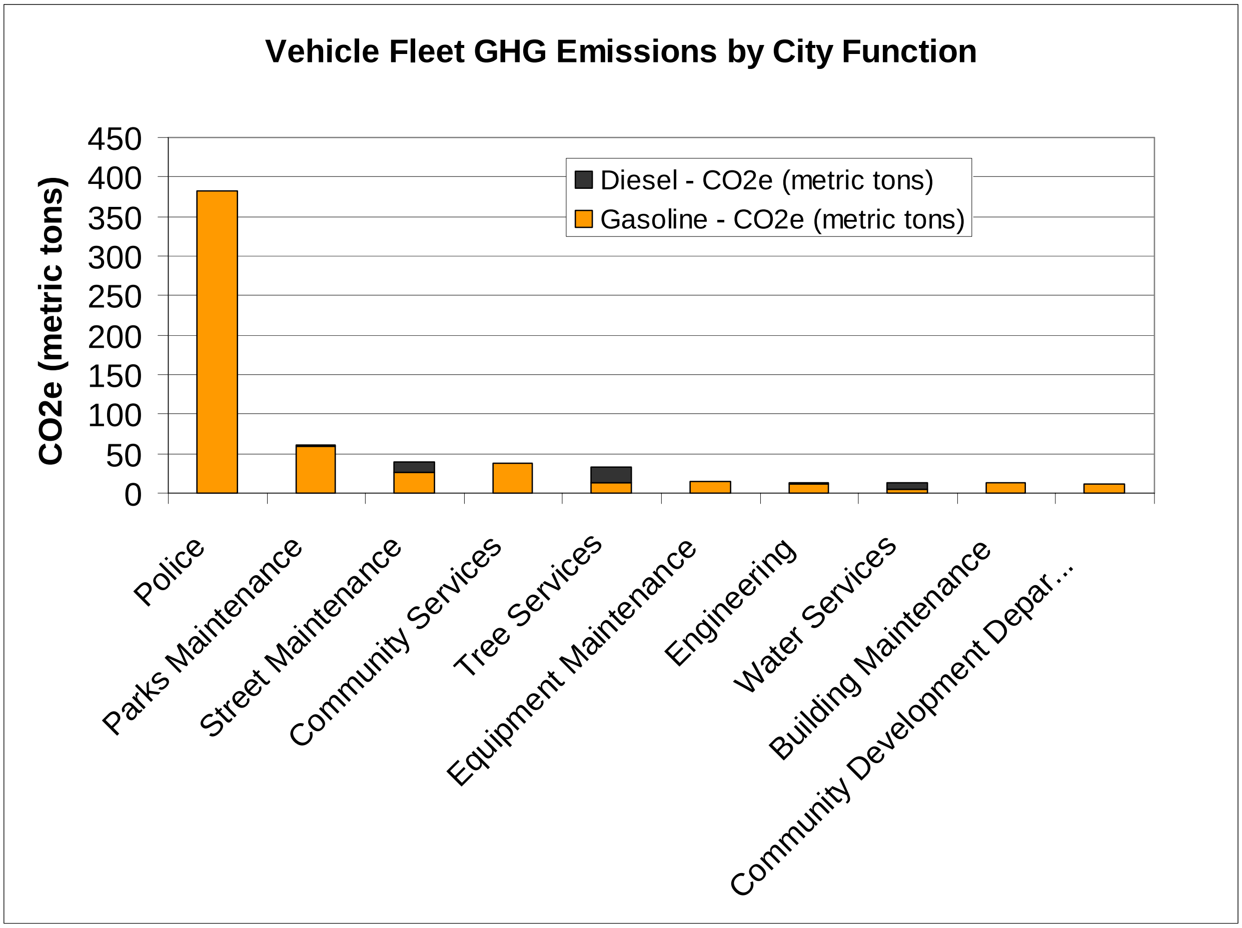
The relative contribution of energy from Menlo Park's municipal vehicle fleet to greenhouse gas emissions is highlighted in Table 15 and Figure 4. Within municipal operations, the vehicle fleet is responsible for the second largest share of the overall emissions, with the Police Department accounting for 61.5 % of those emissions. In 2007 the City added the first hybrid vehicle to its fleet. Between 2005 and 2007 the City has reduced the overall number of vehicles from 108 to 98, which has reduced overall fuel consumption by an estimated 1700 gallons, or 18 metric tons of CO_2e per year (2.5% reduction).

