Town of Fairfax

2010 Greenhouse Gas Emissions Inventory

Final Draft September 4, 2013

Prepared by the
Marin Climate & Energy Partnership

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EXECUTIVE SUMMARY

Climate change, caused by an increase in the concentration of atmospheric greenhouse gases, has been called one of the greatest challenges facing society today. Potential climate change impacts in Northern California include declining water supplies, spread of disease, diminished agricultural productivity, sea level rise, and increased incidence of wildfire, flooding, and landslides. In addition, the volatility of energy markets has roused concern, and is forcing communities to think differently about their resources. Here, in the State of California – with Assembly Bill 32, the Attorney General's efforts to mandate GHG reductions via CEQA, and other legislation—policies, programs and state laws designed to reduce greenhouse gases to 1990 levels by the year 2020 have been created and are being implemented.

In 2009, Fairfax completed a Greenhouse Gas Inventory report for the baseline year of 2005. In April 2012, the Fairfax Town Council adopted the 2010-2030 General Plan, which lays out a path to achieve greenhouse gas reductions in local government operations and throughout the community and directs the Town to develop a Climate Action Plan to achieve those reductions. The Town has adopted a greenhouse gas reduction target of 20% below 2005 levels by the year 2020, a target that exceeds the state goal (a goal comparable to the state goal would be 15% below 2005 levels). This report measures the progress the Town has made on reducing greenhouse gas emissions between 2005 and 2010. In some cases, changes have been made to the baseline year calculations in order to ensure an apples-to-apples comparison of emissions from 2005 and 2010. The inventory quantifies greenhouse gas emissions from a wide variety of sources, from the energy used to power, heat and cool buildings, to the fuel used to move vehicles and power off-road equipment, to the decomposition of solid waste and treatment of wastewater. Emissions are arranged by sector to facilitate detailed analysis of emissions sources and comparison of increases and decreases between 2005 and 2010. It is important to note that the inventory provides a snapshot of two years and does not intend to imply there is necessarily a trend line between those years. Total emissions may have gone up or down during the years between 2005 and 2010.

The encouraging news is that Fairfax reduced community greenhouse gas emissions 4.6% between 2005 and 2010, from 36,166 metric tons in 2005 to 34,516 metric tons in 2010 – a reduction of 1,650 metric tons CO_2e. Reductions occurred in all sectors. On a percentage basis, the greatest declines occurred in the waste (-34%), water (-31%) and off-road (-15%) sectors. In absolute terms, the greatest reductions were made in the transportation (610 metric tons CO_2e), waste (559 metric tons CO_2e) and residential (198 metric tons CO_2e) sectors.

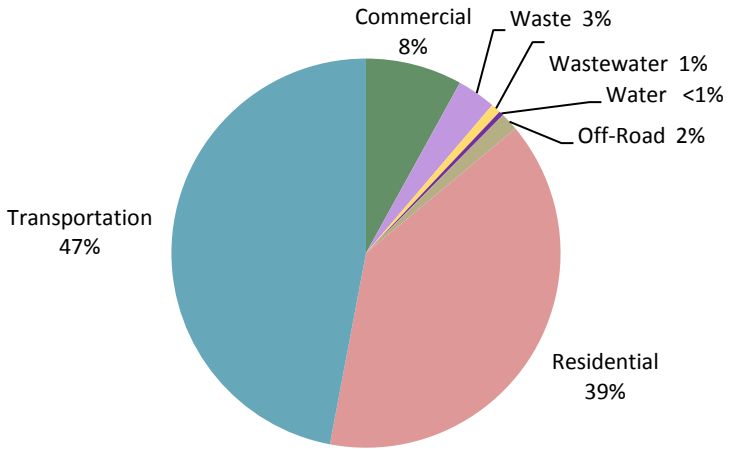
TABLE A: COMMUNITY EMISSIONS BY SECTOR, 2005 AND 2010

Sector	2005 Greenhouse Gas Emissions		2010 Greenhouse Gas Emissions		Change in Metric Tons CO_2e	% Change in Metric Tons
	Metric Tons CO_2e	% of Total	Metric Tons CO_2e	% of Total		
Residential	13,670	38%	13,472	39%	-198	-1.5%
Commercial	2,888	8%	2,770	8%	-117	-4.1%
Transportation	16,842	47%	16,232	47%	-610	-3.6%
Off-Road	610	2%	519	2%	-91	-15.0%
Water	193	1%	134	<1%	-59	-30.5%
Wastewater	295	1%	280	1%	-15	-5.0%
Waste	1,668	5%	1,109	3%	-559	-33.5%
Total	**36,166**	**100%**	**34,516**	**100%**	**-1,650**	**-4.6%**

Reductions in electricity usage, a decline in the carbon intensity of electricity provided by PG&E, and the introduction of greener electricity provided by the Marin Energy Authority were largely responsible for the decrease in emissions in the residential and commercial sectors, while a decrease in water usage led to declines in the water and wastewater sectors. Emission reductions in the waste sector were primarily due to a 31% reduction in waste going to the landfill. In the transportation sector, improvements in fuel efficiency resulted, in part, in lower emissions from vehicles travelling on local roads. Reductions in the off-road sector were due to a 31% decrease in emissions from construction equipment. More detailed analysis of the factors related to decreases in emissions appears in the Community Inventory Detail by Sector section beginning on page 13.

As shown in Figure A, year 2010 emissions from the transportation sector are responsible for the greatest percentage of greenhouse gas emissions (47%), followed by emissions from the residential sector (39%) and the commercial sector (8%). The waste sector contributes approximately 3% of emissions, while the off-road, water, and wastewater sectors are each responsible for 2% or less of total community emissions.

FIGURE A: COMMUNITY EMISSIONS BY SECTOR, 2010



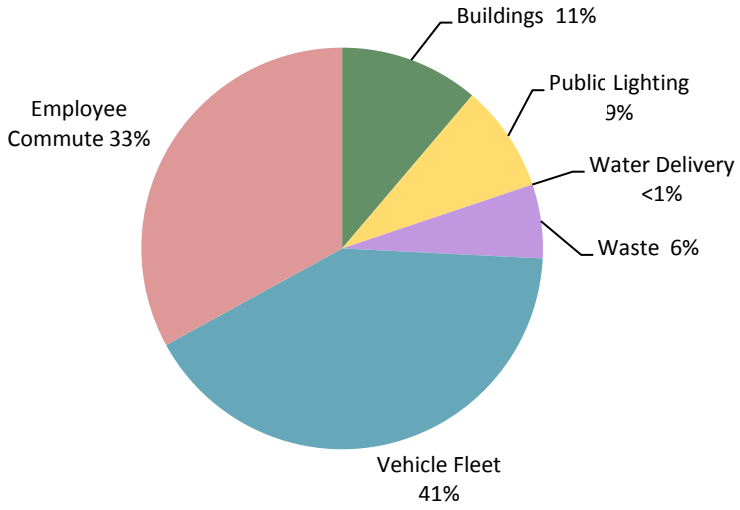
As shown in Table B, government operations emissions decreased by 88 metric tons CO_2e, or 25%. Decreases occurred in all sectors with the largest decreases occurring in the public lighting sector (31 metric tons CO_2e), the employee commute sector (28 metric tons CO_2e), the vehicle fleet sector (17 metric tons CO_2e), and the buildings and facilities sector (11 metric tons CO_2e).

TABLE B: GOVERNMENT OPERATIONS EMISSIONS BY SECTOR, 2005 AND 2010

Sector	2005 Greenhouse Gas Emissions		2010 Greenhouse Gas Emissions		Change in Metric Tons CO_2e	% Change in Metric Tons CO_2e
	Metric tons CO_2e	% of Total	Metric Tons CO_2e	% of Total		
Buildings & Facilities	40.3	13%	29.0	11%	-11.4	-28%
Vehicle Fleet	123.2	28%	106.6	41%	-16.6	-13%
Public Lighting	53.6	17%	22.3	9%	-31.3	-58%
Water Delivery	0.09	<1%	0.03	<0.1%	-0.06	-62%
Waste	16.3	5%	15.4	6%	-0.9	-6%
Employee Commute	112.8	36%	85.3	33%	-27.5	-24%
Total	**346.2**	**100%**	**258.6**	**100%**	**-87.7**	**-25%**

The Town reduced its use of natural gas by 5% but increased its use of electricity by 2%. Despite this increase in electricity consumption, emissions from electricity use decreased 59% due primarily to the Town's decision to switch to Marin Clean Energy "Deep Green" electricity in 2010. About 55% of the Town's electricity came from Main Clean Energy in 2010, resulting in significant declines in greenhouse gas emissions from the buildings, public lighting, and water delivery sectors. The Town also reduced its waste headed to the landfill by 6%.

FIGURE B: GOVERNMENT OPERATIONS EMISSIONS BY SECTOR, 2010



These results show that Fairfax has accomplished its 2020 goal for reducing government operations emissions and is on its way to accomplishing its goal for community emissions. Fairfax will achieve a reduction in community emissions of 13% below 2005 levels by the year 2020 if community emissions continue to decrease at the current rate. More, however, will need to be done in order to achieve the Town's goal to reduce community emissions 20% below 2005 levels by 2020.

INTRODUCTION

PURPOSE OF INVENTORY

The objective of this greenhouse gas emissions inventory is to identify the sources and quantify the amounts of greenhouse gas emissions generated by the activities of the Fairfax community and local government operations in 2010. This inventory provides a comparison to baseline 2005 emissions, and identifies the sectors where significant reductions in greenhouse gas emissions have occurred and where more work needs to be done. In some instances, baseline emissions were recalculated in order to ensure the same methodology was employed for 2005 and 2010. In addition, some new sectors were added to the inventory; this report includes emissions from water use, off-road vehicles and equipment, and wastewater treatment for the community inventory, and fugitive emissions from refrigerants in the government operations inventory.

GENERAL METHODOLOGY

A national standard called the Local Government Operations Protocol (LGO Protocol) has been developed and adopted by the California Air Resources Board (ARB) in conjunction with ICLEI, the California Climate Action Registry and The Climate Registry. This standard provides accounting principles, boundaries, quantification methods and procedures for reporting greenhouse gas emissions from local government operations. The LGO Protocol forms the basis of ICLEI's Clean Air & Climate Protection Software (CACP 2009), which allows local governments to compile data and perform the emissions calculations using standardized methods.

Local government operations emissions have been categorized according to the following sectors:

- Buildings and Other Facilities
- Public Lighting
- Water Delivery Facilities
- Vehicle Fleet
- Solid Waste
- Employee Commute

This inventory utilizes methodologies developed by the Bay Area Air Quality Management District and ICLEI for quantifying community-scale emissions. In general, the inventory follows the standards outlined in the draft International Local Government GHG Emissions Analysis Protocol and, where appropriate, the LGO Protocol, with additional guidance from the Air District with respect to quantifying emissions from the transportation, off-road, water and wastewater sectors.

Community emissions have been categorized according to seven primary sectors:

- Residential
- Commercial
- Transportation
- Off-Road Vehicles and Equipment
- Water
- Wastewater
- Waste

Calculating Emissions

In general, emissions can be quantified in two ways:

1. **Measurement-based methodologies** refer to the direct measurement of greenhouse gas emissions from a monitoring system. Emissions measured in this way may include those from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility. This method is the most accurate way of inventorying emissions from a given source, but is generally available for only a few sources of emissions.
2. **Calculation-based methodologies** refer to an estimate of emissions calculated based upon measurable activity data and emission factors. Table 1 provides examples of common emissions calculations. For example, in order to calculate the carbon dioxide emissions from community electricity consumption, the total amount of kilowatt hours of electricity consumed by the community over a one-year period is multiplied by an emission factor specific to that source. This results in the amount of carbon dioxide gas emitted by electricity consumption in that year. All emissions inventoried in this report are calculated in this manner.

