Town of Tiburon

2010 Greenhouse Gas Emissions Inventory

December 2012

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 May 2009, Tiburon completed a Greenhouse Gas Inventory report for the baseline year of 2005. In April 2011, the Tiburon Town Council approved a Climate Action Plan that lays out a path to achieve greenhouse gas reductions in local government operations and throughout the community. The Tiburon Climate Action Plan utilizes a greenhouse gas reduction target of 15% below 2005 levels by the year 2020, a target that is comparable to the state goal. 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 Tiburon reduced community greenhouse gas emissions 5.6% between 2005 and 2010, from 51,928 metric tons in 2005 to 49,045 metric tons in 2010 – a reduction of 2,883 metric tons CO2e. Reductions occurred in all sectors. On a percentage basis, the greatest declines occurred in the waste (-46%), water (-31%) and off-road (-13%) sectors. In absolute terms, the greatest reductions were made in the waste (1,124 metric tons CO2e), transportation (929 metric tons CO2e), and commercial (374 metric tons CO2e) sectors.

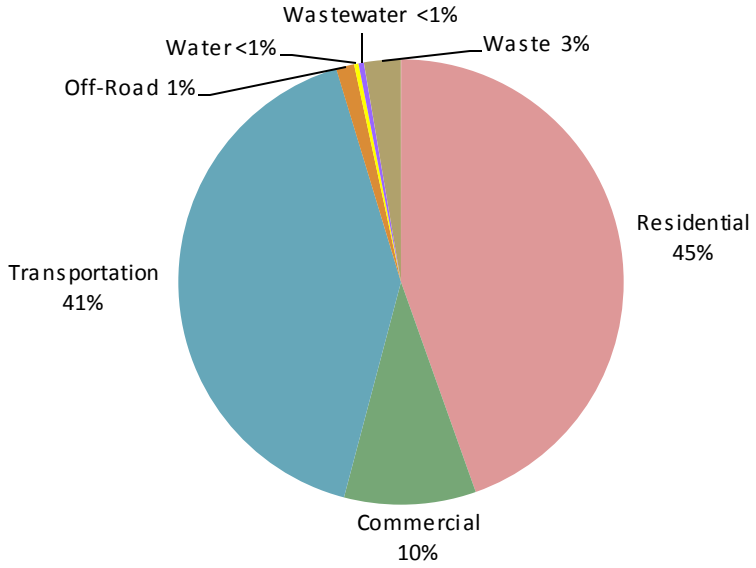
TABLE A: EMISSIONS BY SECTOR, 2005 AND 2010

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	22,191	43%	21,903	45%	-288	-1.3%
Commercial	5,059	10%	4,685	10%	-374	-7.4%
Transportation	21,092	41%	20,163	41%	-929	-4.4%
Off-Road	730	1%	636	1%	-94	-12.9%
Water	232	<1%	161	<1%	-71	-30.6%
Wastewater	189	<1%	188	<1%	-1	-0.5%
Waste	2,434	5%	1,310	3%	-1,124	-46.2%
Total	**51,928**	**100%**	**49,045**	**100%**	**-2,883**	**-5.6%**

The great strides that were made in the waste sector were primarily due to a 44% reduction in waste going to the landfill. In the transportation sector, vehicle miles traveled on local roads and Route 131 are estimated to have declined by 1.5%, and emissions dropped by 4.4% due, in part, to improvements in fuel efficiency. 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. Reductions in the off-road sector were due to a 30% 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 14.

As shown in Figure A, emissions from the residential sector are responsible for the greatest percentage of greenhouse gas emissions (45%), followed by emissions from the transportation sector (41%) and the commercial sector (10%). The waste sector contributes approximately 3% of emissions, while the off-road, water, and wastewater sectors are each responsible for 1% or less of total community emissions.

FIGURE A: EMISSIONS BY SECTOR, 2010



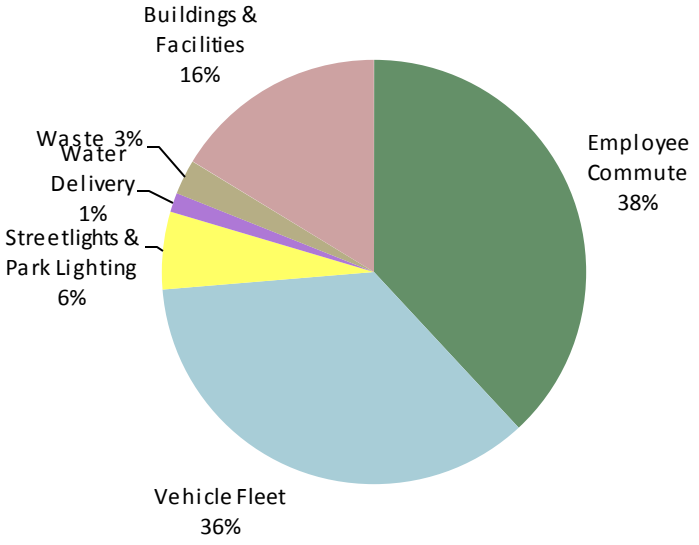
Within government operations, emissions decreased by 11.5 metric tons CO_2e, or by 2.6%. Decreases occurred in all sectors except the vehicle fleet sector (+22.9 metric tons CO_2e) and the water delivery sector (+6.1 metric tons CO_2e). These increases were primarily due to an increase in gasoline used by the police department and the installation of the fountain in downtown Tiburon.

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	78.8	18%	68.9	16%	-9.9	-12.6%
Vehicle Fleet	127.7	29%	150.6	34%	22.9	17.9%
Public Lighting	29.2	7%	25.0	6%	-4.2	-14.2%
Water Delivery	<0.1	<1%	6.2	1%	6.1	15,275%
Waste	28.5	7%	11.3	3%	-17.2	-60.3%
Employee Commute	170.5	39%	161.2	41%	-9.3	-5.5%
Total	**434.7**	**100%**	**423.2**	**100%**	**-11.5**	**-2.6%**

Decreases in greenhouse emissions within the government operations inventory occurred in the waste sector (-17.2 metric tons CO_2e), the buildings and facilities sector (-9.9 metric tons CO_2e), the employee commute sector (-9.3 metric tons CO_2e) and the public lighting sector (-4.2 metric tons CO_2e). While the Town's use of natural gas increased by 32%, electricity usage decreased by 14%. This decline in electricity usage, coupled with an improvement in the carbon intensity of PG&E electricity and the Town's decision to switch to MEA electricity in 2010, were responsible for the overall decline in greenhouse gas emissions from the buildings and public lighting sectors.