Table 15. Vehicle Fleet Greenhouse Gas Emissions in 2005, City of Menlo Park

Function	Greenhouse Gas Emissions (% CO_2e)	Greenhouse Gas Emissions (metric tons CO_2e)	Gasoline Consumption (gal)	Diesel Consumption (gal)	Total Fuel Cost ($)	Energy Equivalent (MMBtu)
Police	61.5%	382	39,354	-	$103,966	4,943
Parks Maintenance	9.9%	62	6,200	149	$16,954	797
Street Maintenance	6.3%	39	2,703	1,351	$10,314	504
Community Service	6.0%	37	3,801	-	$10,023	477
Tree Services	5.4%	34	1,331	2,170	$9,236	423
Equipment Maintenance	2.3%	15	1,509	-	$4,120	190
Building Maintenance	2.2%	14	1,392	-	$3,517	175
Engineering	2.2%	14	1,129	255	$3,835	173
Water Services	2.2%	14	439	955	$3,731	172
Community Development Department	1.9%	12	1,098	-	$2,933	147
Vehicle Fleet Total	**100.0%**	**621**	**58,956**	**4,880**	**$168,629**	**8,001**

[53] This includes pumps for fresh water supplied by the Menlo Park Municipal Water District in the Sharon Heights area, storm water pumping, and pumping wastewater at Marsh Road Landfill.

Figure 4. Vehicle Fleet Greenhouse Gas Emissions by City Function in 2005



Criteria Air Pollutants

The City of Menlo Park was also responsible for the release of criteria air pollution in 2005, as shown below. These pollutants have been linked with various environmental and public health problems. Many of the actions we might take to reduce greenhouse gas emissions will also have the additional benefit of reducing these pollutants as well.

Table 16. Municipal Operations Criteria Air Pollutant Emissions in 2005, City of Menlo Park

Sector	NO_X (lbs)	SO_X (lbs)	CO (lbs)	VOCs (lbs)	PM_{10} (lbs)
Buildings	2,496	1,148	1,271	164	945
Streetlights	1,026	684	649	73	565
Vehicle Fleet	4,030	217	37,374	3,875	102
Water/Sewage	507	338	321	36	279
Total	**8,059**	**2,387**	**39,616**	**4,148**	**1,891**

Menlo Park Fire Protection District

The Menlo Park Fire Protection District (MPFPD) served a population of 88,231 in 2005, including the towns of Menlo Park, East Palo Alto, Atherton, and communities of North Fair

Oaks, Sequoia Tract, West Menlo Park, Menlo Oaks and other unincorporated areas. Menlo Park's share[54] of the greenhouse gas emissions from the MPFPD are included in the "District natural gas and electricity" and "Transportation" sectors in community-wide inventory, and are not included in the City of Menlo Park's municipal operations emissions. The MPFPD emissions are detailed below in Table 17 as an information item because they result from essential local government services.

Table 17. Menlo Park Fire Protection District Greenhouse Gas Emission in 2005

Emissions Source	Greenhouse Gas Emissions (% CO_2e)	Greenhouse Gas Emissions (metric tons CO_2e)	Energy Equivalent (MMBtu)	Energy/Fuel Use	Total Energy Cost ($)
Electricity	17.3%	9	131	38311 kWh	$4,899
Natural Gas	12.3%	6	109	1090 therms	$1,387
Gasoline	23.5%	12	152	1212 gallons	$2,719
Diesel	46.9%	23	296	2431 gallons	$6,116
Total	**100.0%**	**50**	**689**		**$15,107**

Conclusion

In passing a resolution to endorse the U.S. Conference of Mayors Climate Protection Agreement, the City of Menlo Park made a formal commitment to reduce its greenhouse gas 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 Menlo Park community as a whole was responsible for emitting 491,054 metric tons of CO_2e in the base year 2005, with the transportation and commercial building sectors contributing the most to this total. The City of Menlo Park's own municipal operations were responsible for 2,183 metric tons of CO_2e in 2005, in addition to 41,748 metric tons of CO_2e from the Marsh Road Landfill.