Table 1: Factors for Calculating Emissions

Emission Source	Activity Data	Emission Factor	Emissions
Electricity Consumption	Kilowatt hours	CO_2 emitted/kWh	CO_2 emitted
Natural Gas Consumption	Therms	CO_2 emitted/therm	CO_2 emitted
Gasoline/Diesel Consumption	Gallons	$C0_2$ emitted/gallon	CO_2 emitted
Waste Generation	Tons	CH_4 emitted/ton	CH_4 emitted

This inventory calculates individual greenhouse gases – e.g., carbon dioxide, methane and nitrous oxide – and converts each gas emission to a standard metric, known as "carbon dioxide equivalents" or CO_2e, in order to allow an apple-to-apples comparison among the three emissions. Table 2 shows the greenhouse gases identified in this inventory and their global warming potential (GWP), a measure of the amount of warming each gas causes when compared to a similar amount of carbon dioxide. Methane, for example, is 21 times as potent as carbon dioxide; therefore, one metric ton of methane is equivalent to 21 metric tons of carbon dioxide. Greenhouse gas emissions are reported in this inventory as metric tons of carbon dioxide equivalents, or $MTCO_2e$.

TABLE 2: GREENHOUSE GASES

Gas	Chemical Formula	Emission Source	Global Warming Potential
Carbon Dioxide	CO_2	Combustion of natural gas, gasoline, diesel, and other fuels	1
Methane	CH_4	Combustion, anaerobic decomposition of organic waste in landfills and wastewater	21
Nitrous Oxide	N_2O	Combustion, wastewater treatment	310
Hydroflourocarbons	Various	Leaked refrigerants, fire suppressants	12 to 11,700

TYPES OF EMISSIONS

Emissions from each of the greenhouse gases can come in a number of forms:

- **Stationary or mobile combustion** resulting from the on-site combustion of fuels (natural gas, diesel, gasoline, etc.) to generate heat or electricity, or to power vehicles and equipment.
- **Purchased electricity** resulting from the generation of power from utilities outside the town limits.
- **Fugitive emissions** resulting from the unintentional release of greenhouse gases into the atmosphere, such as leaked refrigerants and methane from waste decomposition.
- **Process emissions** from physical or chemical processing of a material, such as wastewater treatment.

THE SCOPES FRAMEWORK

This inventory reports greenhouse gas emission by sector, as described earlier in this report, and by "scope" as follows:

- **Scope 1:** Direct emissions from the combustion of fuels to produce heat, steam, electricity or to power equipment; mobile combustion of fuels; process emissions from physical or chemical processing; fugitive emissions that result from production, processing, transmission, storage and use of fuels; leaked refrigerants; and other sources.
- **Scope 2:** Indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling. Scope 2 emissions occur as a result of activities that take place within the town limits but are generated outside of the town. For example, electricity from Pacific Gas & Electric Company is consumed within Fairfax but the greenhouse gasses associated with this consumption are emitted outside of the town where the electricity is generated.
- **Scope 3:** All other emissions sources that hold policy relevance to the local government that can be measured and reported. Typically, these are emissions not covered in Scope 2 that occur as a result of activities within the town. Scope 3 emissions include (but are not limited to) emissions resulting from the decomposition of solid waste, the treatment and distribution of water, and the treatment of wastewater at facilities located outside of the town boundaries. Within the government operations inventory, Scope 3 emissions also include emissions resulting from employee commutes.

Organizational Boundaries

The organizational boundary for the inventory determines which aspects of operations are included in the emissions inventory and which are not. Under the LGO Protocol, two control approaches are used for reporting emissions: operational control or financial control. A local government has operational control if it has full authority to introduce and implement policies that impact the operation. A local government has financial control if the operation is fully consolidated in financial accounts. If a local government has joint control over an operation, the contractual agreement will have to be examined to see who has authority over operating policies and implementation, and thus the responsibility to report emissions under operational control.

LGO Protocol strongly encourages local governments to utilize operational control as the organizational boundary for a local government operations emission inventory. Operational control is believed to most accurately represent the emissions sources that local governments can most directly influence, and this boundary is consistent with other environmental and air quality reporting program requirements. For this reason, this inventory for local government operations emissions was conducted according to the operational control framework.

Understanding Totals

It is important to realize that the totals listed in the tables and discussed in the report are intended to represent all-inclusive, complete totals for Fairfax's community and government operations emissions. However, these totals are only a summation of inventoried emissions using available estimation methods. Each inventoried sector may have additional emissions sources associated with them that were unaccounted for, due to a lack of data or robust quantification methods. Examples of greenhouse gas emissions that are not included in the community inventory include refrigerants released into the atmosphere from the use of air conditioning in cars and buildings.

Information Items

Information items are emissions sources that are not included as Scope 1, 2, or 3 emissions in the inventory, but are reported here separately in order to provide a more complete picture of emissions from Fairfax's government operations. Information items for this inventory include one refrigerator using the refrigerant R-12 and one air conditioning system using the refrigerant R-22. These refrigerants are not included in the inventory because they are ozone-depleting substances and are being phased out by 2020 under the terms of the Montreal Protocol.

Table 3: Information Items, 2010

Source	Refrigerant	Metric Tons CO_2e
Refrigerators	R-12	0.005
Air Conditioning Units	R-22	0.181
Total		0.186

Regional and Local Context

Climate Change Mitigation Activities in California

Since 2005, the State of California has responded to growing concerns over the effects of climate change by adopting a comprehensive approach to addressing emissions in the public and private sectors. This approach was officially initiated with the passage of the Global Warming Solutions Act of 2006 (AB 32), which requires the state to reduce its greenhouse gas emissions to 1990 levels by 2020. The AB 32 Scoping Plan was developed to identify strategies for meeting the AB 32 goal, and was adopted by the California Air Resources Board (ARB) in December

2008. Among many other strategies, it encourages local governments to reduce emissions in their jurisdictions by 15 percent below current levels by 2020. In addition, it identifies the following strategies that will impact local governance:

- Develop a California cap-and-trade program
- Expand energy efficiency programs
- Establish and seek to achieve reduction targets for transportation-related GHG emissions
- Expand the use of green building practices
- Increase waste diversion, composting, and commercial recycling toward zero-waste
- Continue water efficiency programs and use cleaner energy sources to move and treat water
- Reduce methane emissions at landfills
- Preserve forests that sequester carbon dioxide

Other measures taken by the state include mandating stronger vehicle emissions standards (AB 1493, 2002), establishing a low-carbon fuel standard (EO # S-01-07, 2007), mandating a climate adaptation plan for the state (S-EO # 13-08, 2008), establishing a Green Collar Job Council, and establishing a renewable energy portfolio standard for power generation or purchase in the state. The state also has made a number of legislative and regulatory changes that have significant implications for local governments:

- SB 97 (2007) required the Office of Planning and Research to create greenhouse gas planning guidelines for the California Environmental Quality Act (CEQA). In addition, the ARB is tasked with creating energy-use and transportation thresholds in CEQA reviews, which may require local governments to account for greenhouse gas emissions when reviewing project applications.
- AB 811 (2007) authorizes all local governments in California to establish special districts that can be used to finance solar or other renewable energy improvements to homes and businesses in their jurisdiction.
- SB 375 (2008) revises the process of regional transportation planning by metropolitan planning organizations (MPOs), which are governed by elected officials from local jurisdictions. The statute calls on the ARB to establish regional transportation-related greenhouse gas targets and requires the large MPOs to develop regional "Sustainable Communities Strategies" of land use, housing and transportation policies that will move the region towards its GHG target. The statute stipulates that transportation investments must be consistent with the Sustainable Communities Strategy and provides CEQA streamlining for local development projects that are consistent with the Strategy.

The Marin Climate & Energy Partnership

Created in 2007, the mission of the Marin Climate & Energy Partnership (MCEP) is to reduce greenhouse gases emission levels to the targets of Marin County and local municipalities, consistent with the standards set by AB32. Ten Marin Cities and towns, the County of Marin, the Transportation Authority of Marin, and the Marin Municipal Water District are members. The Marin Climate and Energy Partnership provided staff support and technical expertise for the development of this inventory. Funding for this project was provided in part by the Marin County Energy Watch (MCEW), a joint project of Pacific Gas and Electric Company (PG&E) and the County of Marin.[1]

[1] MCEW is funded by California utility ratepayers under the auspices of the California Public Utilities Commission.

Climate Change Mitigation Activities in Fairfax

The Town has taken a number of initiatives in recent years to reduce greenhouse gas emissions. These include the following early actions:

- Installed energy-efficient lighting, double-paned window and a new door in town hall.
- Installed a 25 KW solar panel system on the Pavilion roof.
- Joined the Marin Energy Authority and chose Marin Clean Energy deep green 100% renewable electricity for all Town operations.
- Adopted the Town of Fairfax Bicycle and Pedestrian Master Plan Update in 2008 which outlines future bicycle and pedestrian improvement programs and projects throughout the Town to promote increased bicycle and pedestrian travel and decrease the use of vehicles.
- Secured Safe Routes to Schools and Safe Paths to Schools grant money to construct crosswalks and safety improvements at Glen Drive/Mitchell Drive and Oak Tree Lane at Sir Francis Drake Boulevard, and a new sidewalk on Oak Manor Drive.
- Constructed bicycle and pedestrian improvements on Center Boulevard between Pastori Avenue and Pacheco Avenue, including new sidewalks, curb extensions, new and improved crosswalks and bicycle lane repaving.
- Working with funding through the Non-Motorized Transportation Pilot Program, installed new sidewalks on Pastori Avenue and Sir Francis Drake Boulevard. The improvements are intended to increase the mode share of cycling and walking for everyday transportation.
- Secured $300,000 in One Bay Area Grant (OBAG) funding to improve pedestrian, bicycle and vehicle circulation through and around the parkade.
- In partnership with Marin Sanitary Service, implemented curbside food waste collection. The program reduces methane emissions by composting food waste instead of depositing it into the landfill.
- Adopted a Zero Waste resolution that commits the Town to reaching a 94% diversion rate by 2025, and an ultimate goal of Zero Waste.
- Adopted the new CALGreen standards as part of the new California Building Code.
- Participated in the Energy Upgrade California program, which provides substantial rebates to homeowners to perform energy audits and “whole house” energy upgrade retrofits.
- Implemented Marin Municipal Water District’s Ordinance 421 which added, amended, and repealed certain sections of MMWD’s Title 13 Water Code. The revisions were necessary to further meet conservation measures within the District’s service area, as well as meet 2010 California Green Building Standards, improve the effectiveness of the District’s water waste prevention program, and increase efficiency standards.
- Purchased numerous pieces of Energy Star-rated computer equipment to phase out older, less energy efficient equipment.

COMMUNITY INVENTORY RESULTS

FAIRFAX PROFILE

Located in Marin County approximately thirteen miles north of the Golden Gate Bridge in beautiful Upper Ross Valley, Fairfax is a small town with a land area of 2.1 square miles. According to the U.S. Census, the population of Fairfax in 2010 was 7,441 and there were 3,585 housing units. The California Department of Finance estimates the population of Fairfax in 2005 was 7,237.[2] Fairfax enjoys a temperate climate, with cool, wet, and almost frostless winters and dry summers. The town is located in climate zone 2, and experienced an estimated 3,649 heating degree days and 292 cooling degree days in 2005. The year 2010 was relatively cooler, with 4,027 heating degree days and 168 cooling degree days. [3]

COMMUNITY INVENTORY SUMMARY

In 2005, the activities taking place by the Fairfax community resulted in approximately 36,166 metric tons of CO_2e. In 2010, those activities resulted in approximately 34,516 metric tons of CO_2e, a reduction of 1,650 metric tons, or 4.6%. These numbers represent a roll-up of emissions. While the roll-up is a valuable figure, the breakdown of emissions information by sectors, sources, and scope allows the comparative analysis and insight needed for effective decision-making for target setting, developing GHG reduction measures, and monitoring. The following summaries break down these totals by sector, sources, and scope.