FIGURE B: GOVERNMENT OPERATIONS EMISSIONS BY SECTOR, 2010



These results show that Tiburon is on its way to accomplishing its greenhouse gas reduction goal for community emissions. If community emissions continue to decrease at the current rate, Tiburon will achieve a reduction in community emissions of 16% below 2005 levels by the year 2020. The Town, however, needs to do more to reach its goal of achieving an emissions reduction of 15% below 2005 levels for government operations.

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 Tiburon 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, as calculating GHG emissions are an ever-changing methodology. 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. In addition, fugitive emissions were from refrigerants were included 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 Tiburon 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 Tiburon's community and government operations emissions. However, these totals are only a summation of inventories 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, and the combustion of propane used in outdoor heaters, barbeques, portable stoves, torches, etc.

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 Tiburon's government operations. Information items for this inventory include refrigerators using the refrigerant R-12 and air conditioning units 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	0.04
Refrigerators and Air Conditioning Units	R-22	1.38
Total		1.41

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, 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 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 gas 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 Tiburon

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

1. The Town purchased two hybrid vehicles – a Honda Civic Hybrid for use by the Building Inspector/Planning Division, and a Ford Escape Hybrid for the parking enforcement officer/Police Department.
2. The Police Department purchased four fuel-efficient patrol cars. The new Dodge Chargers use only four cylinders while idling, but can switch to eight cylinders in the "pursuit ready" mode. The Police Department plans to phase these fuel-efficient models into the police fleet as vehicles are replaced, with purchase of another Dodge Charger scheduled by the end of 2012.
3. The Town installed a 158-panel photovoltaic system, rated at 22KW output, on top of Town Hall in 2006.
4. Working with funding from the Safe Routes to School program, the Town implemented a bicycle and pedestrian project to improve accessibility and safety surrounding Del Mar Middle School, including a new pedestrian bulb-out, new and repainted crosswalks, and upgraded sidewalk ramps.
5. Working with funding through the Non-Motorized Transportation Pilot Program, which is intended to increase the mode share of cycling and walking for everyday transportation, the Town rehabilitated existing walking paths and pedestrian steps.
6. The Town purchased numerous pieces of Energy Star-rated computer equipment to phase out older, less energy-efficient equipment.
7. In 2005, the Town adopted Resolution 05-2005 to create a policy to encourage the installation of solar collector panels, while still protecting and maintaining the valued aesthetic qualities which make the Town unique. This policy waives the building permit fees associated with the installation of flush-mounted roof solar panels that meet certain guidelines.
8. In 2008 the Town adopted Enhanced Energy Efficiency Standards (Ord. No. 506 N.S.) which requires single-family dwellings greater than 3,500 square feet to comply with more restrictive energy standards than what is normally required by the California Energy Code. In 2011, this ordinance became an amendment to the adopted CALGreen standards.
9. In 2008, the Town adopted a Green Building Ordinance (Ord. No. 512 N.S.) which outlined minimum GreenPoint™ building thresholds for new residential structures and additions, and minimum LEED standards for new commercial structures and additions, as well as all Town-sponsored facilities. In 2011, this ordinance was retracted as new CALGreen standards were released.
11. The Town adopted the Town of Tiburon 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.
12. The Town joined the Marin Energy Authority and chose Marin Clean Energy electricity with a minimum 25% (light green) renewable energy source content for all Town operations that consume electricity.

Since approval of the Tiburon Climate Action Plan in April 2011, the Town has continued to implement greenhouse gas reduction programs in Tiburon. These include the following:

- In partnership with Mill Valley Refuse Service, implemented curbside food waste collection. The program reduces methane emissions by composting food waste instead of depositing it into the landfill.
- Adopted a construction and demolition (C&D) debris recycling ordinance that requires a minimum of 70% of C&D waste to be recycled rather than deposited into the landfill. The ordinance incrementally increases diversion requirements until targets meet 94% by the end of 2025.

- Adopted a Zero Waste resolution that commits the Town to reaching a 94% diversion rate by 2025, and an ultimate goal of Zero Waste.
- Participated in the Energy Upgrade California program, which provides substantial rebates to homeowners to perform energy audits and "whole house" energy upgrade retrofits.
- Adopted the new CALGreen standards as part of the new California Building Code.
- Adopted 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.

COMMUNITY INVENTORY RESULTS

TIBURON PROFILE

Located on a peninsula in Marin County approximately seven miles north of the Golden Gate Bridge, Tiburon is a small town with a land area of 4.5 square miles. According to the U.S. Census, the population of Tiburon in 2010 was 8,962 and there were 4,025 housing units. The California Department of Finance estimates the population of Tiburon in 2005 was 8,710.[2] Tiburon enjoys a temperate climate, with cool, wet, and almost frostless winters and cool, dry summers with frequent fog or wind. The town is located in climate zone 3, 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 Tiburon community resulted in approximately 51,928 metric tons of CO_2e. In 2010, those activities resulted in approximately 49,045 metric tons of CO_2e, a reduction of 2,883 metric tons, or approximately 5.6%. 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 residential sector was the largest emitter of greenhouse gas emissions in both 2005 and 2010 (45%). Emissions from the transportation sector produced the second highest quantity (41%), followed by the commercial sector (10%). Emissions were reduced in all sectors, with the greatest reductions occurring in the waste sector (1,124 metric tons), transportation sector (929 metric tons), and commercial sector (374 metric tons).

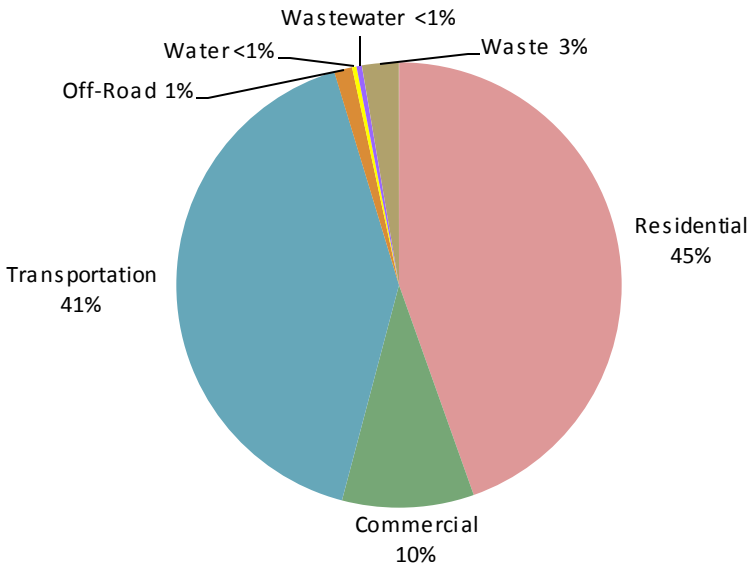
[2] California Department of Finance, "E-4 Population Estimates for Cities, Counties, and the State 2001-2010, with 2000 & 2001 Census Counts," August 2011. To make comparisons to U.S. Census data, this is the average between California Department of Finance estimates for January 1, 2005, and January 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 Tiburon has an average temperature of 49 degrees. For such a day we can approximate the HDD as (65 - 49) = 16.

