TOWN OF TIBURON

GREENHOUSE GAS INVENTORY FOR COMMUNITY EMISSIONS FOR THE YEAR 2022

February 2024

Prepared by the
Marin Climate & Energy Partnership

Table of Contents

EXECUTIVE SUMMARY

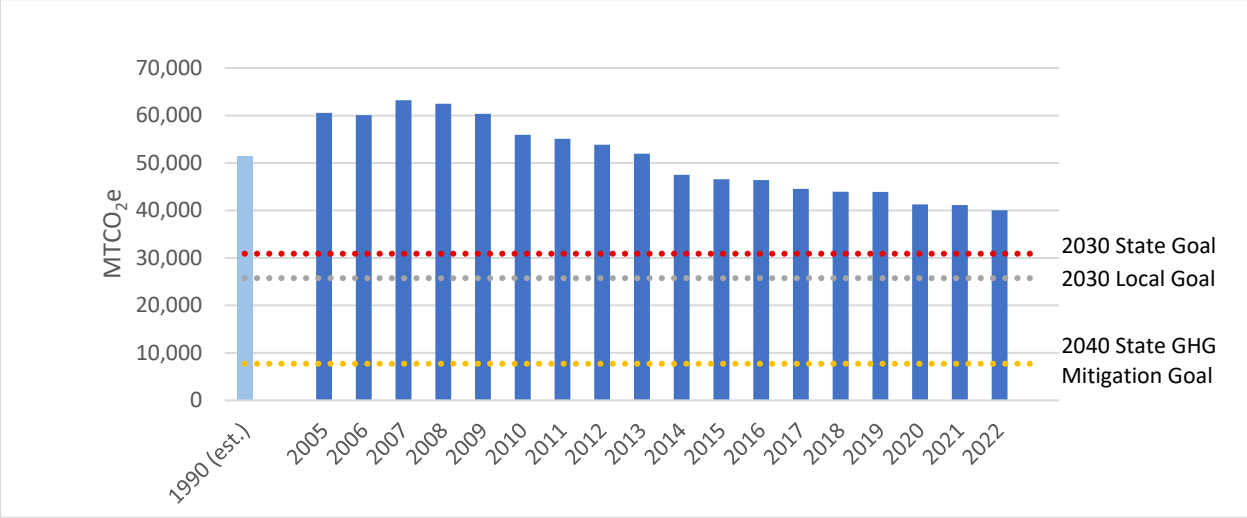
THE TAKEAWAY:

COMMUNITY EMISSIONS DOWN 34% SINCE 2005, EQUIVALENT TO 22% BELOW 1990 LEVEL

Tiburon publishes annual community greenhouse gas (GHG) emissions estimates through the Marin Climate & Energy Partnership (MCEP). Annual inventories help the Town to more closely monitor its progress in meeting its local goal to reduce community emissions 50% below baseline emissions by 2030. In addition to the community inventories, MCEP periodically prepares inventories for government operations emissions. Municipal emissions accounted for less than 1% of community emissions when the municipal inventory was last conducted for year 2016.

This report reviews emissions generated from the community from 2005 through 2022, the most recent year data is available. The inventory shows that the Tiburon community has reduced emissions 34% since 2005, which is equivalent to 22% below estimated 1990 levels. Emissions dropped from about 60,573 metric tons carbon dioxide equivalents ($MTCO_2e$) in 2005 to 40,022 $MTCO_2e$ in 2022. The community emissions trend and targets are shown below. Tiburon needs to reduce emissions another 14,278 $MTCO_2e$ to meet the local target for 2030 and another 32,299 $MTCO_2e$ to meet the State zero net emissions goal for 2045, which includes a GHG mitigation target of 85% below 1990 levels. The State's 2030 goal to reduce emissions 40% below 1990 levels is included for comparison.

FIGURE 1: TIBURON GREENHOUSE GAS EMISSIONS AND TARGETS



Recognizing the need for a collaborative approach to greenhouse gas reductions, town, city, and county leaders launched the Marin Climate and Energy Partnership (MCEP) in 2007. The Town of Tiburon is a member of MCEP and works with representatives from the County of Marin and the other Marin cities and towns to address and streamline the implementation of a variety of greenhouse gas reduction measures. Funding for this inventory was provided by the Marin County Energy Watch Partnership, which administers public goods charges collected by PG&E. Community inventories are available on the MCEP website at marinclimate.org and are used to update the Marin Sustainability Tracker.