SUMMARY BY SECTOR

As shown in Table 4 and Figure 1, the transportation sector was the largest emitter of greenhouse gas emissions in both 2005 and 2010 (representing 47% of total emissions). Emissions from the residential sector produced the second highest quantity (38% in 2005 and 39% in 2010), followed by the commercial sector (8% in 2005 and 2010). Emissions were reduced in all sectors, with the greatest reductions occurring in the transportation sector (610 metric tons), waste sector (559 metric tons), and residential sector (198 metric tons).

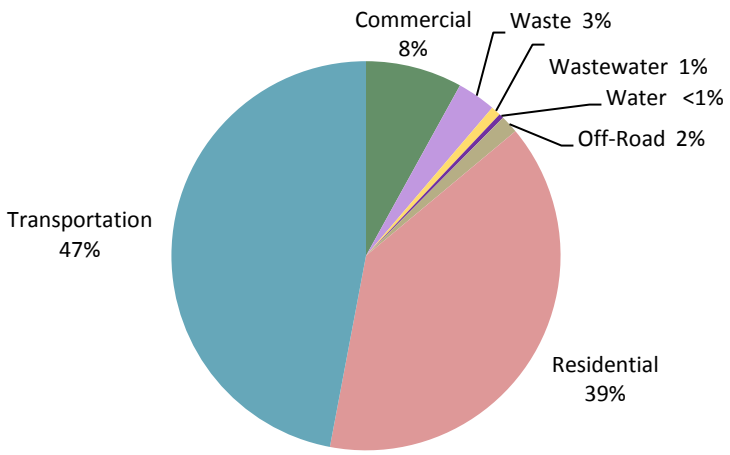
[2] California Department of Finance, "E-4 Population Estimates for Cities, Counties, and the State 2001-2010, with 2000 & 2001 Census Counts," August 2011. To make comparisons to U.S. Census data, this is the average between California Department of Finance estimates for January 1, 2005, and January 1, 2006.

[3] Climate Zone information is supplied by the California Energy Commission, http://www.energy.ca.gov/maps/renewable/Climate_Zones_by_City.pdf, accessed 9/14/12. Heating and cooling degree days data for the North Coast Drainage Division is supplied by NOAA Satellite and Information Service, National Climatic Data Center, U.S. Department of Commerce, http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp, accessed 9/14/12. A heating degree day (HDD) is a measurement designed to reflect demand for energy needed to heat a facility, while a cooling degree day (CDD) is used to reflect the demand on energy needed to cool a building. Degree days are calculated using daily temperature readings and a base temperature (typically 60 or 65 degrees). For example, a typical January day in Fairfax has an average temperature of 47 degrees. For such a day we can approximate the HDD as (65 - 47) = 18.

TABLE 4: COMMUNITY EMISSIONS SUMMARY BY SECTOR, 2005 AND 2010

Sector	2005 Metric Tons CO_{2e}	2010 Metric Tons CO_2e	Change Metric Tons CO_2e	% Change
Residential	13,670	13,472	-198	-1.5%
Commercial	2,888	2,770	-117	-4.1%
Transportation	16,842	16,232	-610	-3.6%
Off-Road	610	519	-91	-15.0%
Water	193	134	-59	-30.5%
Wastewater	295	280	-15	-5.0%
Waste	1,668	1,109	-559	-33.5%
Total	**36,166**	**34,516**	**-1,650**	**-4.6%**

FIGURE 1: COMMUNITY EMISSIONS BY SECTOR, 2010



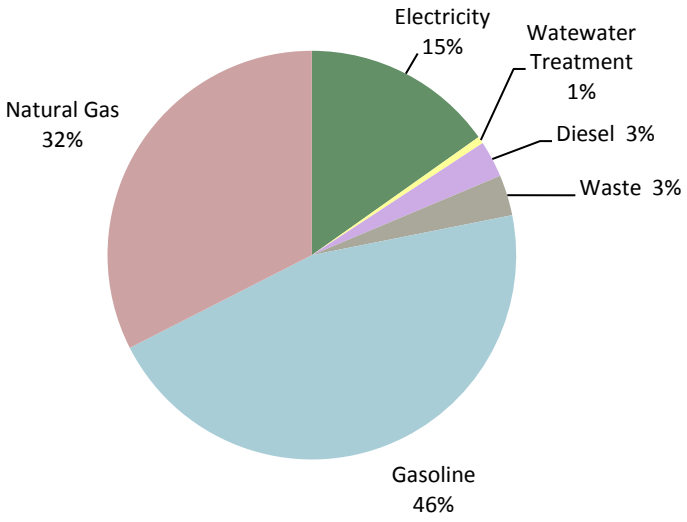
SUMMARY BY SOURCE

When considering how to reduce emissions, it is helpful to look not only at which sectors are generating emissions, but also at the specific raw resources and materials (gasoline, diesel, electricity, natural gas, solid waste, etc.) whose use and generation directly result in the release of greenhouse gases. Table 5 and Figure 2 provide summaries of Fairfax's 2005 and 2010 greenhouse gas emissions by source. Between 2005 and 2010, emissions from the combustion of natural gas increased by 2.6% or 279 metric tons CO_2e. Emissions from other sources decreased in all categories except wastewater treatment which experienced a small increase of 5 metric tons CO_2e. In 2010, the largest source of emissions was gasoline (46% of total emissions), followed by natural gas (32%) and electricity (15%).

TABLE 5: COMMUNITY SUMMARY BY SOURCE, 2005 AND 2010

Source	2005 Metric Tons CO_{2e}	2010 Metric Tons CO_2e	Change Metric Tons CO_2e	% Change
Gasoline	16,260	15,752	-508	-3.1%
Natural Gas	10,938	11,217	279	2.6%
Electricity	5,918	5,244	-674	-11.4%
Diesel	1,193	999	-193	-16.2%
Waste	1,668	1,109	-559	-33.5%
Wastewater Treatment	190	196	5	2.8%
Total	**36,166**	**34,516**	**-1,650**	**-4.6%**

FIGURE 2: COMMUNITY EMISSIONS BY SOURCE, 2010



SUMMARY BY SCOPE

As shown in Table 6, Scope 1 sources produced the largest amount of community greenhouse gas emissions in both 2005 and 2010, with emissions totaling 27,968 metric tons CO_2e in 2010. Scope 2 emissions comprised the second largest amount (5,025 metric tons CO_2e), and Scope 3 emissions totaled 1,523 metric tons CO_2e. The greatest reduction occurred in Scope 3 emissions (-29.4%), which includes emissions from the waste, water, and wastewater sectors. Scope 2 emissions, which represent emissions from the use of electricity generated outside the town limits, decreased by 10.6%. Scope 1 emissions, which result primarily from the combustion of natural gas to heat buildings and gasoline and diesel to power vehicles and off-road equipment, decreased 1.5%.

TABLE 6: COMMUNITY EMISSIONS SUMMARY BY SCOPE, 2005 AND 2010

Activity	2005 Metric Tons CO_{2e}	2010 Metric Tons CO_{2e}	% Change
Scope 1	28,390	27,968	-1.5%
Scope 2	5,620	5,025	-10.6%
Scope 3	2,156	1,523	-29.4%
Total	**36,166**	**34,516**	**-4.6%**

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 that there will be some margin of error when comparing figures.

As detailed in Table 7, dividing the total community-wide GHG emissions by service population (residents and employees) yields a result of 4.0 metric tons CO_2e per capita in 2005. Per capita emissions decreased 6.5% between 2005 and 2010, falling to 3.7 metric tons per person. It is important to understand that this number is not the same as the carbon footprint of the average individual living or working in Fairfax, which would include lifecycle emissions, emissions resulting from air travel, etc.

TABLE 7: PER CAPITA EMISSIONS, 2005 AND 2010

	2005	2010	% Change
Population	7,237	7,441	2.8%
Employees	1,820	1,800	-1.1%
Service Population (Residents + Employees)	9,057	9,241	2.0%
Community GHG Emissions (metric tons CO_2e)	36,166	34,516	-4.6%
Per Capita GHG Emissions (metric tons CO_2e)	**4.0**	**3.7**	**-6.5%**

COMMUNITY INVENTORY DETAIL BY SECTOR

This section explores community activities and emissions by taking a detailed look at each primary sector. As listed above, the sectors included in the community emissions analysis are:

- Residential
- Commercial
- Transportation
- Off-Road Vehicles and Equipment
- Waste
- Water
- Wastewater

Residential Sector

Energy consumption associated with Fairfax homes produced 13,670 metric tons of greenhouse gas emissions in 2005 and 13,472 metric tons in 2010, a decrease of 1.5%. All residential sector emissions are the result of electricity consumption and the on-site combustion of natural gas and propane. Natural gas is typically used in residences as a fuel for home heating, water heating and cooking, and electricity is generally used for lighting, heating and powering appliances. In 2005, Fairfax's entire residential sector consumed 18,314,689 kWh of electricity and 1,800,870 therms of natural gas.

As shown in Table 8, electricity usage in Fairfax's residential sector increased 1.3% between 2005 and 2010, while emissions decreased 9.1%. This decline in GHG emissions occurred for two reasons. First, the carbon intensity of PG&E electricity declined 9% between 2005 and 2010. Second, some Fairfax residents began to purchase their electricity from the Marin Energy Authority (MEA) approximately midway through the year, resulting in about 5% of all residential kWh purchased through MEA in 2010. The carbon intensity of MEA electricity was about 27% lower than that supplied by PG&E in 2010 due to the higher percentage of renewable and non-greenhouse gas emitting energy sources in MEA's energy mix.

The decline in PG&E's emissions from delivered electricity from 2005 to 2010 owed, in large part, to an increase in the amount of zero- and low-emitting electricity in their power portfolio and the expanded use of cleaner fossil-fueled electricity, including two new, state-of-the-art natural gas-fired plants that PG&E brought into service in 2010. More than half of PG&E's power came from a combination of non-greenhouse gas emitting and renewable sources in 2010. Several factors affect PG&E's power mix and emissions from year to year, including demand growth, the weather and the availability of hydro power.

Table 8: Residential Emissions Sources, 2005 and 2010

Source	2005 Energy Consumption	2005 GHG Emissions ($MTCO_2e$)	2010 Energy Consumption	2010 GHG Emissions ($MTCO_2e$)	% Change in Energy Consumption	% Change in GHG Emissions ($MTCO_2e$)
Electricity	18,314,689 kWh	4,097	18,548,430 kWh	3,723	1.3%	-9.1%
Natural Gas	1,800,870 therms	9,573	1,833,949 therms	9,749	1.8%	1.8%
Total	--	**13,670**	**--**	**13,472**	**--**	**-1.5%**

Natural gas usage increased 1.8% between 2005 and 2010. This may be due, in part, to the fact that 2010 was a cooler year than 2005.[4] Since the natural gas emissions factor does not fluctuate, the amount of greenhouse gases emitted by the combustion of natural gas also increased 1.8%.

As shown in Table 9, Fairfax residents generated approximately 4.1 metric tons of greenhouse gas emissions per household in 2010. This is a decrease of approximately 3.5% per household since 2005. [5]

[4] See discussion on page 10.

[5] Number of Fairfax households is from ABAG Projections 2009 and 2010 U.S. Census SF1:H.

TABLE 9: RESIDENTIAL EMISSIONS PER HOUSEHOLD

	2005	2010
Number of Occupied Housing Units	3,310	3,379
Residential GHG Emissions (metric tons CO_2e)	13,670	13,472
Residential GHG Emissions per Household (metric tons CO_2e)	4.1	4.0

COMMERCIAL SECTOR

The commercial sector includes emissions from the operations of businesses as well as public agencies. Between 2005 and 2010, emissions from the commercial sector fell by 4.1%. In 2010, buildings and facilities within the commercial sector produced 2,770 metric tons of greenhouse gas emissions. All commercial sector emissions included in this inventory are the result of electricity consumption and the on-site combustion of natural gas. Natural gas is typically used in the commercial sector to heat buildings, fire boilers, and generate electricity; electricity is generally used for lighting, heating, and powering equipment and appliances.