TABLE 4: SUMMARY BY SECTOR, 2005 AND 2010

Sector	2005 Metric Tons CO_{2e}	2010 Metric Tons CO_2e	Change Metric Tons CO_2e	% Change
Residential	22,191	21,903	-288	-1.3%
Commercial	5,059	4,685	-374	-7.4%
Transportation	21,092	20,163	-929	-4.4%
Off-Road	730	636	-94	-12.9%
Water	232	161	-71	-30.6%
Wastewater	189	188	-1	-0.5%
Waste	2,434	1,310	-1,124	-46.2%
Total	**51,928**	**49,045**	**-2,883**	**-5.6%**

FIGURE 1: EMISSIONS BY SECTOR, 2010



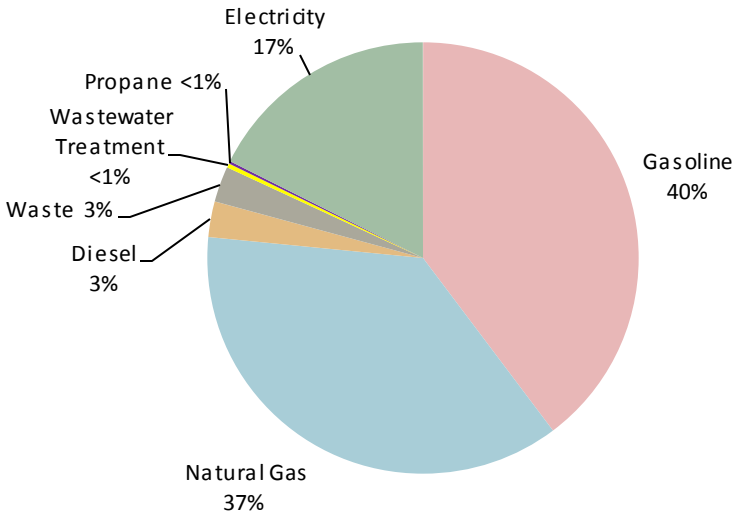
SUMMARY BY SOURCE

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 Tiburon's 2005 and 2010 greenhouse gas emissions by source. Between 2005 and 2010, emissions from the combustion of natural gas increased by about 7%, or nearly 1,200 metric tons CO_2e. Emissions from other sources decreased in all categories except natural gas and wastewater treatment which experienced a small increase of 8 metric tons CO_2e. In 2010, the largest sources of emissions were gasoline (40%), followed by natural gas (37%) and electricity (17%).

TABLE 5: SUMMARY BY SOURCE, 2005 AND 2010

Source	2005 Metric Tons CO_{2e}	2010 Metric Tons CO_2e	Change Metric Tons CO_2e	% Change
Gasoline	20,464	19,489	-978	-4.8%
Natural Gas	16,859	18,058	1,199	7.1%
Electricity	10,568	8,631	-1,937	-18.3%
Diesel	1,358	1,310	-48	-3.5%
Waste	2,434	1,310	-1,124	-46.2%
Wastewater Treatment	147	155	8	5.4%
Propane/LPG	98	93	-5	-4.7%
Total	**51,928**	**49,045**	**-2,883**	**-5.6%**

FIGURE 2: 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 39,015 metric tons CO_2e in 2010. Scope 2 emissions comprised the second largest amount (8,436 metric tons CO_2e), and Scope 3 emissions totaled 1,594 metric tons CO_2e. The greatest reduction occurred in Scope 3 emissions, which includes emissions from the waste, water, and wastewater sectors. Scope 2 emissions, which represents emissions from the use of electricity generated outside the town limits, decreased by 18%. 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, was virtually unchanged.

Table 6: Summary by Scope, 2005 and 2010

Activity	2005 Metric Tons CO_{2e}	2010 Metric Tons CO_{2e}	% Change
Scope 1	38,845	39,015	0.4%
Scope 2	10,293	8,436	-18.0%
Scope 3	2,790	1,594	-42.9%
Total	**51,928**	**49,045**	**-5.6%**

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 4.4 metric tons CO_2e per capita in 2005. Per capita emissions decreased 7.6% between 2005 and 2010, falling to 4.0 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 Tiburon, which would include lifecycle emissions, emissions resulting from air travel, etc.

Table 7: Per Capita Emissions, 2005 and 2010

	2005	2010	% Change
Service Population	11,890	12,152	2.2%
Community GHG Emissions (metric tons CO_2e)	51,928	49,045	-5.6%
Per Capita GHG Emissions (metric tons CO_2e)	4.4	4.0	-7.6%

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 Tiburon homes produced 22,191 metric tons of greenhouse gas emissions in 2005 and 21,903 metric tons in 2010, a decrease of 1.3%. All residential sector emissions in this inventory are the result of electricity consumption and the on-site combustion of natural gas and propane/LPG. 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 to power appliances. In 2005, Tiburon's entire residential sector consumed 32,005,155 kWh of electricity and 2,809,377 therms of natural gas.

As shown in Table 8, electricity usage in Tiburon's residential sector decreased by 2.6% between 2005 and 2010, while emissions decreased by 16.0%. 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 Tiburon residents began to purchase their electricity from the Marin Energy Authority (MEA) approximately mid-way through the year, resulting in about 19% 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	32,005,155 kWh	7,160	31,174,262 kWh	6,015	-2.6%	-16.0%
Natural Gas	2,809,377 therms	14,934	2,971,266 therms	15,794	5.8%	5.8%
Propane/LPG	1,578 MMBtu	98	1,504 MMBtu	93	-4.7%	-4.7%
Total	-	22,191	-	21,903	-	-1.3%

Natural gas usage increased 5.8% 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 5.8%.

As shown in Table 9, Tiburon residents generated approximately 5.9 metric tons of greenhouse gas emissions per household in 2010. This is a decrease of approximately 0.5% per household since 2005.[5]

TABLE 9: RESIDENTIAL EMISSIONS PER HOUSEHOLD

	2005	2010
Number of Occupied Housing Units	3,760	3,729
Residential GHG Emissions (metric tons CO_2e)	22,191	21,903
Residential GHG Emissions per Household (metric tons CO_2e)	5.9	5.9

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 7.4%. In 2010, buildings and facilities within the commercial sector produced 4,685 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 to power equipment and appliances.