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 in 2022. This inventory provides a comparison to baseline 2005 emissions and identifies the sectors where significant reductions in greenhouse gas emissions have occurred. In some instances, previous year emissions were updated with new data and/or recalculated to ensure the same methodology was employed for all inventory years.

GENERAL METHODOLOGY

This inventory uses national standards for the accounting and reporting of greenhouse gas emissions. The U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, version 1.2 (July 2019) was used for the quantification and reporting of community emissions. Quantification methodologies, emission factors, and activity and source data are detailed in the appendix.

Community emissions are categorized according to seven sectors:

- Built Environment - Electricity
- Built Environment – Natural Gas
- Transportation
- Off-Road Vehicles and Equipment
- Waste
- Water
- Wastewater

CALCULATING EMISSIONS

Emissions are quantified by multiplying the measurable activity data – e.g., kilowatt hours of electricity, therms of natural gas, and gallons of diesel or gasoline – by emissions factors specific to the energy source. Most emissions factors are the same from year to year. Emission factors for electricity, however, change from year to year due to the specific sources that are used to produce electricity. For example, electricity that is produced from coal generates more greenhouse gases than electricity that is generated from natural gas and therefore has a higher emissions factor. Electricity that is produced solely from renewable energy sources such as solar and wind has an emissions factor of zero.

This inventory calculates individual greenhouse gases – e.g., carbon dioxide, methane and nitrous oxide – and converts each greenhouse gas emission to a standard metric, known as "carbon dioxide equivalents" or CO_2e, to provide an apple-to-apples comparison among the various emissions. Table 1 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 28 times as potent as carbon dioxide; therefore, one metric ton of methane is equivalent to 28 metric tons of carbon dioxide. Greenhouse gas emissions are reported in this inventory as metric tons of carbon dioxide equivalents, or $MTCO_2e$.

TABLE 1: 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	28
Nitrous Oxide	N_2O	Combustion, wastewater treatment	265

Source: IPCC Fifth Assessment Report (2014)

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 jurisdictional boundary.
- **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.

Understanding Totals

The totals listed in the tables and discussed in the report are a summation of 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. For example, greenhouse gas emissions associated with air travel and the production of goods outside the community's boundary are not included in the inventory. Additionally, the community inventory does not include refrigerants released into the atmosphere from the use of air conditioning in cars and buildings.

COMMUNITY INVENTORY

COMMUNITY INVENTORY SUMMARY

In 2005, the activities taking place by the Tiburon community resulted in approximately 60,573 metric tons of CO_2e. In 2022, those activities resulted in approximately 40,022 metric tons of CO_2e, a reduction of 34% from 2005 levels, which is equivalent to 22% below estimated 1990 levels.

The community inventory tracks emissions in seven sectors:

- The **Built Environment – Electricity** sector represents emissions generated from the use of electricity in Tiburon homes and commercial, industrial, and governmental buildings and facilities.
- The **Built Environment – Natural Gas** sector represents emissions generated from the use of natural gas in Tiburon homes and commercial, industrial, and governmental buildings and facilities. Propane used as a primary heating source is also included, although it represents less than 1% of emissions in this sector.
- The **Transportation** sector includes tailpipe emissions from passenger vehicle trips originating and ending in Tiburon, as well as a share of tailpipe emissions generated by medium and heavy-duty vehicles and buses travelling on Marin County roads. The sector also includes emissions from Marin Transit and Golden Gate Transit buses a as these vehicles travel within Tiburon's boundaries. Electricity used to power electric vehicles is embedded in electricity consumption reported in the Built Environment - Electricity sectors.
- The **Waste** sector represents fugitive methane emissions that are generated over time as organic material decomposes in the landfill. Although most methane is captured or flared off at the landfill, approximately 25% escapes into the atmosphere.
- The **Off-Road** sector represents emissions from the combustion of gasoline and diesel fuel from the operation of off-road vehicles and equipment used for construction and landscape maintenance.
- The **Water** sector represents emissions from energy used to pump, treat, and convey potable water from the water source to Tiburon water users.
- The **Wastewater** sector represents stationary, process and fugitive greenhouse gases that are created during the treatment of wastewater generated by the community, as well as emissions created from electricity used to convey and treat wastewater.