As shown in Table 10, electricity usage increased 4.9% in the commercial sector between 2005 and 2010, while electricity emissions decreased 14.5%. This occurred because the carbon intensity of electricity was lower in 2010 (see above discussion on residential sector emissions). In 2010, nearly 9% of commercial electricity was purchased through MEA. The decrease in electricity emissions was offset by an increase in natural gas usage and emissions of 7.6%. The net effect was to decrease total emissions from the commercial sector by 4.1%.

TABLE 10: COMMERCIAL EMISSIONS, 2005 AND 2010

Source	2005 Energy Consumption	2005 GHG Emissions ($MTCO_2e$)	2010 Energy Consumption	2010 GHG Emissions ($MTCO_2e$)	% Change in Energy Consumption	% Change in GHG Emissions ($MTCO_2e$)
Electricity	6,070,502 kWh	1,522	6,368,457 kWh	1,302	4.9%	-14.5%
Natural Gas	256,827 therms	1,365	276,235 therms	1,468	7.6%	7.6%
Total	--	2,888	--	2,770	--	-4.1%

Table 11 shows commercial emissions based on the estimated number of jobs in Fairfax in 2005 and 2010.[6] Emissions decreased approximately 3% per job.

TABLE 11: COMMERCIAL EMISSIONS PER JOB

	2005	2010
Number of Jobs	1,820	1,800
Commercial / Industrial GHG Emissions (metric tons CO_2e)	2,888	2,770
Commercial /Industrial GHG Emissions per Job (metric tons CO_2e)	1.6	1.5

[6] Number of Fairfax jobs in 2005 and 2010 is based on ABAG Projections 2009 estimates.

Transportation Sector

Emissions in the transportation sector are calculated by estimating all vehicle miles traveled on local roads within the town limits. This methodology includes vehicle miles traveled by Fairfax residents as well as vehicle miles from pass-through traffic. Air travel and vehicle miles traveled outside of Marin County are not included in the analysis. In 2005, the transportation sector generated 16,842 metric tons of CO_2e. By 2010, emissions from the transportation sector decreased approximately 3.6% to 16,232 metric tons CO_2e. As shown in Table 12, vehicle miles traveled on local roads decreased slightly by 0.3% between 2005 and 2010.

Table 12: Transportation Emissions, 2005 and 2010

Source	2005 Vehicle Miles Traveled	2005 GHG Emissions ($MTCO_2e$)	2010 Vehicle Miles Traveled	2010 GHG Emissions ($MTCO_2e$)	% Change in Vehicle Miles Traveled	% Change in GHG Emissions ($MTCO_2e$)
Local Roads	34,401,250	16,842	34,313,650	16,232	-0.3%	-3.6%

Decreases in transportation sector emissions are due to changes in fuel efficiency and the carbon intensity of transportation fuels. The Pavley I vehicle standards are over the long-term increasing fuel efficiency and decreasing emissions per vehicle mile. Fuel efficiency data available for this inventory show an increase in fuel efficiency of vehicles using gasoline from an average of 18.1 miles per gallon in 2005 to an average of 18.5 miles per gallon in 2010. California's Low Carbon Fuel Standard is reducing the carbon intensity of fuel over the long term, and some decreases in carbon intensity were measured between 2005 and 2010.[7]

Off-Road Sector

Emissions in the off-road sector are from the combustion of fuels used to power vehicles and equipment in the construction and lawn and garden categories, and include everything from hedge trimmers to cranes. As shown in Table 13, off-road emissions decreased 15% between 2005 and 2010. This decrease was due to a reduction in gasoline and diesel use in off-road vehicles and equipment, and an improvement in the carbon-intensity of fuels. Emissions from construction equipment and off-road vehicles, in particular, decreased by about 31%, a result of the decline in construction activity since the peak of the real estate boom in 2006-2007. Emissions from lawn and garden equipment rose slightly by less than 1%.

Table 13: Off-Road Emissions, 2005 and 2010

Source	2005 Energy Consumption (gallons)	2005 GHG Emissions ($MTCO_2e$)	2010 Energy Consumption (gallons)	2010 GHG Emissions ($MTCO_2e$)	% Change in Energy Consumption	% Change in GHG Emissions
Construction Equipment	29,752	299	20,551	205	-30.9%	-31.4%
Lawn and Garden Equipment	34,351	311	34,581	314	0.7%	0.8%
Total	**64,103**	**610**	**55,132**	**519**	**-14.0%**	**-15.0%**

[7] See the Appendix for further information.

Water Sector

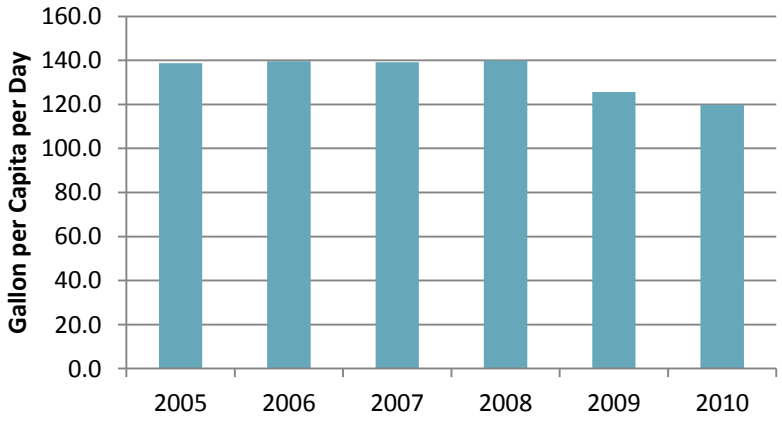
Emissions in the water sector are a result of Marin Municipal Water District's (MMWD) use of electricity to pump, treat, convey and distribute water from the water source to the water users in Fairfax. Emissions from the water sector decreased 30.5% between 2005 and 2010 (see Table 14). This reduction is based on two factors: a decline in the amount of electricity needed to treat and distribute water, and a decline in the carbon intensity of the electricity provided by PG&E and the Marin Energy Authority (MEA). MMWD began purchasing electricity procured by the Marin Energy Authority about midway through 2010, and MEA electricity represented about 54% of the District's total electricity usage in that year. MEA's electricity was about 27% less carbon intensive than PG&E electricity in 2010.

Table 14: Water Emissions, 2005 and 2010

Source	2005 Energy Consumption (kWh)	2005 GHG Emissions ($MTCO_2e$)	2010 Energy Consumption (kWh)	2010 GHG Emissions ($MTCO_2e$)	% Change in Energy Consumption	% Change in GHG Emissions
Water	862,794	193	772,095	134	-10.5%	-30.5%

The Water District's electricity usage decreased by almost 13% between 2005 and 2010 as a result of declining water demand. As shown in Figure 3, water use has declined from 138.7 gallons per person in 2005 to 119.8 gallons per person in 2010, a reduction of almost 14%. Water demand responds to a variety of factors, including economic conditions, precipitation patterns and weather conditions, water conservation fixture and behavioral changes, and water rate structure changes. MMWD has increased water rates significantly in recent years (9.7% in 2008, 7.3% in 2009, and 9.8% in 2010), and demand has likely declined in response to these rate increases. The recession of December 2007 to June 2009, and the poor economic conditions that followed the official end of the recession, have also contributed to a reduction in water demand.

Figure 3: MMWD Per Capita Water Use, 2005 to 2010



Wastewater Sector

Wastewater coming from homes and businesses is rich in organic matter and has a high concentration of nitrogen and carbon, along with other organic elements. As wastewater is collected, treated and discharged by the Central Marin Sanitation Agency, chemical processes in anaerobic conditions lead to the creation and emission of two greenhouse gases: methane and nitrous oxide. Emissions are also created from use of electricity to collect and process the wastewater.

Emissions from the wastewater sector decreased 5% between 2005 and 2010, due to a reduction in overall water usage in the community and an improvement in the carbon intensity of PG&E electricity.

Table 15: Wastewater Emissions, 2005 and 2010

Source	2005 Energy Consumption (kWh)	2005 GHG Emissions ($MTCO_2e$)	2010 Energy Consumption (kWh)	2010 GHG Emissions ($MTCO_2e$)	% Change in Energy Consumption	% Change in GHG Emissions
Electricity	469,275	105	416,961	85	-11.1%	-19.2%
Treatment	--	190	--	196	--	2.8%
Total	--	**295**	--	**280**	--	**-5.0%**

Waste Sector

Emissions from the waste sector are an estimate of methane generation from the decomposition of municipal solid waste and alternative daily cover sent to the landfill in the 2005 and 2010. These emissions are calculated by estimating the emissions that will result from the decomposition of 2005 and 2010 waste over the full 100+ year cycle of its decomposition. About 75 percent[8] of landfill methane emissions are captured through landfill gas collection systems, but the remaining 25 percent escape into the atmosphere as a significant contributor to global warming.

As shown in Table 16, emissions from waste generated by the Fairfax community in 2010 were 33.5% lower than 2005. This was due to a 31% reduction in landfilled waste and a change in the composition of alternative daily cover. In 2005, a greater proportion of green waste was used as alternative daily cover and then buried in the landfill, generating methane as the waste decomposed.

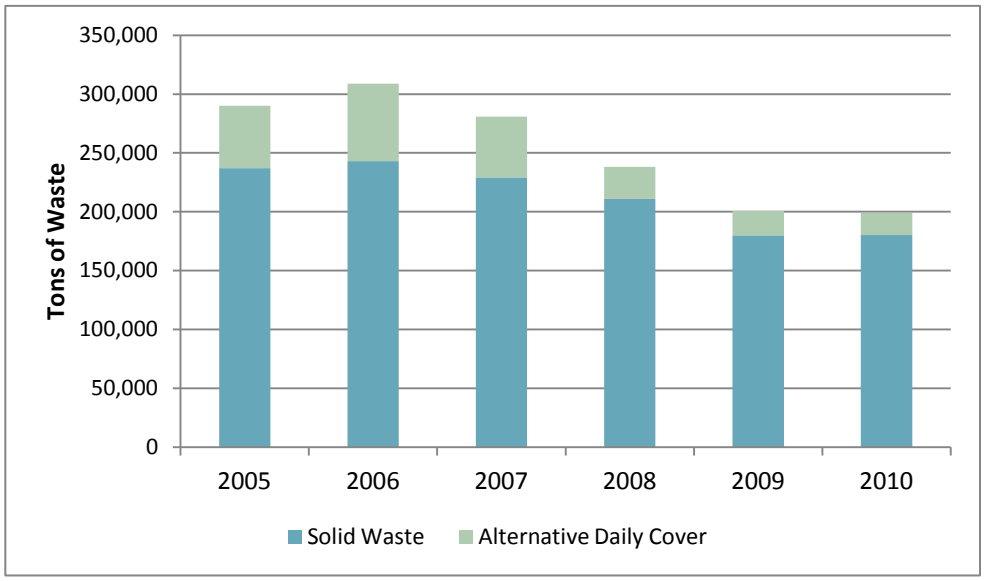
Table 16: Waste Emissions, 2005 and 2010

Source	2005 Quantity (tons)	2005 GHG Emissions ($MTCO_2e$)	2010 Quantity (tons)	2010 GHG Emissions ($MTCO_2e$)	% Change in Waste Generation	% Change in GHG Emissions
Solid Waste	6,953	1,405	5,311	1,074	-23.6%	-23.6%
Alternative Daily Cover	1,549	262	559	35	-63.9%	-86.7%
Total	**8,502**	**1,668**	**5,870**	**1,109**	**-31.0%**	**-33.5%**

[8] U.S. Environmental Protection Agency, "Compilation of Air Pollutant Emissions Factors," AP-42, Fifth Edition, January 1995.

Figure 4 shows the trend in county-wide waste generation between 2005 and 2010. Waste disposal decreased approximately 31% over that time period. County-wide waste disposal hit a high of nearly 309,000 tons in 2006, steadily declined over the next three years, and leveled off at just over 199,000 tons in 2010.