As shown in Table 10, electricity usage decreased by 5.8% in the commercial sector between 2005 and 2010, while natural gas usage increased 17.6%. Electricity emissions decreased for the emission factor reasons explained above. This decrease was offset by an increase in natural gas emissions of 17.6%. The net effect was to decrease total emissions from the commercial sector by 7.4%.

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	12,494,589 kWh	3,133	11,771,513 kWh	2,421	-5.8%	-22.7%
Natural Gas	362,207 therms	1,925	425,834 therms	2,264	17.6%	17.6%
Total		5,059		4,685		-7.4%

Table 11 shows commercial emissions based on the estimated number of jobs in Tiburon in 2005 and 2010.[6] Emissions decreased by approximately 8% per job.

[4] See discussion on page 9.

[5] Number of Tiburon households is from ABAG Projections 2009 and 2010 U.S. Census SF1:H3.

TABLE 11: COMMERCIAL EMISSIONS PER JOB

	2005	2010
Number of Jobs	3,180	3,190
Commercial / Industrial GHG Emissions (metric tons CO_2e)	5,059	4,685
Commercial /Industrial GHG Emissions per Job (metric tons CO_2e)	1.6	1.5

TRANSPORTATION SECTOR

Emissions in the transportation sector are calculated by estimating all vehicle miles traveled on local roads and on Route 131, a state highway, within the town limits. Air travel and vehicle miles traveled outside of Marin County are not included in the analysis. In 2005, the transportation sector generated 21,092 metric tons of CO_2e. By 2010, emissions from the transportation sector decreased approximately 4.4% to 20,163 metric tons CO_2e. As shown in Table 12, vehicle miles traveled on local roads and Route 131 are estimated to have decreased between 2005 and 2010 by 1.5%.

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	13,618,510	6,667	13,413,750	6,345	-1.5%	-4.8%
State Highway	29,653,695	14,425	29,208,611	13,817	-1.5%	-4.2%
Total	43,272,205	21,092	42,622,361	20,163	-1.5%	-4.4%

Decreases in transportation sector emissions are also 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 by approximately 12.9% 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-

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

[7] See the Appendix for further information.

intensity of fuels. Emissions from construction equipment and off-road vehicles, in particular, decreased by about 30%, a result of the decline in construction activity since the peak of the real estate boom in 2006-2007.

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	35,808	320	11,057	97	-30.9%	-30.3%
Lawn and Garden Equipment	41,342	410	41,649	413	0.7%	0.6%
Total	77,150	730	66,400	636	-13.9%	-12.9%

WATER SECTOR

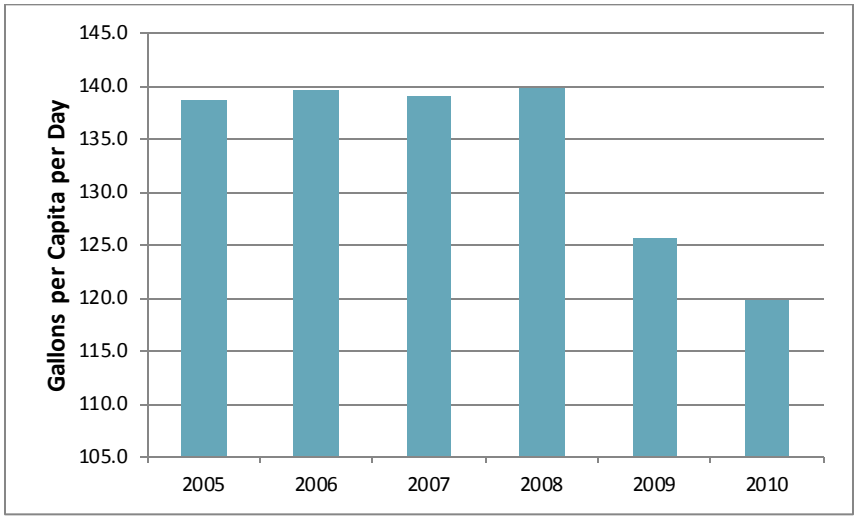
Emissions in the water sector are a result of Marin Municipal Water District's (MMWD) use of electricity to pump, treat, convey and distribute water from the water source to the water users in Tiburon. Emissions from the water sector decreased nearly 31% between 2005 and 2010 (see Table 14). This reduction 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 mid-way 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	1,038,405	232	929,916	161	-10.4%	-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 most 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: 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 Sanitary District No. 5 and the Sewerage Agency of Southern Marin, chemical processes in aerobic and 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 by 0.5% 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	189,150	42	163,456	33	-13.6%	-21.4%
Treatment	-	147	-	155	-	5.5%
Total	-	189	-	188		-0.5%

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 2005 and 2010. These emissions are considered Scope 3 because they are not generated in the base year, but 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

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

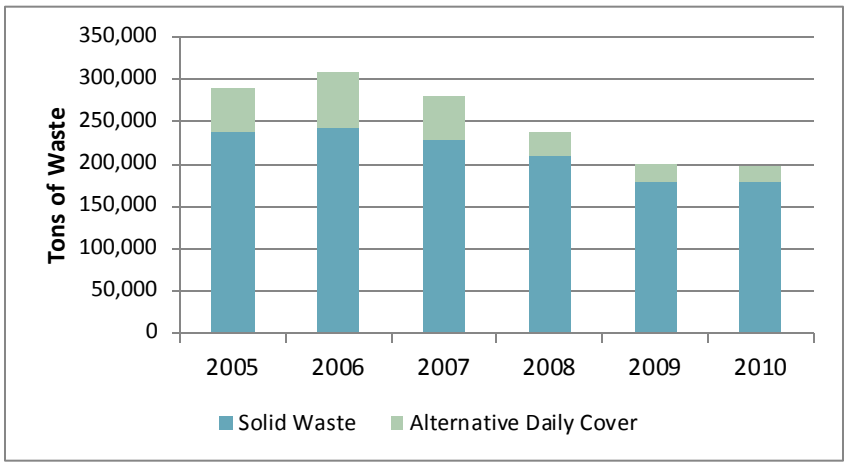
through landfill gas collection systems, but the remaining 25 percent escape into the atmosphere as a significant contributor to global warming.

Emissions from waste generated by the Tiburon community in 2010 were 46% lower than 2005. This was due to a reduction in landfilled waste and in 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	9,850	1,992	6,273	1,269	-36.3%	-36.3%
Alternative Daily Cover	2,609	442	660	41	-74.7%	-90.6%
Total	12,459	2,434	6,933	1,310	-44.4%	-46.2%

FIGURE 4: COUNTYWIDE WASTE GENERATION, 2005 TO 2010



GOVERNMENT OPERATIONS INVENTORY

GOVERNMENT PROFILE

The Town of Tiburon 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 42 total employees. The operating budget for expenditures was $8,841,760 in fiscal year 2009-2010 and $8,575,482 in fiscal year 2010-2011.