Table 2 shows how emissions in each sector have changed since 2005. The greatest reductions have occurred in the Built Environment - Electricity sector (9,909 $MTCO_2e$), followed by the Transportation sector (6,978 $MTCO_2e$) and the Waste sector (1,451 $MTCO_2e$). The likely reasons for the largest emissions decreases are described in the remainder of this report.

TABLE 2: EMISSIONS SUMMARY BY SECTOR ($MTCO_2E$), 2005 THROUGH 2022

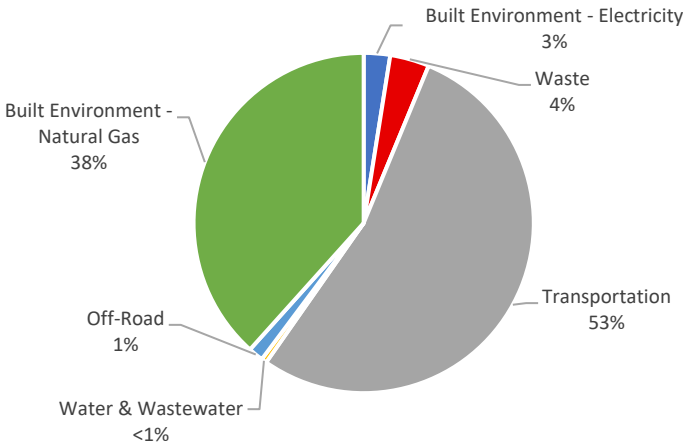
Year	Built Environment - Electricity	Built Environment – Natural Gas	Transportation	Waste	Off-Road	Water	Wastewater	Total	% Change from 2005	% Change from 1990[1]
1990 (est.)[2]								63,328		
2005	10,914	16,892	28,379	2,945	837	366	240	60,573		
2006	10,312	17,038	28,367	2,933	877	322	239	60,088	-1%	
2007	13,821	16,866	28,148	2,642	1,038	433	256	63,205	4%	
2008	13,687	17,345	27,745	2,200	849	399	259	62,483	3%	
2009	12,153	17,187	27,749	1,896	715	402	250	60,352	0%	
2010	8,643	17,889	26,449	1,864	638	231	238	55,951	-8%	
2011	7,958	18,158	26,151	1,820	620	164	234	55,106	-9%	
2012	8,116	17,044	25,774	1,895	610	177	243	53,860	-11%	
2013	7,652	16,559	24,765	1,935	609	208	247	51,975	-14%	
2014	6,989	13,773	23,771	1,960	606	187	243	47,529	-22%	
2015	6,721	13,978	22,855	2,034	600	147	241	46,577	-23%	
2016	5,494	14,969	22,590	2,404	594	110	232	46,394	-23%	
2017	2,471	15,408	23,316	2,517	585	32	228	44,556	-26%	
2018	2,552	14,801	23,541	2,241	571	0	228	43,935	-27%	
2019	2,805	15,354	22,854	2,138	555	0	214	43,921	-27%	
2020	1,838	15,239	21,568	1,889	516	0	216	41,267	-32%	19%
2021	1,419	15,899	21,501	1,558	544	0	209	41,131	-32%	20%
2022	1,005	15,348	21,401	1,493	572	0	203	40,022	-34%	22%
Change from 2005	-9,909	-1,545	-6,978	-1,451	-265	-366	-37	-20,552		
% Change from 2005	-91%	-9%	-25%	-49%	-32%	-100%	-15%	-34%		

Figure 2 shows the relative contribution of emissions from these sectors in 2022. Transportation is the largest sector, representing 53% of community emissions, while the use of natural gas and propane in the Built Environment accounts for 38% of emissions.