FIGURE 4: COUNTYWIDE WASTE GENERATION, 2005 TO 2010



GOVERNMENT OPERATIONS INVENTORY

GOVERNMENT PROFILE

The Town of Fairfax is a general law city and operates under the council-city manager form of government. The local government operates administrative, planning, building and public works departments, as well as a police department. In 2010, there were 30 total employees. General Fund expenditures were $6,758,910 in fiscal year 2009-2010 and $7,093,600 in fiscal year 2010-2011.

GOVERNMENT OPERATIONS INVENTORY SUMMARY

In 2005, Fairfax's government operations produced approximately 346 metric tons of CO_2e. In 2010, those activities resulted in approximately 259 metric tons of CO_2e, a decrease of 88 metric tons, or 25%. These numbers include all Scope 1 emissions from the on-site combustion of fuels and fugitive emissions from leaked refrigerants in facilities and vehicles, Scope 2 emissions from the purchase of electricity generated outside Fairfax's borders, and Scope 3 emissions from waste generated by local government operations and employee commutes. The following summaries break down these totals by sector, sources and scope.

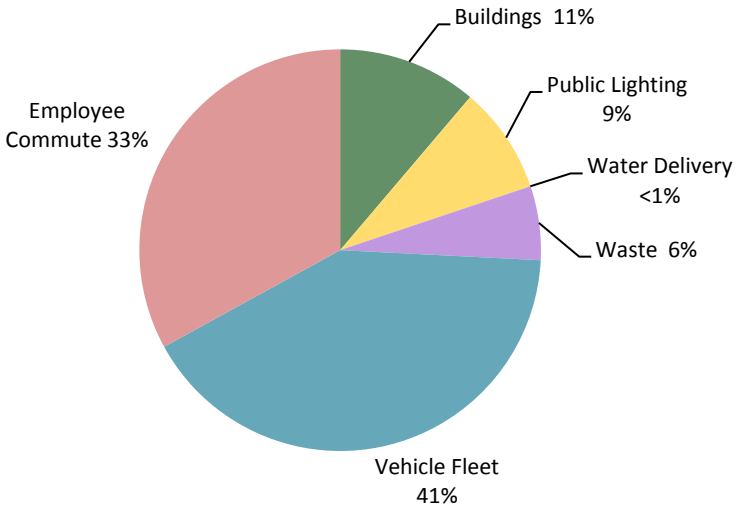
SUMMARY BY SECTOR

Emissions from government operations decreased in all sectors. As shown in Table 17, the greatest emissions reductions came from the public lighting sector, which experienced a reduction in emissions of 31 metric tons CO2e, or about 58%. Emissions were also reduced in the buildings and facilities sector (-28%), the vehicle fleet sector (-13%), the water delivery sector (-62%), the waste sector (-6%) and the employee commute sector (-24%). Figure 5 shows that the vehicle fleet sector was the largest emitter of greenhouse gas emissions in 2010 (41% of total emissions), followed by the employee commute sector (33%).

TABLE 17: GOVERNMENT OPERATIONS SUMMARY BY SECTOR, 2005 AND 2010

Sector	2005 Metric Tons CO_{2e}	2010 Metric Tons CO_2e	Change Metric Tons CO_2e	% Change
Buildings & Facilities	40.3	29.0	-11.4	-28%
Vehicle Fleet	123.2	106.6	-16.6	-13%
Public Lighting	53.6	22.3	-31.3	-58%
Water Delivery	0.09	0.03	-0.06	-62%
Waste	16.3	15.4	-0.9	-6%
Employee Commute	112.8	85.3	-27.5	-24%
Total	**346.3**	**258.6**	**-87.7**	**-25%**

FIGURE 5: GOVERNMENT OPERATIONS EMISSIONS BY SECTOR, 2010



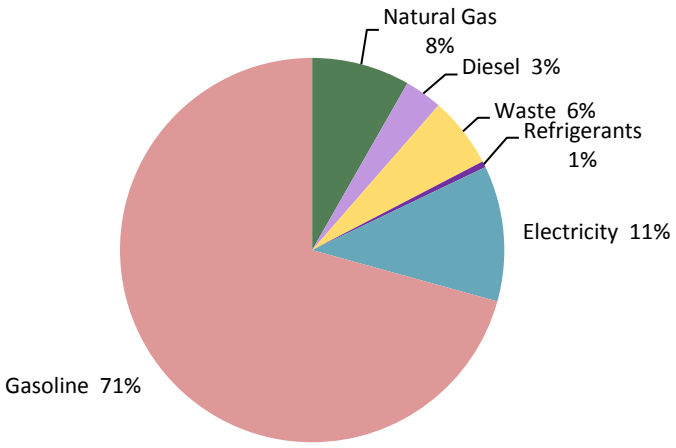
SUMMARY BY SOURCE

Table 18 shows a summary of the Town's greenhouse gas emissions by source. Emissions decreased in all sectors, with emissions from gasoline consumption decreasing the most ((43 metric tons CO_2e). Emissions from electricity also decreased significantly (42 metric tons CO_2e) due to the Town's switch to Marin Clean Energy Deep Green electricity mid-way through 2010. As shown in Figure 6, gasoline was the largest source of greenhouse gas emissions (71% of total emissions) in 2010, followed by electricity (11%).

TABLE 18: GOVERNMENT OPERATIONS SUMMARY BY SOURCE, 2005 AND 2010

Source	2005 Metric Tons CO_{2e}	2010 Metric Tons CO_2e	Change Metric Tons CO_2e	% Change
Electricity	71.2	29.5	-41.7	-59%
Natural Gas	22.4	21.4	-1.0	-5%
Gasoline	225.7	182.8	-42.8	-19%
Diesel	9.4	8.2	-1.2	-13%
Solid Waste	16.3	15.4	-0.9	-6%
Refrigerants	1.3	1.3	0.0	0%
Total	**346.3**	**258.6**	**-87.7**	**-25%**

FIGURE 6: GOVERNMENT OPERATIONS EMISSIONS BY SOURCE, 2010



SUMMARY BY SCOPE

As shown in Table 19, Scope 1 sources represented the largest share of emissions in 2005 and 2010. Scope 1 emissions, which result primarily from the combustion of gasoline and diesel in the Town's vehicle fleet and the combustion of natural gas in the Town's buildings, decreased 12%. Scope 2 emissions, which represent emissions from electricity produced outside Fairfax's borders, decreased 59%. Scope 3 emissions, comprising emissions from employee commutes and the decomposition of solid waste in landfills, decreased 22%.

TABLE 19: GOVERNMENT OPERATIONS SUMMARY BY SCOPE, 2005 AND 2010

Activity	2005 Metric Tons CO_{2e}	2010 Metric Tons CO_{2e}	% Change
Scope 1	146.0	128.4	-12%
Scope 2	71.2	29.5	-59%
Scope 3	129.1	100.7	-22%
Total	**346.3**	**258.6**	**-25%**

GOVERNMENT OPERATIONS INVENTORY DETAIL BY SECTOR

This section explores government operations and emissions by taking a detailed look at each primary sector. As listed above, the sectors included in the government operations emissions analysis are:

- Buildings and Other Facilities
- Public Lighting
- Water Delivery
- Vehicle Fleet
- Waste
- Employee Commute

Buildings and Other Facilities

Facilities operations contribute to greenhouse gas emissions in two major ways. First, facilities consume electricity and fuels such as natural gas. This consumption is associated with the majority of greenhouse gas emissions from buildings and facilities. In addition, air conditioning and refrigeration equipment in buildings can emit hydrofluorocarbons (HFCs) when these systems leak refrigerants. Refrigerants are very potent greenhouse gases, and have a Global Warming Potential (GWP) of up to many thousand times that of CO_2. For example, HFC-134a, a very common refrigerant, has a GWP of 1,300, or 1,300 times that of CO_2. Therefore, even small amounts of leaked refrigerants can have an effect on greenhouse gas emissions.

In 2010, Fairfax operated five major facilities – the Town Offices, the corporation yard, the Pavilion, the Youth Center and the Women's Club. As shown in Table 20, emissions from the buildings sector decreased by 28% between 2005 and 2010. This decline was due to reductions in both electricity and natural gas emissions. Electricity consumption increased 1% while emissions dropped 59% primarily because the Town switched to 100% renewable Deep Green electricity from the Marin Energy Authority (MEA) about midway through the year. The Town purchased approximately 55% of its electricity for buildings from MEA in 2010. The balance of the electricity mix was supplied by PG&E, which was less carbon intensive in 2010 than PG&E's electricity mix in 2005.

Natural gas consumption and emissions decreased 5%. Fugitive emissions from refrigerants used in refrigerators and air conditioners contributed a small amount of greenhouse gas emissions.

Table 20: Buildings and Other Facilities Emissions, 2005 and 2010

Source	2005 Energy Consumption	2005 GHG Emissions ($MTCO_2e$)	2010 Energy Consumption	2010 GHG Emissions ($MTCO_2e$)	% Change in Energy Consumption	% Change in GHG Emissions ($MTCO_2e$)
Electricity	78,235 kWh	17.5	78,991 kWh	7.2	1%	-59%
Natural Gas	4,215 therms	22.4	4,019 therms	21.4	-5%	-5%
Refrigerants	--	0.4	--	0.4	0%	0%
Total	**--**	**40.3**	**--**	**29.0**	**--**	**-28%**

Table 21 shows electricity and natural gas usage by facility. Electricity consumption decreased dramatically (-83%) at the Pavilion due to the installation of a solar energy system at the building. Electricity consumption increased most significantly at the Youth Center (131%) due to the purchase of a new air conditioning unit in 2007. Electricity usage also increased significantly at the Town Offices (36%). Natural gas usage declined at most facilities, but increased 4% at the Youth Center.

TABLE 21: ENERGY USAGE AT FAIRFAX BUILDINGS AND FACILITIES

Building/ Facility	Energy Source	2005 Energy Consumption	2010 Energy Consumption	% Change in Energy Consumption
Town Offices	Electricity	32,915 kWh	44,778 kWh	36%
	Natural Gas	1,966 therms	1,839 therms	-6%
Corp Yard	Electricity	12,317 kWh	13,249 kWh	8%
Pavilion	Electricity	16,321 kWh	2,729 kWh	-83%
Youth Center	Electricity	3,360 kWh	7,749 kWh	131%
	Natural Gas	1,115 therms	1,160 therms	4%
Women's Club	Electricity	4,721 kWh	4,318 kWh	-9%
	Natural Gas	1,134 therms	1,020 therms	-10%
Concession Stand & Minor Facilities	Electricity	8,601 kWh	6,168 kWh	-28%

PUBLIC LIGHTING

Fairfax operates approximately 600 streetlight as well as traffic signals and other outdoor lighting. Emissions associated with the operation of this public lighting are from electricity consumption. While electricity use for streetlights was relatively flat, electricity use in traffic signals decreased 11% and electricity use for other outdoor lighting nearly doubled. The Town purchased approximately 56% of electricity for public lighting from the Marin Energy Authority in 2010, and this electricity was 100% renewable and emissions-free. Overall, electricity consumption in the public lighting sector increased 3% between 2005 and 2010, and emissions declined 58%.

TABLE 22: PUBLIC LIGHTING EMISSIONS, 2005 AND 2010

Source	2005 Electricity Consumption (kWh)	2005 GHG Emissions ($MTCO_2e$)	2010 Electricity Consumption (kWh)	2010 GHG Emissions ($MTCO_2e$)	% Change in Electricity Consumption	% Change in GHG Emissions ($MTCO_2e$)
Streetlights	218,709	48.9	219,911	18.7	1%	-62%
Traffic Signals	13,954	3.1	12,460	1.1	-11%	-65%
Outdoor Lighting	7,105	1.6	14,082	2.5	98%	58%
Total	**239,768**	**53.6**	**246,453**	**22.3**	**3%**	**-58%**

WATER DELIVERY

This sector includes any facilities used for the management and distribution of water. Typical systems included in this sector are potable water delivery pumps, sprinkler and irrigation controls, and stormwater management. Electricity use in the water sector is responsible for a small amount of government operations emissions. Electricity consumption for the Town's irrigation systems was relatively flat, but emissions decreased by 62% as shown in Table 23. Approximately 59% of the electricity used for irrigation was purchased from MEA in 2010.