GOVERNMENT OPERATIONS INVENTORY SUMMARY

In 2005, Tiburon's government operations produced approximately 435 metric tons of CO_2e. In 2010, those activities resulted in approximately 423 metric tons of CO_2e, a decrease of 11.5 metric tons, or 2.6%. These numbers include all Scope 1 emissions from the on-site combustion of fuels in facilities and vehicles, Scope 2 emissions from the purchase of electricity generated outside Tiburon'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.

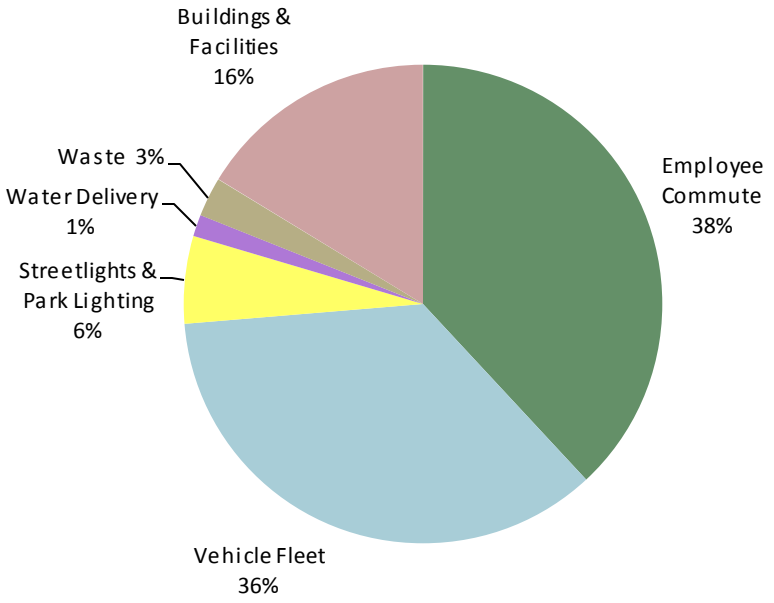
SUMMARY BY SECTOR

Emissions from government operations decreased in all sectors except the vehicle fleet and water sectors. As shown in Table 17, the greatest emissions reductions came from the waste sector, which experienced a reduction in emissions of 17.2 metric tons CO_2e, or about 60%. Emissions were also reduced in the public lighting sector (-14%), the buildings and facilities sector (-13%), and the employee commute sector (-6%). On the other hand, emissions increased in the vehicle fleet sector by nearly 23 metric tons CO_2e, or almost 18% Emissions also increased by 6.1 metric tons in the water delivery sector because of the installation of a fountain in downtown Tiburon. Figure 5 shows that the employee commute sector was the largest emitter of greenhouse gas emissions in 2010 (38%), followed by the vehicle fleet sector (36%).

TABLE 17: 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	78.8	68.9	-9.9	-12.6%
Vehicle Fleet	127.7	150.6	22.9	17.9%
Public Lighting	29.2	25.0	-4.2	-14.2%
Water Delivery	<0.1	6.2	6.1	15,300%
Waste	28.5	11.3	-17.2	-60.3%
Employee Commute	170.5	161.2	-9.3	-5.5%
Total	**434.7**	**423.2**	**-11.5**	**-2.6%**

FIGURE 5: EMISSIONS BY SECTOR, 2010



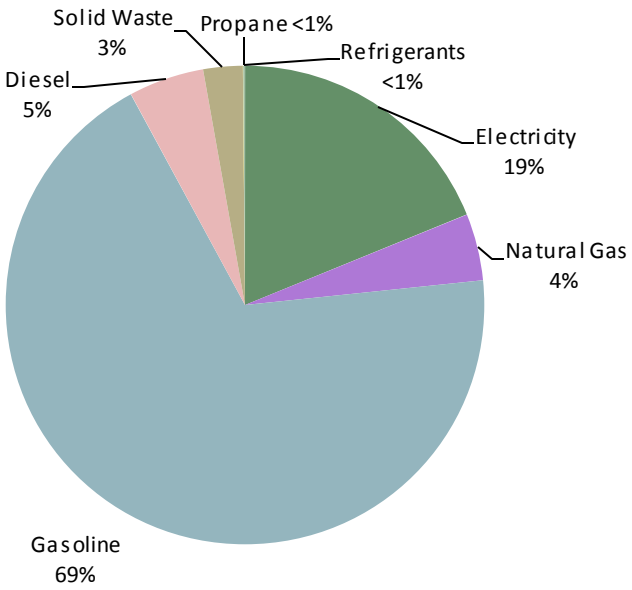
SUMMARY BY SOURCE

Table 18 shows a summary of the Town's greenhouse gas emissions by source. On a percentage basis, emissions from diesel increased the most (49%), while emissions from waste decreased the most (-60%). In absolute terms, the greatest increase in emissions came from gasoline and diesel sources. As shown in Figure 6, gasoline was the largest source of greenhouse gas emissions (69%) in 2010, followed by electricity (19%). Emissions from refrigerants were not calculated in the 2005 inventory, so the same amount of 2010 greenhouse gas emissions from refrigerants is assumed for 2005.

TABLE 18: SUMMARY BY SOURCE, 2005 AND 2010

Source	2005 Metric Tons CO_{2e}	2010 Metric Tons CO_2e	Change Metric Tons CO_2e	% Change
Electricity	92.9	79.7	-13.2	-14.2%
Natural Gas	14.5	19.1	4.6	31.7%
Gasoline	283.9	290.9	7.0	2.5%
Diesel	14.4	21.5	7.1	49.4%
Solid Waste	28.5	11.3	-17.2	-60.4%
Propane	--	0.1	0.1	--
Refrigerants	0.5	0.5	0.0	0%
Total	**434.7**	**423.2**	**-11.5**	**-2.6%**

FIGURE 6: EMISSIONS BY SOURCE, 2010



SUMMARY BY SCOPE

As shown in Table 19, Scope 3 sources produced the largest amount of greenhouse gas emissions from governmental operations in 2005, and these emissions decreased by 13.3% in 2010. The largest decrease occurred in Scope 2 emissions, which represents emissions from electricity produced outside Tiburon's borders.

TABLE 19: SUMMARY BY SCOPE, 2005 AND 2010

Activity	2005 Metric Tons CO_{2e}	2010 Metric Tons CO_{2e}	% Change
Scope 1	142.9	171.0	19.7%
Scope 2	92.9	79.7	-14.2%
Scope 3	199.0	172.4	-13.3%
Total	**434.7**	**423.2**	**-2.6%**

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) and other greenhouse gases when these systems leak refrigerants. Refrigerants are very potent greenhouse gases, and have 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 a significant effect on greenhouse gas emissions.