[1] *In 2022, Tiburon adopted a Climate Action Plan that established a goal to reduce emissions 50% below 1990 levels by 2030. This column will track that progress over time.*

[2] *Per California Air Resources Board guidance, 1990 levels are estimated at 15% below 2005 levels.*

FIGURE 2: EMISSIONS BY SECTOR, 2022

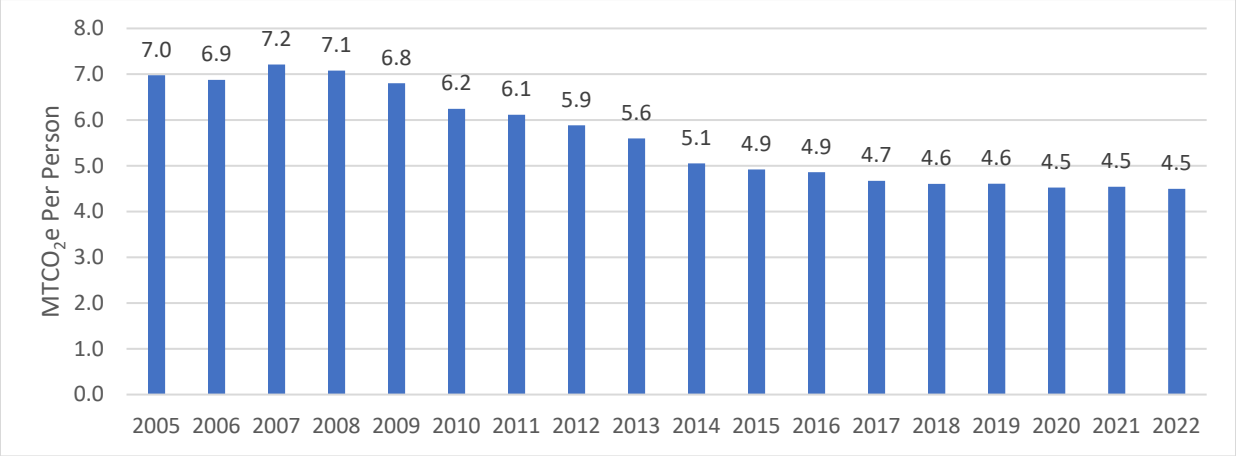


PER CAPITA EMISSIONS

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. Per capita emission rates may be compared among Marin jurisdictions, although some jurisdictions may have higher rates due to the presence of commercial and industrial uses.

Dividing the total communitywide GHG emissions by residents yields a result of 7.0 metric tons CO_2e per capita in 2005. Per capita emissions decreased 36% between 2005 and 2022, falling to 4.5 metric tons per person. Figure 3 shows the trend in per capita emissions over time. It is important to understand that this number is not the same as the carbon footprint of the average individual living in Tiburon, which would include lifecycle emissions, emissions resulting from air travel, emissions resulting from air travel, etc.

FIGURE 3: EMISSIONS PER CAPITA



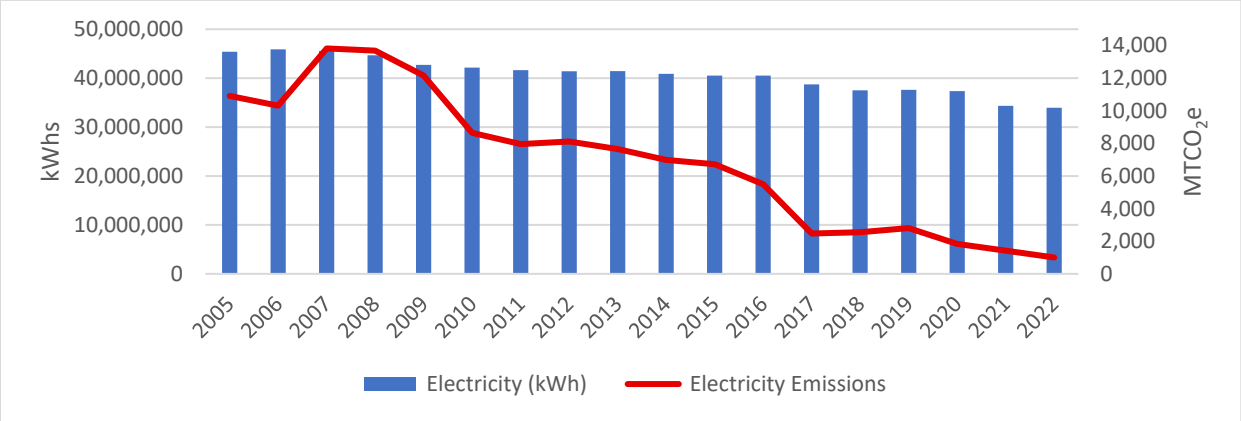
Significant Sources of Emissions

The following sections provide a year-by-year analysis of the changes in GHG emissions from the Town's use of electricity, natural gas, transportation and water and generation of waste. Whenever possible, each section discusses the change in emissions from previous years and the likely influence of state and local programs or policies and external factors on reducing emissions.