TABLE 23: WATER DELIVERY EMISSIONS, 2005 AND 2010

Source	2005 Electricity Consumption (kWh)	2005 GHG Emissions ($MTCO_2e$)	2010 Electricity Consumption (kWh)	2010 GHG Emissions ($MTCO_2e$)	% Change in Electricity Consumption	% Change in GHG Emissions ($MTCO_2e$)
Irrigation	396	0.09	398	0.03	1%	-62%

VEHICLE FLEET

The vehicles and mobile equipment used for Fairfax's daily operations include police cars and public works trucks and equipment. These vehicles and equipment burn gasoline and diesel, which result in greenhouse gas emissions. In addition, vehicles with air conditioning use refrigerants that leak from the vehicles. In 2010, Fairfax operated a fleet of 18 vehicles.

Table 24 shows that total fuel consumption and emissions from the Town's vehicle fleet decreased 13% between 2005 and 2010. Fuel consumption increased in all departments.

TABLE 24: VEHICLE FLEET EMISSIONS, 2005 AND 2010

Source	2005 Fuel Consumption (gallons)	2005 GHG Emissions ($MTCO_2e$)	2010 Fuel Consumption (gallons)	2010 GHG Emissions ($MTCO_2e$)	% Change in Fuel Consumption	% Change in GHG Emissions ($MTCO_2e$)
Police	5,780	52.0	4,970	44.6	-14%	-14%
Public Works	6,401	58.7	5,620	51.4	-12%	-12%
Building	1,284	11.6	1,071	9.7	-17%	-17%
Refrigerants, all departments	--	0.9	--	0.9	--	0%
Total	**13,465**	**123.2**	**11,661**	**106.6**	**-13%**	**-13%**

WASTE

Waste generated by government buildings and operations include organic material such as paper, food scraps, plant debris, textiles, and construction waste. This organic material generates methane as it decays in the anaerobic environment of a landfill. An estimated 75 percent of this methane is routinely captured via landfill gas collection systems; however, a portion escapes into the atmosphere, contributing to the greenhouse effect. Emissions from waste are an estimate of methane generation that will result from the decomposition of all organic waste sent to the landfill in the inventoried year, even though those emissions will occur over the 100+ year timeframe that the waste will decompose.

As shown in Table 25, waste generated by governmental operations and deposited into the landfill decreased 6% between 2005 and 2010, resulting in an emissions decrease of the same percentage.

TABLE 25: WASTE EMISSIONS, 2005 AND 2010

Source	2005 Landfilled Waste (tons)	2005 GHG Emissions ($MTCO_2e$)	2010 Landfilled Waste (tons)	2010 GHG Emissions ($MTCO_2e$)	% Change in Landfilled Waste	% Change in GHG Emissions ($MTCO_2e$)
Town Hall	1.5	0.3	1.2	0.3	-16%	-16%
Corp Yard	75.5	15.3	71.8	14.5	-5%	-5%
Street Cans	3.7	0.7	3.1	0.6	-16%	-16%
Total	**80.6**	**16.3**	**76.1**	**15.4**	**-6%**	**-6%**

EMPLOYEE COMMUTE

Emissions in the employee commute sector are due to the combustion of fuels used by Town employees commuting to and from work in Fairfax. Table 26 shows that vehicle miles traveled decreased 2% between 2005 and 2010, and emissions decreased 24%. Table 27 shows that the amount of greenhouse gas emissions generated by commuting decreased 22% per employee. This may be due to a higher use of alternative transportation and better fuel efficiencies in the cars driven by Fairfax employees. However, it is difficult to draw definitive conclusions from the data, as emissions are determined from employee commute surveys, and changes from year to year may be due to differences in sampling.

TABLE 26: EMPLOYEE COMMUTE EMISSIONS, 2005 AND 2010

Source	2005 Vehicle Miles Traveled	2005 GHG Emissions ($MTCO_2e$)	2010 Vehicle Miles Traveled	2010 GHG Emissions ($MTCO_2e$)	% Change in Vehicle Miles Traveled	% Change in GHG Emissions
Employee Commute	197,805	112.8	184,115	85.3	-7%	-24%

TABLE 27: COMMUTE EMISSIONS PER EMPLOYEE, 2005 AND 2010

	2005	2010	% Change
Employees	30.75 FTE	30	-2%
Commute GHG Emissions (metric tons CO_2e)	112.8	85.3	-24%
Per Employee GHG Emissions (metric tons CO_2e)	3.7	2.8	-22%

CONCLUSION

Fairfax has achieved some early success in reducing greenhouse gas emissions between 2005 and 2010. Community emissions decreased 4.6% over these five years, putting the town on track to reduce emissions by approximately 13% below the 2005 baseline year if the community continues to reduce emissions at the current rate. Emissions decreased in all sectors.

Some of the largest decreases occurred in the transportation sector. Further reductions in transportation emissions can be expected as state mandates to increase vehicle fuel efficiency and reduce the carbon intensity of transportation fuels take hold. Locally, the Town can continue to implement programs and provide infrastructure to increase travel by bicycle, foot, and alternative means of transportation. Electric vehicles also offer much promise to reduce emissions significantly in the community, especially since the electricity provided by local utilities is significantly lower in carbon intensity than most other electricity producers in the rest of the country.

The waste sector also experienced significant decreases in emissions. Programs to divert food waste from the landfill, recycle more construction and demolition debris, and achieve zero waste goals in Marin County will continue to reduce waste sector emissions.

Emissions reductions in the residential sector, while small on a percentage basis, had a significant effect on the bottom line. Fairfax will most likely experience additional reductions from electricity emissions as PG&E and the Marin Energy Authority add more renewable sources to their energy portfolios. Since the Marin Energy Authority began supplying electricity to some of its customers midway through 2010, emissions reductions attributed to the switch to MEA's greener electricity were not fully realized in that year. Therefore, Fairfax can expect to see additional reductions in electricity emissions in subsequent years. An increase in the number of customers who sign up for 100% renewable electricity from MEA could further reduce Fairfax's community emissions.

Despite the potential for greener electricity, residents and businesses need to do their part to reduce energy demand in homes and commercial buildings. Natural gas consumption increased in 2010, and emissions rose lockstep with consumption. In order to reduce emissions from natural gas consumption, consumers can reduce demand by better insulating and sealing buildings, turning down the thermostat, and installing solar-powered water heaters and more energy-efficient furnaces.

Within government operations, emissions decreased 25%. Reductions occurred in the buildings, vehicle fleet, public lighting, water delivery, waste and employee commute sectors. The Town's continued use of Marin Clean Energy Deep Green electricity for all facilities will decrease emissions even further, by an estimated 29.5 metric tons CO_2e. The Town could reduce future energy use and emissions by completing energy efficient upgrades to its buildings and equipment, upgrading streetlights to more energy-efficient technologies, and purchasing more fuel-efficient vehicles. Staff should always be aware of the impact their decisions have on the environment.

Fairfax has made a good start. If the community's emissions are to continue to decline, then residents, businesses, and other organizations must conserve energy, use alternative transportation, and support more clean energy from utility providers. Fairfax can serve as a model to others in curbing greenhouse gas emissions affecting the entire world.

APPENDIX A: COMMUNITY INVENTORY

RESIDENTIAL AND COMMERCIAL SECTOR NOTES

2005 DATA SUMMARY

Sector	Scope	Fuel	Quantity	Units	Greenhouse Gas Emissions (metric tons)			
					CO_2	N_2O	CH_4	CO_2e
Residential	2	Electricity	18,314,689	kWh	4,063.65	0.09	0.25	4,097.21
	1	Natural Gas	1,800,870	therms	9,548.21	0.02	0.90	9,572.70
		TOTAL			13,611.86	0.11	1.15	13,669.92
Commercial	2	Electricity	5,281,602	kWh	1,171.88	0.03	0.07	1,181.56
	1	Natural Gas	256,827	therms	1,361.70	0.00	0.13	1,365.19
	2	Direct Access Electricity	788,900	kWh	339.33	0.00	0.01	340.78
		TOTAL			2,872.91	0.03	0.21	2,887.52

2010 DATA SUMMARY

Sector	Scope	Fuel	Quantity	Units	Greenhouse Gas Emissions (metric tons)			
					CO_2	N_2O	CH_4	CO_2e
Residential	2	PG&E Electricity	17,561,168	kWh	3,544.70	0.08	0.23	3,574.24
	1	Natural Gas	1,833,949	therms	9,723.60	0.02	0.92	9,748.54
	2	MEA Electricity	973,803	kWh	143.05	0.00	0.01	144.69
	2	Direct Access Electricity	13,459	kWh	4.02	0.00	0.00	4.04
		TOTAL			13,415.37	0.10	1.16	13,471.51
Commercial	2	PG&E Electricity	5,430,420	kWh	1,096.12	0.02	0.07	1,105.26
	1	Natural Gas	276,235	therms	1,464.60	0.00	0.14	1,468.35
	2	MEA Electricity	558,692	kWh	82.07	0.00	0.01	83.01
	2	Direct Access Electricity	379,345	kWh	113.34	0.00	0.00	113.77
		TOTAL			2,756.13	0.03	0.22	2,770.40

2005 Emission Factors

Emission Source	GHG	Emission Factor	Emission Factor Source
PG&E Electricity	CO_2	0.48916 lbs/kWh	Local Government Operations Protocol, Version 1.1, May 2010, Table G.6, Utility Specific Verified Electricity CO2 Emission Factors
	CH_4	0.000030 lbs/kWh	Local Government Operations Protocol, Version 1.1, May 2010, G.7 California Grid Average Electricity Emission Factors
	N_20	0.000011 lbs/kWh	
Default Direct Access Electricity	CO_2	0.94828 lbs/kWh	Local Government Operations Protocol, Version 1.1, May 2010, G.7 California Grid Average Electricity Emission Factors
	CH_4	0.000030 lbs/kWh	
	N_20	0.000011 lbs/kWh	
Natural Gas	CO_2	53.02 kg/MMBtu	Local Government Operations Protocol, Version 1.1, May 2010, Table G.1 U.S. Default Factors for Calculating Carbon Dioxide Emission from Fossil Fuel Combustion
	CH_4	0.005 kg/MMBtu	Local Government Operations Protocol, Version 1.1, May 2010, Table G.3 Default Methane and Nitrous Oxide Emission Factors by Fuel type and Sector
	N_20	0.0001 kg/MMBtu	

2010 Emission Factors

Emission Source	GHG	Emission Factor	Emission Factor Source
PG&E Electricity	CO_2	0.445 lbs/kWh	PG&E, http://www.pgecurrents.com/2012/03/26/pge-reports-lowest-greenhouse-gas-emissions/
	CH_4	0.000029 lbs/kWh	Local Government Operations Protocol, Version 1.1, May 2010, G.7 California Grid Average Electricity Emission Factors (2007 factors used)
	N_20	0.000010 lbs/kWh	
Default Direct Access Electricity	CO_2	0.65868 lbs/kWh	eGrid2012 Version 1.0 Year 2009Summary Tables http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2012V1_0_year09_SummaryTables.pdf
	CH_4	0.00002894 lbs/kWh	
	N_20	0.00000617 lbs/kWh	
Marin Energy Authority	CO_2	0.323859 lbs/kWh	Marin Energy Authority, Light Green and Deep Green combined. Emission factor is not certified.
	CH_4	0.000029 lbs/kWh	Local Government Operations Protocol, Version 1.1, May 2010, G.7 California Grid Average Electricity Emission Factors (2007 factors used)
	N_20	0.000010 lbs/kWh	
Natural Gas	CO_2	53.02 kg/MMBtu	Local Government Operations Protocol, Version 1.1, May 2010, Table G.1 U.S. Default Factors for Calculating Carbon Dioxide Emission from Fossil Fuel Combustion
	CH_4	0.005 kg/MMBtu	Local Government Operations Protocol, Version 1.1, May 2010, Table G.3 Default Methane and Nitrous Oxide Emission Factors by Fuel type and Sector
	N_20	0.0001 kg/MMBtu	

Data Sources

PG&E Electricity and Natural Gas Data: John Joseph, JGJ3@pge.com, Mathew Sturm, MwSs@pge.com.
Direct Access Electricity: California Energy Commission (CEC): Steven Mac, Smac@energy.state.ca.us
Marin Energy Authority: Justin Kudo, jkudo@marinenergy.com.