In 2010, Tiburon operated three major facilities – the Town Hall, the police station, and the public works corporation yard. Data relating to electricity and natural gas consumption for buildings and facilities was obtained from PG&E and data for refrigerants and fuel used for backup generators was obtained from Tiburon staff.

As shown in Table 20, emissions from the buildings sector decreased by 13% between 2005 and 2010. This decline was due to reductions in electricity consumption and emissions. Electricity consumption decreased by 14% and emissions decreased further – by 24% – primarily because the carbon intensity of PG&E electricity was lower in 2010. In addition, the Town purchased approximately 9% of its electricity from MEA in 2010; as noted earlier, 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.

Offsetting the decline in electricity emissions was an increase in emissions from natural gas, gasoline and diesel use. Natural gas consumption and emissions increased by 32%. Fuel usage for generators nearly doubled, but since the amount of gasoline and diesel used for generators is relatively small, this did not have a significant impact on overall emissions from the buildings sector. Fugitive emissions from refrigerants used in air conditioners and refrigerators barely registered because most of the older equipment in Tiburon uses refrigerants that are being phased out and are not reported in the Local Government Operating Protocol. These emissions are reported separately and were discussed on page 7.

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	284,581 kWh	64.0	244,273 kWh	48.5	-14%	-24%
Natural Gas	2,734 therms	14.5	3,601 therms	19.1	32%	32%
Fuel	69 gallons	0.6	124 gallons	1.3	80%	117%
Refrigerants	--	0.003	--	0.003	--	0%
Total	--	78.8	--	68.9	--	-13%

Table 21 shows electricity, natural gas, and fuel usage by facility. Electricity declined by 25% at Town Hall; the installation of the photovoltaic system at Town Hall in 2006 was responsible for 95% of the drop in purchased electricity for that building between 2005 and 2010 (36,861 kWh were generated by the PV system in 2010). Electricity usage increased by 3% at the police station and decreased by 18% at the corporation yard. Natural gas usage increased by approximately 49% at Town Hall and 54% at the police station, but decreased by 19% at the corporation yard. As noted earlier in this report, 2010 was a cooler year than 2005, and these cooler temperatures most likely contributed to the increase in natural gas usage for heating buildings.

TABLE 21: ENERGY USAGE AT TIBURON BUILDINGS AND FACILITIES

Building/ Facility	Energy Source	2005 Energy Consumption	2010 Energy Consumption	% Change in Energy Consumption
Town Hall	Electricity	157,360 kWh	118,640 kWh	-25%
	Natural Gas	1,129 therms	1,684 therms	49%
	Diesel	9 gallons	44 gallons	389%
Police Station	Electricity	105,120 kWh	108,560 kWh	3%
	Natural Gas	838 therms	1,293 therms	54%
	Diesel	12 gallons	49 gallons	308%
Corp Yard	Electricity	20,828 kWh	17,004 kWh	-18%
	Natural Gas	767 therms	624 therms	-19%
	Gasoline	48 gallons	31 gallons	-35%
Marsh Condos	Electricity	1,273 kWh	69 kWh	-95%

PUBLIC LIGHTING

Tiburon operates 277 street and park lights. Emissions associated with the operation of this public lighting are from electricity consumption. Electricity usage for streetlights increased by about 1%, while electricity usage for park lighting decreased by 56% because the lights at Shoreline park and the restroom lights at Blackie's Pasture and South of Knoll park were put on timers to save electricity during the evening hours. Overall, electricity consumption in the public lighting sector decreased 4% between 2005 and 2010. Emissions dropped even more, by 14%.

TABLE 22: PUBLIC LIGHTING EMISSIONS, 2005 AND 2010

Source	2005 Electricity Consumption	2005 GHG Emissions ($MTCO_2e$)	2010 Electricity Consumption	2010 GHG Emissions ($MTCO_2e$)	% Change in Electricity Consumption	% Change in GHG Emissions ($MTCO_2e$)
Streetlights	120,857 kWh	27.0	121,532 kWh	24.2	1%	-10%
Park Lighting	9,542 kWh	2.1	4,155 kWh	0.8	-56%	-62%
Total	130,399 kWh	29.2	125,687 kWh	25.0	-4%	-14%

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 usage increased dramatically between 2005 and 2010, by 30,767 kWh, due to the installation of a fountain at the corner of Main Street and Tiburon Boulevard in the downtown area (the fountain used 30,774 kWh of electricity in 2010). The operation of this fountain increases annual greenhouse gas emissions by more than 6 metric tons.

Table 23: Water Delivery Emissions, 2005 and 2010

Source	2005 Electricity Consumption	2005 GHG Emissions ($MTCO_2e$)	2010 Electricity Consumption	2010 GHG Emissions ($MTCO_2e$)	% Change in Electricity Consumption	% Change in GHG Emissions ($MTCO_2e$)
Water Delivery	180 kWh	0.04	30,947 kWh	6.2	17,093%	15,275%

Vehicle Fleet

The vehicles and mobile equipment used in Tiburon's daily operation include public works trucks and equipment, police cars, and cars for building and planning staff use. 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 vehicle. In 2010, Tiburon operated a fleet of 23 vehicles, including nine police patrol cars, six pick-up trucks, a backhoe, a loader and a street sweeper.

Table 24 shows that total fuel consumption increased by 19% between 2005 and 2010 and emissions increased by 18%. The police department increased its gasoline use by 41%, while the public works department, the other major user of fuel at the Town, decreased its use of diesel and gasoline by 2%.

Table 24: Vehicle Fleet Emissions, 2005 and 2010

Source	2005 Fuel Consumption	2005 GHG Emissions ($MTCO_2e$)	2010 Fuel Consumption	2010 GHG Emissions ($MTCO_2e$)	% Change in Fuel Consumption	% Change in GHG Emissions ($MTCO_2e$)
Police	7,847 gallons	70.0	11,082 gallons	97.6	41%	39%
Public Works	5,436 gallons	49.9	5,304 gallons	49.2	-2%	-1%
Building	733 gallons	6.6	284 gallons	2.5	-61%	-62%
Planning	73 gallons	0.7	85 gallons	0.8	16%	14%
Refrigerants, all departments	—	0.5	—	0.5	--	0.0%
Total	14,089 gallons	127.7	16,755 gallons	150.6	19%	18%

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.

Waste generated by governmental operations and deposited into the landfill decreased by 60% between 2005 and 2010, and emissions dropped by the same percentage. This is due to the diversion of nearly 59 tons of yard waste from the landfill, which is now sent to a compost facility at Redwood Landfill rather than deposited in the landfill.