Built Environment - Electricity

Purchased electricity use in homes and businesses in Tiburon decreased about 25% between 2005 and 2022. This is due to solar PV installation and improved energy efficiency and conservation. Greenhouse gas emissions from this electricity use decreased 91% since 2005, as shown in Figure 4. T This is primarily due to the lower carbon intensity of electricity. PG&E has been steadily increasing the amount of renewable energy in its electricity mix. In 2022, PG&E electricity came from a mix of renewable (38%), large hydroelectric (8%), nuclear (49%), and natural gas (5%) energy sources and was 95% GHG-free.[3] MCE Light Green electricity came primarily from renewable (60%) and hydroelectric (40%) sources and was 95% GHG-free.[4] In 2022, about 4.7% of MCE electricity purchased by Tiburon customers was 100% renewable Deep Green electricity, including electricity purchased by the Town for facilities and operations. The Tiburon Climate Action Plan targets a 96% decrease in electricity emissions between 2005 and 2030.

FIGURE 4: ELECTRICITY USE AND EMISSIONS



Built Environment - Natural Gas

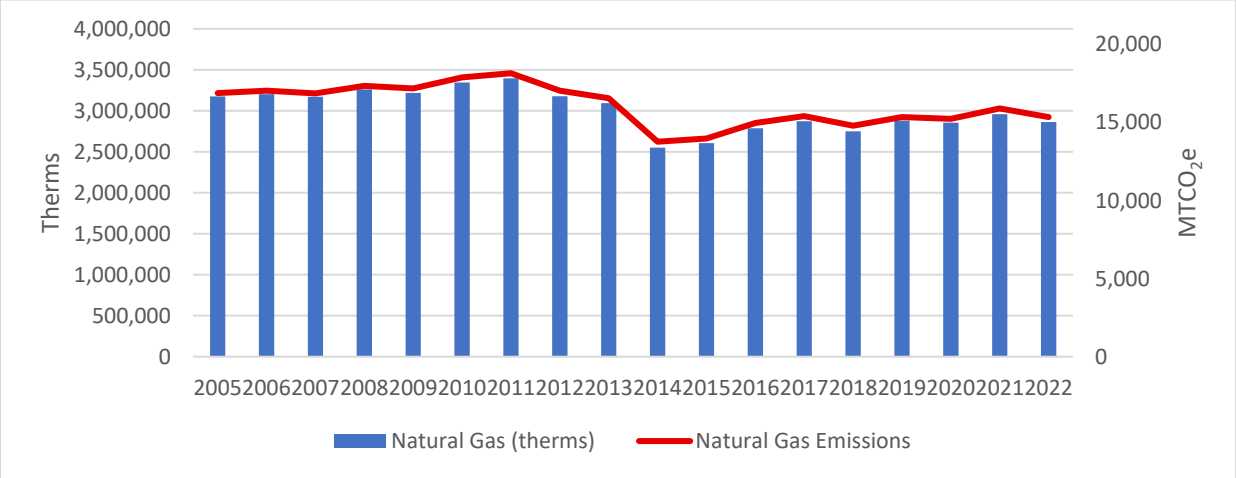
Natural gas is used in residential, commercial, and industrial buildings to provide space and water heating and power appliances. Use of natural gas is highly variable depending on the weather conditions. Reduction in natural gas use may also be attributed to energy efficiency programs and rebates and State building codes.

Natural gas consumption decreased 10% between 2005 and 2022. Unlike electricity emissions which reflect the power content mix, natural gas emissions track the amount of natural gas consumed (Figure 5). Tiburon's Climate Action Plan's target is to reduce natural gas consumption and emissions 34% below the 2005 level by 2030.

[3] PG&E 2022 Power Content Label, https://www.pge.com/content/dam/pge/docs/account/billing-and-assistance/power-content-label.pdf. Nuclear and large hydro sources are considered GHG-free.