Additional Notes

Estimates of electricity purchased through Direct Access (DA) contracts are derived from county level DA consumption figures, provided by the California Energy Commission.

2005 emissions were recalculated using updated activity data from the 2005 Greenhouse Gas Emissions Inventory and 2005 emission factors from the LGO Protocol. Activity data for residential natural gas consumption was revised according to updated data provided by PG&E. Activity data for direct access electricity was revised due to a change in the methodology to allocate direct access among jurisdictions.

Transportation Sector Notes

2005 Data Summary

Sector	Scope	Subsector	Quantity	Units	Greenhouse Gas Emissions (metric tons)			
					CO_2	N_2O	CH_4	CO_2e
Transportation	1	Local Roads	34,401,250	VMT	16,059.23	2.38	2.18	16,841.96
	1	State Highways	0	VMT	0.00	0.00	0.00	0.00
		TOTAL	34,401,250	VMT	16,059.23	2.38	2.18	16,841.96

2005 Emission Factors: Provided by the BAAQMD, using EMFAC 2007

County	CO_2 Rates (grams/mile)		CH_4 Rates (grams/mile)		N_2O Rates (grams/mile)		VMT Mix		CO_2 Rates- (grams/gallon)		Fuel Usage		Fuel Efficiency (miles/gallon)	
	Gas	Diesel	Gas	Diesel	Gas	Diesel	Gas	Diesel	Gas	Diesel	Gas	Diesel	Gas	Diesel
Marin County	476	1,426	0.065	0.030	0.070	0.050	95.5%	4.5%	8,628	9,957	89.2%	10.8%	18.1	7.0
BAAQMD Average	463	1,389	0.063	0.030	0.070	0.050	94.9%	5.1%	8,607	10,091	87.8%	12.2%	18.6	7.3

2010 Data Summary

Sector	Scope	Subsector	Quantity	Units	Greenhouse Gas Emissions (metric tons)			
					CO_2	N_2O	CH_4	CO_2e
Transportation	1	Local Roads	34,313,650	VMT	15,464.23	2.37	1.52	16,232.10
	1	State Highways	0	VMT	0.00	0.00	0.00	0.00
		TOTAL	34,313,650	VMT	15,464.23	2.37	1.52	16,232.10

2010 Emission Factors: Provided by the BAAQMD, using EMFAC 2007

County	CO_2 Rates (grams/mile)		CH_4 Rates (grams/mile)		N_2O Rates (grams/mile)		VMT Mix		CO_2 Rates- (grams/gallon)		Fuel Usage		Fuel Efficiency (miles/gallon)	
	Gas	Diesel	Gas	Diesel	Gas	Diesel	Gas	Diesel	Gas	Diesel	Gas	Diesel	Gas	Diesel
Marin County	471	1,500	0.045	0.030	0.070	0.050	95.9%	4.1%	8,732	9,673	89.0%	11.0%	18.5	6.4
BAAQMD Average	461	1,469	0.042	0.027	0.070	0.050	95.3%	4.7%	8,695	10,086	88.1%	11.9%	18.9	6.9

Data Sources

Local Roads Vehicle Miles Traveled (VMT) Data: 2005 Public Roads Data, Highway Performance Monitoring System (HPMS) division of the California Department of Transportation (Caltrans), http://www.dot.ca.gov/hq/tsip/hpms/hpmslibrary/hpmspdf/2005PRD.pdf; 2010 Public Roads Data, HPMS division of Caltrans, http://www.dot.ca.gov/hq/tsip/hpms/hpmslibrary/hpmspdf/2010PRD.pdf.

EMFAC Data: Amir Fanai, Principal Air Quality Engineer, Bay Area Air Quality Management District, AFanai@baaqmd.gov.

Additional Notes

Local Road and State Highway VMT data provided by MTC is in Daily VMT (DVMT); Annual VMT = DVMT x 365. Fleet mix data (on-road fleet breakdown by vehicle type, fuel efficiency, and fuel type) was used to extrapolate VMT into actual gallons of gasoline and diesel consumed on Marin roads and state highways.

2005 data was recalculated using emission factors and fuel usage estimates provided by the Bay Area Air Quality Management District.

Off-Road Vehicles and Equipment Sector Notes

2005 Data Summary

Sector	Scope	Subsector	Quantity	Units	Fuel	Greenhouse Gas Emissions (metric tons)			
						CO_2	N_2O	CH_4	CO_2e
Off-Road	1	Construction and Mining Equipment	26,394	gallons	diesel	269.48	0.00	0.00	269.48
	1		3,358	gallons	gasoline	29.48	0.00	0.00	29.48
	1	Lawn and Garden Equipment	6,901	gallons	diesel	70.46	0.00	0.00	70.46
	1		27,450	gallons	gasoline	241.01	0.00	0.00	241.01
		TOTAL	64,103	gallons		610.44	0.00	0.00	610.44

2010 Data Summary

Sector	Scope	Subsector	Quantity	Units	Fuel	Greenhouse Gas Emissions (metric tons)			
						CO_2	N_2O	CH_4	CO_2e
Off-Road	1	Construction and Mining Equipment	17,182	gallons	diesel	175.43	0.00	0.00	175.43
	1		3,369	gallons	gasoline	29.58	0.00	0.00	29.58
	1	Lawn and Garden Equipment	7,211	gallons	diesel	73.62	0.00	0.00	73.62
	1		27,370	gallons	gasoline	240.31	0.00	0.00	240.31
		TOTAL	55,132	gallons		518.94	0.00	0.00	518.94

Fuel usage data provided by Steve Zelinka, Manager, Emission Inventory Development Section, California Air Resources Board, szelinka@arb.ca.gov. Fuel usage was provided at the county level and allocated to individual cities according to population. Emission factors for gasoline and diesel consumption from the 2010 Local Government Operations Protocol, Table G.11.

Water Sector Notes

2005 Data Summary

Sector	Scope	Fuel	Quantity	Units	Greenhouse Gas Emissions (metric tons)			
					CO_2	N_2O	CH_4	CO_2e
Water	3	PG&E Electricity	862,794	kWh	191.44	0.00	0.01	193.02
		TOTAL	862,794	kWh	191.44	0.00	0.01	193.02

2010 Data Summary

Sector	Scope	Fuel	Quantity	Units	Greenhouse Gas Emissions (metric tons)			
					CO_2	N_2O	CH_4	CO_2e
Water	3	PG&E Electricity	352,276	kWh	71.11	0.00	0.00	71.70
	3	MEA Electricity	419,819	kWh	61.67	0.00	0.01	62.38
		TOTAL	772,095	kWh	132.78	0.00	0.01	134.08

Data Sources

Marin Municipal Water District (MMWD) electricity usage provided by Jon LaHaye, MMWD Principal Engineer, jlahaye@marinwater.org and Jamie Tuckey, Marin Energy Authority Communications Director, jtuckey@marinenergyauthority.org. Electricity usage was provided for the service area population and allocated to individual cities on a per capita basis.

Wastewater Sector Notes

2005 Data Summary

Sector	Scope	Fuel	Quantity	Units	Greenhouse Gas Emissions (metric tons)			
					CO_2	N_2O	CH_4	CO_2e
Wastewater	3	PG&E Electricity	469,275	kWh	104.12	0.00	0.01	104.98
	3	Treatment	7,237	people	0.00	0.59	0.40	190.18
		TOTAL			104.12	0.59	0.40	295.17

2010 Data Summary

Sector	Scope	Fuel	Quantity	Units	Greenhouse Gas Emissions (metric tons)			
					CO_2	N_2O	CH_4	CO_2e
Wastewater	3	PG&E Electricity	416,961	kWh	84.16	0.00	0.01	84.86
	3	Treatment	7,441	people	0.00	0.60	0.41	195.53
		TOTAL			84.16	0.60	0.41	280.40

Data Sources

Electricity usage estimates: “Refining Estimates of Water-Related Energy Use in California,” California Energy Commissions, December 2006.

Wastewater production estimates: Nancy Gibbs, Marin Municipal Water District Business Systems Analyst, ngibbs@marinwater.org and Dan Carney, Marin Municipal Water District Water Conservation Manager, dcarney@marinwater.org.

Wastewater treatment data provided by Robert Cole, Environmental Services Manager, Central Marin Sanitation Agency, rcole@cmsa.us, 415-459-1455 ext 142.
2005 population estimate from CA Dept. of Finance E-4 Population Estimates for Cities, Counties and State 2001-2010 with 2000 and 2010 Census Counts. 2005 population estimate is mid-point between 1/1/2005 and 1/1/2006 estimates. 2010 population from 2010 U.S. Census.

Additional Notes

Electricity usage calculated according to BAAQMD recommended methodology. 67% of per capita water use assumed to be indoor water use and processed as wastewater. Electricity used to treat wastewater based on northern California averages.

Treatment process emissions calculated according to ICLEI methodology for process N2O emissions from a centralized wastewater treatment plant and stationary CH4 emissions from an anaerobic digester.

Waste Sector Notes

2005 Data Summary

Sector	Scope	Subsector	Quantity	Units	Greenhouse Gas Emissions (metric tons)			
					CO_2	N_2O	CH_4	CO_2e
Waste	3	Landfilled Municipal Solid Waste	6,953	tons	0.00	0.00	66.93	1,405.46
	3	Alternative Daily Cover	1,549	tons	0.00	0.00	12.49	262.38
		TOTAL	8,502	tons	0.00	0.00	79.42	1,667.84

2010 Data Summary

Sector	Scope	Subsector	Quantity	Units	Greenhouse Gas Emissions (metric tons)			
					CO_2	N_2O	CH_4	CO_2e
Waste	3	Landfilled Municipal Solid Waste	5,311	tons	0.00	0.00	51.12	1,073.55
	3	Alternative Daily Cover	559	tons	0.00	0.00	1.67	35.03
		TOTAL	5,870	tons	0.00	0.00	52.79	1,108.58

Emission Factors

Waste Type	Methane Emissions (metric tons / short ton of waste)	Emission Factor Source
Paper Products	1.940	US EPA
Food Waste	1.098	US EPA
Plant Debris	0.622	US EPA
Wood / Textiles	0.549	US EPA
All Other Waste	0.000	US EPA

Data Sources

Municipal solid waste and ADC tonnage data: CalRecycle Disposal Reporting System http://www.calrecycle.ca.gov/LGCentral/Reports/DRS/Destination/JurDspFa.aspx and Alex Soulard, Waste Management Specialist, ASoulard@marincounty.org, County of Marin Public Works Department - Waste Management.

Landfilled waste characterization: Final Draft Zero Waste Feasibility Study, Marin County Hazardous and Solid Waste Management JPA, R3 Consulting Group, December 2009, http://www.marinrecycles.org/Docs/Final_Draft_Zero_Waste_Feasibility_Study_121609.pdf.

ADC waste characterization: CalRecycle, "Alternative Daily cover (ADC) by Jurisdiction of Origin and Material Type," http://www.calrecycle.ca.gov/LGCentral/Reports/Viewer.aspx?P=ReportName%3dEdrsJurisAndMaterials%26CountyID%3d21%26ReportYear%3d2005 and http://www.calrecycle.ca.gov/LGCentral/Reports/Viewer.aspx?P=ReportName%3dEdrsJurisAndMaterials%26CountyID%3d21%26ReportYear%3d2010.