TABLE 25: WASTE EMISSIONS, 2005 AND 2010

Source	2005 Landfilled Waste	2005 GHG Emissions ($MTCO_2e$)	2010 Landfilled Waste	2010 GHG Emissions ($MTCO_2e$)	% Change in Landfilled Waste	% Change in GHG Emissions ($MTCO_2e$)
Police Station	5.0 tons	1.0	5.0 tons	1.0	0%	0%
Public Works	108.6 tons	22.0	24.9 tons	5.0	-77%	-77%
Town Hall	10.0 tons	2.0	8.9 tons	1.8	-11%	-11%
Street Cans	17.3 tons	3.5	17.0 tons	3.4	-2%	-2%
Total	140.9 tons	28.5	55.9 tons	11.3	-60%	-60%

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 Tiburon. Table 26 shows that vehicle miles traveled increased by 5% between 2005 and 2010, but emissions decreased by 5%. This lower rate may be attributed to an improvement in the fuel efficiency of the vehicles that Tiburon employees drive. 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 within the survey's margin of error.

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	309,711 miles	170.5	323,978 miles	161.2	5%	-5%

TABLE 27: COMMUTE EMISSIONS PER EMPLOYEE, 2005 AND 2010

	2005	2010	% Change
Employees	42	42	0%
Commute GHG Emissions (metric tons CO_2e)	170.5	161.2	+6%
Per Employee GHG Emissions (metric tons CO_2e)	4.1	3.8	-5%

CONCLUSION

Tiburon has achieved some early successes in reducing greenhouse gas emissions between 2005 and 2010. Community emissions decreased by 5.6% over these five years, putting the town on track to reduce emissions by approximately 16% below the 2005 baseline year if the community continues to reduce emissions at the current rate. Emissions decreased in all sectors.

One of the brightest spots in the inventory came from the waste sector, which saw a reduction in emissions of nearly 51%. 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 emissions in this sector.

While the largest declines (on a percentage basis) occurred in the waste, water and off-road categories, these sectors are relatively small, collectively representing about 4% of total community emissions. Emissions reductions in the transportation and residential sectors, while small on a percentage basis, had a significant effect on the bottom line. 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 greenhouse gas emissions than most other electricity producers in the rest of the country.

Tiburon can also expect to see 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. Tiburon 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 Tiburon'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 by 2.6%. While reductions occurred in the waste, buildings, public lighting and employee commute sectors, emissions rose in the vehicle fleet and water delivery sectors. The Town's continued use of Marin Clean Energy electricity for all facilities should have a significant, positive effect on emissions. The Town could reduce future emissions by completing energy efficient upgrades to its buildings and equipment, installing a solar energy system at the police station, purchasing more fuel-efficient vehicles, and

completing other actions identified in the Tiburon Climate Action Plan. Staff should always be aware of the impact their decisions have on the environment.

Tiburon has made a good start. If the community's emissions are to continue to decline, then residents, businesses, and other organizations must modify their energy consumption and travel patterns and support more clean energy from utility providers. Tiburon can serve as a model to others in curbing the greenhouse gas emissions that will affect the entire world by getting its own house in order.

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	32,005,155	kWh	7,101.28	0.16	0.44	7,159.93
	1	Natural Gas	2,809,377	therms	14,895,.32	0.03	1.40	14,933.52
	1	Propane/LPG	1,578	MMBtu	96.98	0.00	0.02	97.89
		TOTAL			22,093.58	0.19	1.86	22,191.34
Commercial	2	Electricity	10,870,839	kWh	2,412.01	0.05	0.15	2,431.93
	1	Natural Gas	362,207	therms	1,920.42	0.00	0.18	1,925.35
	2	Direct Access Electricity	1,623,750	kWh	698.43	0.01	0.02	701.40
		TOTAL			5,030.86	0.07	0.35	5,058.69

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	25,129,523	kWh	5,072.36	0.11	0.33	5,114.64
	1	Natural Gas	2,971,266	therms	15,753.65	0.03	1.49	15,794.06
	2	MEA Electricity	6,028,138	kWh	885.53	0.03	0.08	895.67
	2	Direct Access Electricity	16,601	kWh	4.96	0.00	0.00	4.98
	1	Propane/LPG	1,504	MMBtu	92.44	0.00	0.02	93.30
		TOTAL			21,808.94	0.17	1.91	21,902.65
Commercial	2	PG&E Electricity	10,789,050	kWh	2,177.75	0.05	0.14	2,195.91
	1	Natural Gas	425,834	therms	2,257.77	0.00	0.21	2,263.56
	2	MEA Electricity	459,660	kWh	67.52	0.00	0.01	68.30
	2	Direct Access Electricity	522,803	kWh	156.20	0.00	0.01	156.80
		TOTAL			4,659.25	0.06	0.37	4,684.56

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

Data analyzed by Christine O'Rourke, Marin Climate and Energy Partnership Sustainability Coordinator, christine.o@comcast.net.
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 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	13,618,150	VMT	6,357.24	0.94	0.86	6,667.09
	1	State Highways	29,653,695	VMT	13,750.21	2.05	1.88	14,424.91
		TOTAL	43,272,205	VMT	20,107.45	2.99	2.74	21,092.01

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	13,413,750	VMT	6,045.21	0.93	0.60	6,345.38
	1	State Highways	29,208,611	VMT	13,163.53	2.02	1.30	13,817.16
		TOTAL	42,622,361	VMT	19,208.74	2.95	1.89	20,162.54

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

State Highway and 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. State Highway VMT determined by decreasing State Highway VMT calculated for the Tiburon 2005 Greenhouse Gas Inventory by the decrease reported in Local Road VMT.

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

Additional Notes

Data analyzed by Christine O'Rourke, Marin Climate and Energy Partnership Sustainability Coordinator, christine.o@comcast.net.
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 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	4,042	gallons	diesel	41.27	0.00	0.00	41.27
	1		31,766	gallons	gasoline	278.91	0.00	0.00	278.91
	1	Lawn and Garden Equipment	33,037	gallons	diesel	337.31	0.00	0.00	337.31
	1		8,305	gallons	gasoline	72.92	0.00	0.00	72.92
		TOTAL	77,150	gallons		730.40	0.00	0.00	730.40

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	4,057	gallons	diesel	41.42	0.00	0.00	41.42
	1		20,694	gallons	gasoline	181.69	0.00	0.00	181.69
	1	Lawn and Garden Equipment	32,964	gallons	diesel	336.56	0.00	0.00	336.56
	1		8,685	gallons	gasoline	76.25	0.00	0.00	76.25
		TOTAL	66,400	gallons		635.93	0.00	0.00	635.93

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.

Additional Notes

Data analyzed by Christine O'Rourke, Marin Climate and Energy Partnership Sustainability Coordinator, christine.o@comcast.net.