The results from the 2020 emissions forecast demonstrate that under a business-as-usual scenario, emissions will grow significantly in the commercial and transportation sectors. These results suggest that energy use in commercial buildings and vehicular travel present both the greatest challenge and require the most urgent action in order for the City to reduce its emissions in the future. Community climate action planning efforts should not neglect these sectors.

Following the ICLEI methodology, we recommend that the City of Menlo Park should begin to document emission reduction measures that have already been implemented since 2005, and to quantify the emissions benefits of these measures to demonstrate progress made to date.

As Menlo Park moves forward with considering emission reduction targets and works to create a local climate action plan, the City should identify and quantify the emission reduction benefits of new emissions reduction measures that could be implemented in the future, including energy

[54] Based on number of residents in Menlo Park served by the MPFPD.

efficiency, renewable energy, vehicle fuel efficiency, alternative transportation, trip reduction, and other strategies.

APPENDIX 1 Detailed Community Inventory Notes

	Equiv CO2 (metric tons)	Energy (million Btu)
Transportation		
Menlo Park, CA		
CalTrain Commuters		
Diesel	2,782	33,228
Subtotal CalTrain Commuters	2,782	33,228

NOTES:

Data, estimates, and assumptions made in calculating vehicle miles traveled and energy use by CalTrain

The following Data came from the "2005 CalTrain Ridership Report" and "Budget FY 2004-2005 Caltrain" on the CalTrain Website: http://www.caltrain.org

- Number of Riders going northbound from Menlo Park during the AM peak hours in Feb 2005: 175
- Number of Riders going southbound from Menlo Park during the AM peak hours in Feb 2005: 119
- Average 2005 Weekday ridership (people getting on the train) in Menlo Park: 1009

- Roundtrip Distance from Menlo Park CalTrain station to San Francisco CalTrain Station: 62 miles (estimate)
- Roundtrip Distance from Menlo Park CalTrain station to San Jose CalTrain Station: 50 miles (estimate)

- Total daily passenger miles traveled from Menlo Park Northbound roundtrip: 37,237
- Total daily passenger miles traveled from Menlo Park Southbound roundtrip: 20, 420

Therefore the total daily passenger miles traveled that Menlo Park is responsible for is 57,657.
(This is a calculated estimate based on above numbers and using the ratio of riders getting on going northbound versus riders going southbound; and assuming that all northbound passengers go to the San Francisco Station and all southbound passengers go to the San Jose station. Ridership data shows that this assumption is an acceptable estimate based on average passenger traffic at these two stations)

- Overall, trains run at 38.1% of their capacity (2005 Caltrain Ridership)
- The average number of passenger cars per train is 4.7.
- The average car capacity is 135 people.
- The average capacity for a train in 634.5 people

634.6 x 38.1% = 242 people are on each train on average

- Ridership on Saturday and Sunday is a combined 42.8% of ridership on weekdays (2005 CalTrain Ridership)
- Average Daily Weekday Menlo Park Riders = 1009
- Total Average Daily Weekday Riders = 28,393

Menlo Park Riders account for an average of 3.55% of daily ridership

- On average, CalTrain engines use 3.13 gallons of diesel per mile traveled. (from Budget FY 2004-2005 CalTrain)

CalTrain fuel efficiency = (1mile/3.13 gallons)x(242 passengers) = 77.3 passenger miles / gallon

The number of gallons of diesel that Menlo Park passengers are responsible for:
(57,657 passenger miles/day) x (1 gallon/77.3 passenger miles) = (746 gallons/day) x (365 days/year) = 272,333 gallons of diesel per year

(If these same passengers were riding in single occupancy vehicles that get 27 mpg, the equivalent gasoline usage would be 779,681 gallons.)

	Equiv CO2 (metric tons)	Energy (million Btu)
Menlo Park State Highway VMT		
Gasoline	146,484	2,031,107
Diesel	13,385	157,830
Subtotal Estimated Menlo Park State Highway VMT	158,869	1,490,480

NOTES:
State Highway VMT data was provided to ICLEI by Benjamin Espinosa at the Metropolitan Transportation Commission. MTC obtained the data from the CalTrans HPMS division. MTC provided ICLEI with an unpublished spreadsheet which contains all State highway VMT broken-out by road segment, as defined by the federal Highway Performance Monitoring System (HPMS). Using 2000 Census data to determine city boundaries, 6 complete segments and 2 partial segments were determined to fall within the boundaries of the City of Menlo Park. These segments included parts of State Highways 82, 84, 101, 109, and 114. A 0.50 mile stretch of Highway 82 (El Camino Real) falls on the Menlo Park-Atherton border. In this case, half of the vehicle miles traveled for the segment were assigned to Menlo Park.