Landfilled Waste Characterization, 2005 and 2010

Waste Type	% of Total
Paper Products	23.50
Food Waste	22.85
Plant Debris	7.98
Wood / Textiles	9.57
All Other Waste	36.12

Alternative Daily Cover Waste Characterization, 2005

Waste Type	% of Total
Paper Products	0.00
Food Waste	11.63
Plant Debris	88.37
Wood / Textiles	0.00
All Other Waste	0.00

Alternative Daily Cover Waste Characterization, 2010

Waste Type	% of Total
Paper Products	0.00
Food Waste	16.65
Plant Debris	10.90
Wood / Textiles	0.00
All Other Waste	72.46

Additional Notes

The methane emission factors used in ICLEI's CACP Software were derived from the EPA WARM model. For quantification of emissions, only methane generation (or gross emissions) is taken into account. These emissions are estimated to take place over an extensive (up to 100 year) cycle, as anaerobically degradable organic carbon decomposes in a landfill. More information on the WARM Model is available at: http://epa.gov/climatechange/wycd/waste/calculators/Warm_home.html.

2005 solid waste tonnage and emissions were recalculated using municipal solid waste and ADC tonnage data (including sludge ADC) provided by County of Marin Public Works Department Waste Management Division, updated waste characterization from the Final Draft Zero Waste Feasibility Study, Marin County Hazardous and Solid Waste Management JPA, R3 Consulting Group, December 2009, and updated ADC waste characterization from CalRecycle 2005 report , "Alternative Daily Cover (ADC) by Jurisdiction of Origin and Material Type" for Marin County.

APPENDIX B: GOVERNMENT OPERATIONS INVENTORY

BUILDINGS AND OTHER FACILITIES SECTOR NOTES

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2005

Scope	Emission Type	Energy Consumption	Greenhouse Gas Emissions (metric tons)				
			CO_2	N_2O	CH_4	HFCs	CO_2e
Scope 1	Stationary Combustion	4,215 therms	22.35	0.00	0.00	0.00	22.41
	Fugitive Emissions	--	0.00	0.00	0.00	0.00	0.44
	TOTAL		22.62	0.00	0.00	0.00	22.85
Scope 2	Purchased Electricity PG&E	78,235 kWh	17.36	0.00	0.00	0.00	17.50
	TOTAL		17.36	0.00	0.00	0.00	17.50

LGO PROTOCOL – EMISSIONS BY SCOPE AND EMISSION TYPE, 2010

Scope	Emission Type	Energy Consumption	Greenhouse Gas Emissions (metric tons)				
			CO_2	N_2O	CH_4	HFCs	CO_2e
Scope 1	Stationary Combustion	4,019 therms	21.31	0.00	0.00	0.00	21.36
	Fugitive Emissions	--	0.00	0.00	0.00	0.00	0.44
	TOTAL		21.31	0.00	0.00	0.00	21.81
Scope 2	Purchased Electricity PG&E	35,302 kWh	7.13	0.00	0.00	0.00	7.19
	Purchased Electricity MEA	43,689 kWh	0.00	0.00	0.00	0.00	0.00
	TOTAL	78,991 kWh	7.13	0.00	0.00	0.00	7.19

2005 emissions were recalculated using activity data from the 2005 Fairfax Greenhouse Gas Emissions Inventory and 2005 emission factors from the LGO Protocol. Since refrigerants were not inventoried in 2005, refrigerant data from 2010 was used as a proxy.

2010 energy usage was provided by Pacific Gas & Electric Company (PG&E) based on energy usage of PG&E service accounts. MEA electricity usage data provided by Jamie Tuckey, Marin Energy Authority Communications Director, jtuckey@marinenergyauthority.org. Energy usage data included electricity in units of kilowatt hours (kWh) and natural gas in thermal units (therms). LGO Protocol recommended methods were followed in collection and analysis of this activity data. See Appendix A for emission factors.

LGO Protocol alternate methods were followed in collection and analysis of refrigerant activity data.

Public Lighting Sector Notes

LGO Protocol – Emissions by Scope and Emission Type, 2005

Scope	Emission Type	Energy Consumption	Greenhouse Gas Emissions (metric tons)				
			CO_2	N_2O	CH_4	HFCs	CO_2e
Scope 2	Purchased Electricity PG&E	239,768 kWh	53.20	0.00	0.00	0.00	53.64
	TOTAL	239,768 kWh	53.20	0.00	0.00	0.00	53.64

LGO Protocol – Emissions by Scope and Emission Type, 2010

Scope	Emission Type	Energy Consumption	Greenhouse Gas Emissions (metric tons)				
			CO_2	N_2O	CH_4	HFCs	CO_2e
Scope 2	Purchased Electricity PG&E	109,596 kWh	22.12	0.00	0.00	0.00	22.31
	Purchased Electricity MEA	136,857 kWh	0.00	0.00	0.00	0.00	0.00
	TOTAL	246,453 kWh	22.12	0.00	0.00	0.00	22.31

2005 emissions were recalculated using activity data from the Fairfax 2005 Greenhouse Gas Emissions Inventory and 2005 emission factors from the LGO Protocol.

2010 energy usage was provided by Pacific Gas & Electric Company (PG&E) based on energy usage of PG&E service accounts. MEA electricity usage data provided by Jamie Tuckey, Marin Energy Authority Communications Director, jtuckey@marinenergyauthority.org. Energy usage data included electricity in units of kilowatt hours (kWh). LGO Protocol recommended methods were followed in collection and analysis of this activity data. See Appendix A for emission factors.

Water Delivery Sector Notes

LGO Protocol – Emissions by Scope and Emission Type, 2005

Scope	Emission Type	Energy Consumption	Greenhouse Gas Emissions (metric tons)				
			CO_2	N_2O	CH_4	HFCs	CO_2e
Scope 2	Purchased Electricity PG&E	396 kWh	0.09	0.00	0.00	0.00	0.09
	TOTAL	396 kWh	0.09	0.00	0.00	0.00	0.09

LGO Protocol – Emissions by Scope and Emission Type, 2010

Scope	Emission Type	Energy Consumption	Greenhouse Gas Emissions (metric tons)				
			CO_2	N_2O	CH_4	HFCs	CO_2e
Scope 2	Purchased Electricity PG&E	165 kWh	0.03	0.00	0.00	0.00	0.03
	Purchased Electricity MEA	233 kWh	0.00	0.00	0.00	0.00	0.00
	TOTAL	398 kWh	0.03	0.00	0.00	0.00	0.03

2005 emissions were recalculated using activity data from the Fairfax 2005 Greenhouse Gas Emissions Inventory and 2005 emission factors from the LGO Protocol.

2010 energy usage was provided by Pacific Gas & Electric Company (PG&E) based on energy usage of PG&E service accounts. MEA electricity usage data provided by Jamie Tuckey, Marin Energy Authority Communications Director, jtuckey@marinenergyauthority.org. Energy usage data included electricity in units of kilowatt hours (kWh). LGO Protocol recommended methods were followed in collection and analysis of this activity data. See Appendix A for emission factors.

Vehicle Fleet Sector Notes

LGO Protocol – Emissions by Scope and Emission Type, 2005

Scope	Emission Type	Fuel	Consumption	Greenhouse Gas Emissions (metric tons)				
				CO_2	N_2O	CH_4	HFCs	CO_2e
Scope 1	Mobile Combustion	Gasoline	12,545 gallons	110.15	0.01	0.01	0.00	112.89
	Mobile Combustion	Diesel	920 gallons	9.39	0.00	0.00	0.00	9.40
	Fugitive Emissions	R-134a		0.00	0.00	0.00	0.00	0.88
	TOTAL		13,465 gallons	119.54	0.01	0.01	0.00	123.17

LGO Protocol – Emissions by Scope and Emission Type, 2010

Scope	Emission Type	Fuel	Consumption	Greenhouse Gas Emissions (metric tons)				
				CO_2	N_2O	CH_4	HFCs	CO_2e
Scope 1	Mobile Combustion	Gasoline	10,861 gallons	95.36	0.01	0.01	0.00	97.53
	Mobile Combustion	Diesel	800 gallons	8.17	0.00	0.00	0.00	8.18
	Fugitive Emissions	R-134a		0.00	0.00	0.00	0.00	0.88
	TOTAL		11,661 gallons	103.53	0.01	0.01	0.00	106.58

2005 emissions were recalculated using revised data provided by Fairfax staff. Vehicle fleet data was provided by Fairfax staff. LGO Protocol methods were followed in collection and analysis of vehicle fuel consumption. Vehicle miles traveled (VMT) were estimated and emissions were calculated using ICLEI's CACP 2009 software, Version 3.0.

Refrigerant capacities for vehicles were estimated using sources provided by ICLEI. LGO Protocol alternate methods were followed in collection and analysis of refrigerant activity data.

Waste Sector Notes

LGO Protocol – Emissions by Scope and Emission Type, 2005

Scope	Emission Type	Weight	Greenhouse Gas Emissions (metric tons)				
			CO_2	N_2O	CH_4	HFCs	CO_2e
Scope 3	Landfilled Waste	80.6 tons	0.00	0.00	0.78	0.00	16.31
	TOTAL	80.6 tons	0.00	0.00	0.78	0.00	16.31

LGO Protocol – Emissions by Scope and Emission Type, 2010

Scope	Emission Type	Weight	Greenhouse Gas Emissions (metric tons)				
			CO_2	N_2O	CH_4	HFCs	CO_2e
Scope 3	Landfilled Waste	76.14 tons	0.00	0.00	0.73	0.00	14.51
	TOTAL	76.14 tons	0.00	0.00	0.85	0.00	15.39

2005 solid waste emissions were recalculated using activity data from the Fairfax 2005 Greenhouse Gas Inventory and updated waste characterization from the Final Draft Zero Waste Feasibility Study, Marin County Hazardous and Solid Waste Management JPA, R3 Consulting Group, December 2009, http://www.marinrecycles.org/Docs/Final_Draft_Zero_Waste_Feasibility_Study_121609.pdf

2010 solid waste collection data for quantity of containers, container size, pick-ups per week was provided by Neil Roscoe at Marin Sanitary District. Containers were assumed to be 100% filled at 75 lbs. cubic yard. Landfilled waste characterization: Final Draft Zero Waste Feasibility Study, Marin County Hazardous and Solid Waste Management JPA, R3 Consulting Group, December 2009, http://www.marinrecycles.org/Docs/Final_Draft_Zero_Waste_Feasibility_Study_121609.pdf.
See Appendix A for emission factors.

Employee Commute Sector Notes

LGO Protocol – Emissions by Scope and Emission Type, 2005

Scope	Emission Type	Number Employees	Vehicle Miles Traveled	Greenhouse Gas Emissions (metric tons)				
				CO_2	N_2O	CH_4	HFCs	CO_2e
Scope 3	Mobile Combustion	30.75 FTE	197,805	111.17	0.00	0.00	0.00	112.79
	TOTAL	30.75 FTE	197,805	111.17	0.00	0.00	0.00	112.79

LGO Protocol – Emissions by Scope and Emission Type, 2010

Scope	Emission Type	Number Employees	Vehicle Miles Traveled	Greenhouse Gas Emissions (metric tons)				
				CO_2	N_2O	CH_4	HFCs	CO_2e
Scope 3	Mobile Combustion	30	194,235	88.98	0.01	0.01	0.00	91.50
	TOTAL	30	194,235	88.98	0.01	0.01	0.00	91.50

2005 emissions were recalculated using activity data from the Fairfax 2005 Greenhouse Gas Emissions Inventory and emission factors from the LGO Protocol.

For the 2010 inventory, the Town distributed commute surveys to its employees regarding travel mode, vehicle type and model year, fuel type, time of travel to work, and miles traveled to work. Information provided by respondents was used to determine fuel efficiency at www.fueleconomy.gov and estimate gallons of fuel consumed. Weekly data were converted into annual VMT data assuming 10 vacation days, 10 sick days and 10 holidays for full-time employees. Thirty employees responded to the survey, a response rate of 100%.