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	1,038,405	kWh	230.40	0.01	0.01	232.30
		TOTAL	1,038,405	kWh	230.40	0.01	0.01	232.30

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	424,283	kWh	85.64	0.00	0.01	86.35
	3	MEA Electricity	505,633	kWh	74.28	0.00	0.01	75.13
		TOTAL	929,916	kWh	159.92	0.00	0.01	161.48

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.

Additional Notes

Data analyzed by Christine O'Rourke, Marin Climate and Energy Partnership Sustainability Coordinator, christine.o@comcast.net.

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	189,150	kWh	41.97	0.00	0.00	42.32
	3	Treatment	2,665	people	0.00	0.25	0.11	81.18
	1	Treatment	6,045	people	0.00	0.19	0.27	65.36
		TOTAL			41.97	0.45	0.38	188.86

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	163,456	kWh	32.99	0.00	0.00	33.27
	3	Treatment	2,917	people	0.00	0.28	0.14	89.31
	1	Treatment	6,045	people	0.00	0.19	0.27	65.36
		TOTAL			32.99	0.47	0.41	187.94

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 Stephen Danehy, General Manager, Sewerage Agency of Southern Marin, 415-388-2402 x16, sdanehy@cityofmillvalley and Tony Rubio, Sanitary District No. 5, 415-435-1501, trubio@sani5.org
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

Data analyzed by Christine O'Rourke, Marin Climate and Energy Partnership Sustainability Coordinator, christine.o@comcast.net
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	9,850	tons	0.00	0.00	94.86	1,992.01
	3	Alternative Daily Cover	2,609	tons	0.00	0.00	21.04	441.92
		TOTAL	12,459	tons	0.00	0.00	115.90	2,433.93

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	6,273	tons	0.00	0.00	60.41	1,268.61
	3	Alternative Daily Cover	660	tons	0.00	0.00	0.52	41.36
		TOTAL	6,933	tons	0.00	0.00	16.34	1,309.97

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: 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

Data analyzed by Christine O'Rourke, Marin Climate and Energy Partnership Sustainability Coordinator, christine.o@comcast.net.
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 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	2,734 therms	14.50	0.00	0.00	0.00	14.53
	Stationary Combustion	69 gallons	0.64	0.00	0.00	0.00	0.64
	Fugitive Emissions	--	0.00	0.00	0.00	0.00	0.00
	TOTAL		15.13	0.00	0.00	0.00	15.17
Scope 2	Purchased Electricity PG&E	284,581 kWh	63.14	0.00	0.00	0.00	63.66
	TOTAL	284,581 kWh	63.14	0.00	0.00	0.00	63.66

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	3,601 therms	19.09	0.00	0.00	0.00	19.14
	Stationary Combustion	124 gallons	1.27	0.00	0.00	0.00	1.27
	Fugitive Emissions	--	0.00	0.00	0.00	0.00	0.00
	TOTAL		20.36	0.00	0.00	0.00	20.41
Scope 2	Purchased Electricity PG&E	222,479 kWh	44.91	0.00	0.00	0.00	45.28
	Purchased Electricity MEA	21,794 kWh	3.20	0.00	0.00	0.00	3.24
	TOTAL	244,273 kWh	48.11	0.00	0.00	0.00	48.52

2005 emissions were recalculated using activity data from the 2005 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). Backup generators for buildings and facilities were recorded by amount of fuel consumed and fuel type. LGO Protocol recommended methods were followed in collection and analysis of this activity data. See Appendix A for emission factors.

Refrigerant type and capacity for air conditioning units and refrigerators was provided by Tiburon public works staff. 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	130,399 kWh	28.93	0.00	0.00	0.00	29.17
	TOTAL	130,399 kWh	28.93	0.00	0.00	0.00	29.17

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	115,527 kWh	23.32	0.00	0.00	0.00	23.51
	Purchased Electricity MEA	10,160 kWh	1.49	0.00	0.00	0.00	1.51
	TOTAL	102,907 kWh	24.81	0.00	0.00	0.00	25.02

2005 emissions were recalculated using activity data from the Tiburon 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	180 kWh	0.04	0.00	0.00	0.00	0.04
	TOTAL	180 kWh	0.04	0.00	0.00	0.00	0.04

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	28,177 kWh	5.69	0.00	0.00	0.00	5.73
	Purchased Electricity MEA	2,770 kWh	0.41	0.00	0.00	0.00	0.41
	TOTAL	30,947 kWh	6.09	0.00	0.00	0.00	6.15

2005 emissions were recalculated using activity data from the Tiburon 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	Energy Consumption	Greenhouse Gas Emissions (metric tons)				
			CO_2	N_2O	CH_4	HFCs	CO_2e
Scope 1	Mobile Combustion	14,089 gallons	125.26	0.00	0.00	0.00	127.21
	Fugitive Emissions	--	0.00	0.00	0.00	0.00	0.50
	TOTAL		125.26	0.00	0.00	0.00	127.71

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	Mobile Combustion	16,755 gallons	149.20	0.00	0.00	0.00	150.13
	Fugitive Emissions	--	0.00	0.00	0.00	0.00	0.50
	TOTAL		149.20	0.00	0.00	0.00	150.63

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

Vehicle fleet data was provided by Tiburon staff. LGO Protocol methods were followed in collection and analysis of vehicle fuel consumption and vehicle miles traveled (VMT). In some cases, VMT was estimated according to fuel consumption and estimated vehicle fuel efficiency. Emissions were calculated using default emission factors from the LGOP.

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. As refrigerant emissions were not included in the 2005 Greenhouse Gas Inventory, 2010 data was used as a proxy for 2005 fugitive emissions.

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	140.9 tons	0.00	0.00	1.36	0.00	28.49
	TOTAL	140.9 tons	0.00	0.00	1.36	0.00	28.49

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	55.9 tons	0.00	0.00	0.54	0.00	11.30
	TOTAL	55.9 tons	0.00	0.00	0.54	0.00	11.30

2005 solid waste emissions were recalculated using activity data from the Tiburon 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, percent containers filled, and pick-ups per week was provided by Jim Iavarone at Mill Valley Refuse. See Appendix A for more details on waste characterization and 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	42	309,711	163.37	0.02	0.02	0.00	170.48
	TOTAL		309,711	163.37	0.02	0.02	0.00	170.48

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	42	323,978	158.71	0.01	0.01	0.00	161.16
	TOTAL		323,978	158.71	0.01	0.01	0.00	161.16

2005 data obtained from the Tiburon 2005 Greenhouse Gas Inventory. Emissions reported in the 2005 inventory were based on the 27 employees who completed the survey and had worked in 2005. This data was recalculated to estimate commute emissions for all 42 employees who were employed by the Town in 2005.

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. Forty-two employees responded to the survey, a response rate of 100%.