	Equiv CO2 (metric tons)	Energy (million Btu)
Total Community On-road VMT		
Gasoline	57,674	799,694
Diesel	5,270	62,141
Subtotal Total Community On-road VMT	62,944	861,835
Subtotal Transportation	**225,595**	**3,084,001**

NOTES:
Vehicle miles traveled on non-state highway roads within the boundaries of Menlo Park.

Source:
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

	Equiv CO2 (metric tons)	Energy (million Btu)
Waste		
Menlo Park, CA		
Disposal Method - Managed Landfill		
Total Solid Waste Landfilled Tonnage		
Paper Products	10,300	*NA*
Food Waste	3,413	*NA*
Plant Debris	1,515	*NA*
Wood/Textiles	2,730	*NA*
Subtotal Total Solid Waste Landfilled Tonnage	17,957	*NA*

NOTES:

Data is from:

California Integrated Waste Management Board

http://www.ciwmb.ca.gov/LGCentral/DRS/Reports/JurDspFa.asp

Statewide Waste Characterization Study

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

CO_2e emission were calculated using the methane commitment method in the CACP software, which uses a version of the EPA WARM model. This model has the following general formula:

$CO_2e = W_t * (1-R)A$

Where:

W_t is the quantify of waste type 't',

R is the methane recovery factor,

A is the CO_2e emissions of methane per metric ton of waste at the disposal site (the methane factor)

Marsh Road Landfill Emissions calculations

CO2e Generated (Metric Tons)	Methane Generated (Metric Tons)	Waste Acceptance		Decomposable Waste In Place (Metric Tons)	Average Landfill Gas Collected (scfm)	Estimated Landfill Gas Generated (scfm)	Landfill Gas Capture Rate (calculated)
		Began	Ceased				
41,748	1,988	1960	1984	5,000,000	760.9	1,167.0	65.20%

Waste-in-Place Method

To calculate emission that occurred in 2005 from the Marsh Road Landfill (located within the boundaries of Menlo Park), the Waste-In-Place method was used. Methane emissions were estimated using EPA's Landfill Gas Emission Model (LandGEM) version 3.02. This method is often used in national and state inventories of greenhouse gas emissions. This method calculates emissions based on the amount of waste in the landfill less the amount of gas recovered. While not particularly sensitive to "three R" (Reduce, Reuse, Recycle) waste programs, the waste-in-place method is appropriate for approximating the amount of landfill gas available for flaring, heat recovery, or power generation projects.

Methane emissions in LandGEM are computed using a first order kinetics model. For a particular amount of waste-in-place, at a landfill, the simplifying assumption is made that the waste was deposited in the landfill in equal installments for each of the years the landfill was open. It therefore follows that the methane generated in the current year (before recovery) can be estimated as:

$$k * L_o * R_n * WIP * \frac{\exp^{-kA} - \exp^{-kB}}{\exp^{-k} - 1}$$

where

k is the exponential time constant of decay. (0.05 was used for Marsh Road Landfill).

Lo is the methagenic potential of the waste, expressed in cubic meters of methane per kg of waste. It has a value of 0.17 cubic meters of methane per kg of waste (or 2.72 cubic feet per pound in Standard American units).

WIP is the total waste-in-place in the landfill as of the year you are analyzing, input in metric tons.

Rn is a factor that incorporates the density of methane and any unit conversions required to balance the equation dimensionally.

A is the difference between the current year (plus one) and year the landfill was opened.

B is the difference between the current year (plus one) and the most recent year and the last year waste was deposited in the landfill.