[4] MCE 2022 Power Content Label, https://www.mcecleanenergy.org/energy-suppliers/

FIGURE 5: NATURAL GAS USE AND EMISSIONS

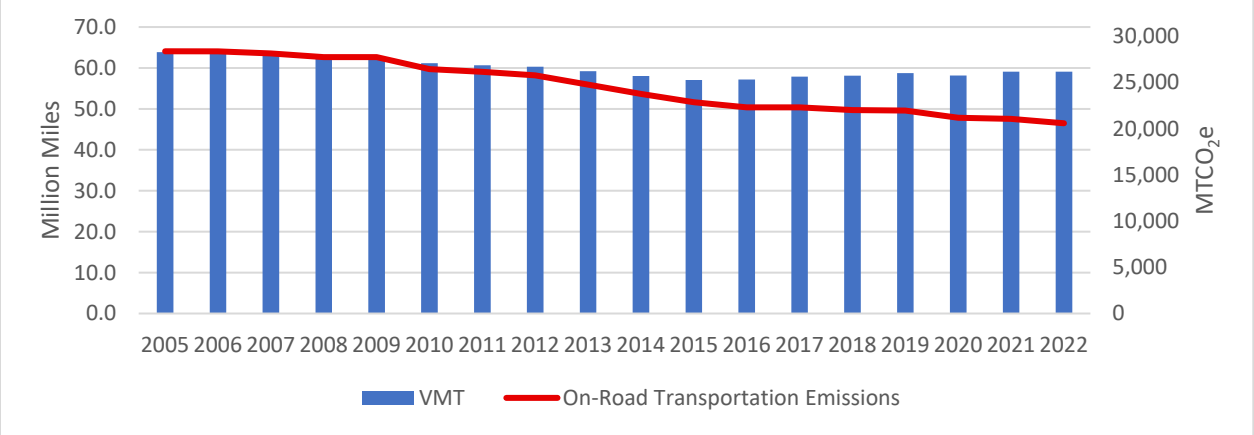


TRANSPORTATION

Transportation activities accounted for approximately 53% of Tiburon's emissions in 2022. According to the transportation model and annual data the Town uses to calculate passenger and commercial vehicle miles, vehicle miles traveled (VMT) have increased approximately 7% since 2005.

On-road transportation emissions have decreased 27% since 2005 due to more fuel-efficient and alternatively fueled cars (see Figure 6). The Golden Gate Ferry, which represents approximately 2% of transportation emissions, began using renewable diesel in 2019, which reduces emissions by approximately 60%. The Climate Action Plan targets a 52% reduction in transportation emissions by 2030.

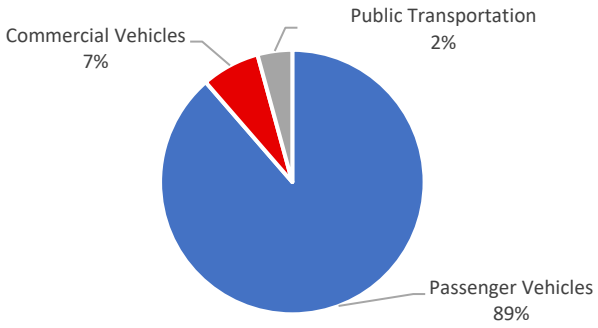
FIGURE 6: VEHICLE MILES TRAVELED AND TRANSPORTATION EMISSIONS



As shown in Figure 7, most of the emissions associated with travel in Tiburon come from passenger vehicles, which accounted for 89% of transportation emissions in 2022. Marin County continues to be a leader in zero emission vehicles (ZEVs) – second only to Santa Clara County – with 15,449 ZEVs in Marin at the end of 2022, or about 7.5% of registered automobiles. ZEVs include battery electric cars, plug-in hybrid electric cars, hydrogen fuel cell cars,

and zero-emission motorcycles. Tiburon's Climate Action Plan targets 45% of passenger vehicles registered in Marin and travelling in Tiburon to be ZEVs by 2030.