APPENDIX 2 Detailed Government Inventory Notes

	Equiv CO2 (metric tons)	Equiv CO2 (%)	Energy (million Btu)	Cost ($)
Water/Storm Water				
Menlo Park, CA				
Irrigation Controllers				
Electricity	5	0.2	71	4,399
Subtotal Irrigation Controllers	5	0.2	71	4,399
Pump Stations				
Electricity	123	6.2	1,880	66,020
Subtotal Pump Stations	128	6.2	1,880	66,020
Subtotal Water/Storm Water	**128**	**5.9**	**1,951**	**70,418**

NOTES:

Data on electricity and natural gas use is from the Pacific Gas and Electric Company

Provided by John McGirr, Revenue and Claims Manager, City of Menlo Park

The South Bayside System Authority (SBSA) treats the wastewater for the City of Menlo Park at the South Bayside System Authority Regional Treatment Plant in San Carlos. (Data provided by Dan Child, Plant Manager at the South Bayside System Authority)

In 2005 SBSA treated 18.5 million gallons of wastewater per day, which consumed 18,949 kWh per day at an expense of $2,287 per day. In addition, the facility generated 7,945 kWh of electricity from methane captured and burned in the treatment process. In 2005, the SBSA treatment plant treated wastewater from a service area with a population of 217,000 people. Using population as a proxy for estimating Menlo Park's share of the wastewater treated, Menlo Park is responsible for 13.8% of SBSA's operations. Of the 6,916,385 kWh used for wastewater treatment in 2005, we attribute 13.8% to treating wastewater from Menlo Park. Therefore, Menlo Park is responsible for the 214 metric tons CO2e per year resulting from the use of 956,182 kWh of electricity. This data was not included in the inventory for Menlo Park.

It was outside the scope of this project to gather data on methane and N2O emissions from the wastewater treatment process. Using data from the United State Greenhouse Gas Inventory (US EPA 2007, http://epa.gov/climatechange/emissions/usinventoryreport.html), it is possible to calculate the average CO2e emissions per person based on national wastewater treatment averages. In 2005, US wastewater treatment plants emitted 27.6 x 10^6 metric tons of CO2e from methane and nitrous oxide emissions from the treatment of residential and commercial wastewater. Multiplied by Menlo Park's population of 30,000 people, we can estimate that wastewater treatment is contributing 2,504 metric tons of CO2e emissions.

214 metric tons CO2e (electricity) + 2,502 metric tons CO2e (methane and nitrous oxide) = 2,718 metric tons CO2e. This estimate is on-par with emissions estimates from wastewater treatment for other small and medium sized cities in the United States, where it is not uncommon for wastewater treatment to contribute 40-60% of the greenhouse gas emissions from municipal operations.

	Equiv CO2 (metric tons)	Equiv CO2 (%)	Cost ($)
Waste			
Menlo Park, CA			
Disposal Method - Managed Landfill			
Regular Pick-up Containers			
Paper Products	97	4.5	
Food Waste	14	0.6	
Plant Debris	13	0.6	
Wood/Textiles	4	0.2	
All Other Waste	0	0.0	
Subtotal City Staff Use	128	5.9	$51,092
Public Bins			
Paper Products	14	0.6	
Food Waste	5	0.2	
Plant Debris	2	0.1	
Wood/Textiles	4	0.2	
All Other Waste	0	0.0	
Subtotal Public Bins	24	1.1	$18,904
Rolloff Boxes			
Paper Products	231	10.6	
Food Waste	32	1.5	
Plant Debris	30	1.4	
Wood/Textiles	10	0.4	
All Other Waste	0	0.0	
Subtotal Rolloff Boxes	303	13.9	$26,848
Subtotal Waste	**455**	**20.9**	**$96,845**

NOTES:

Greenhouse gas emissions were calculated using the methane commitment method, as

Data on tonnage of waste and cost is from Allied Waste Services of San Mateo County. This data was provided by Laurann Sarubbi, Sales Coordinator, Allied Waste and Dianne Dryer, Environmental Program Coordinator, City of Menlo Park.

“Cost” is the total dollar amount that the City of Menlo Park paid Allied Waste for waste disposal.

“Rolloff Boxes” are containers that are periodically picked up.

Waste Composition data was not available for "public bins". Therefore, waste share numbers were taken from overall waste composition study conducted by the CIWMB.

Waste Composition Data is from:
California Integrated Waste Management Board, 2004. "Public Administration" business group Waste Composition Study: http://www.ciwmb.ca.gov/WasteChar/BizGrpCp.asp .

California Integrated Waste Management Board, 2004. “Statewide Waste Characterization Study” http://www.ciwmb.ca.gov/Publications/default.asp?pubid=1097 . December 2004.