FIGURE 7: TRANSPORTATION EMISSIONS BY VEHICLE TYPE, 2022



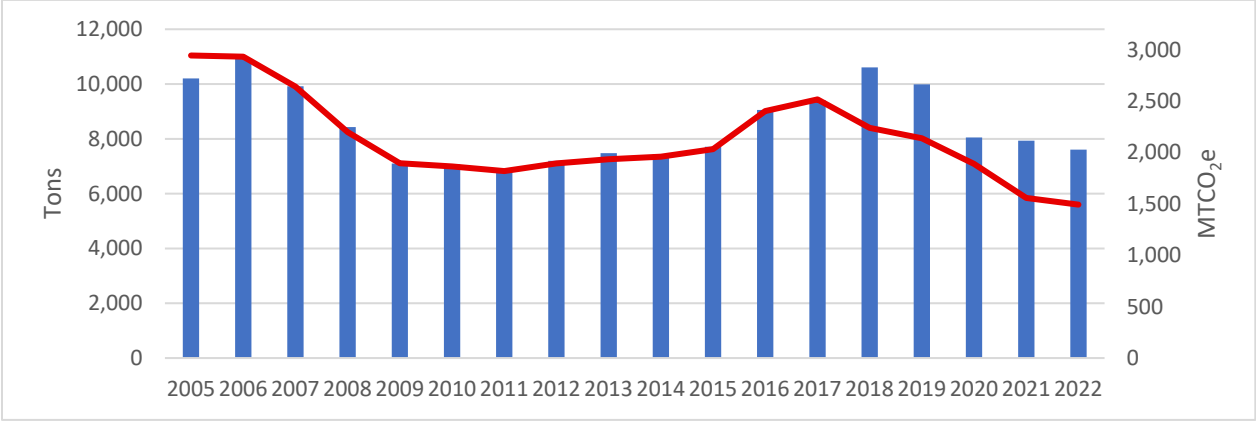
Note: Public Transportation represents emissions from Marin Transit and Golden Gate Transit fixed-route buses and ferries.

While it is difficult to pinpoint exactly how each land use and transportation policy affects emissions, the Town has undertaken many efforts to reduce transportation emissions. The Town encourages workforce housing and has made it easier for residents to use carbon-free modes of transportation, such as bicycling and walking, through improvements to the transportation network.

Waste Disposal

Total landfilled waste (including alternative daily cover)[5] decreased 4% between 2021 and 2022 and was 25% below 2005 levels in 2022, based on countywide disposal data. Emissions from waste disposal decreased 49% since 2005 primarily due to the lower organic content of waste deposited in the landfill and material used for alternative daily cover. The Climate Action Plan's target is to reduce waste disposal emissions 95% below the 2005 level by 2030.

FIGURE 8: DISPOSED WASTE AND EMISSIONS

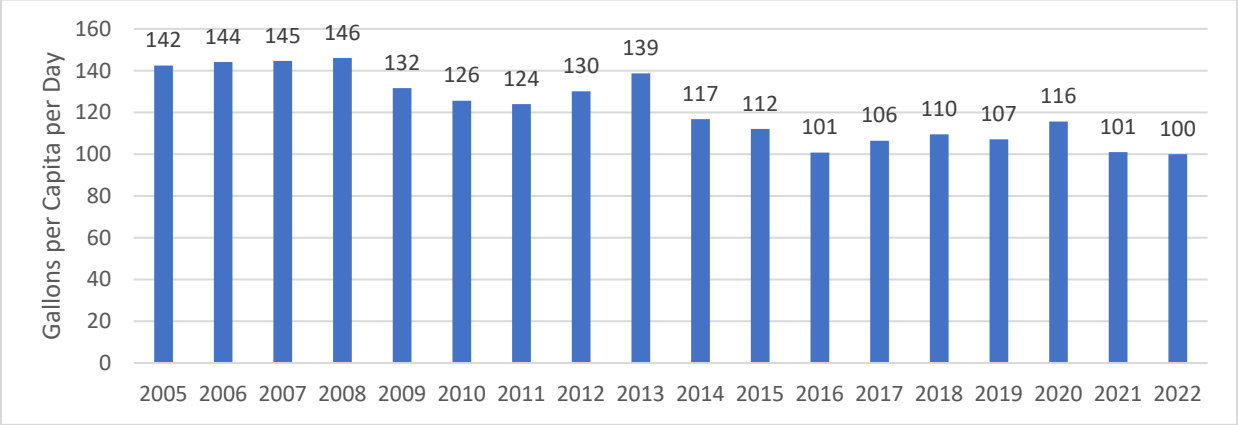


[5] Alternative daily cover is material other than earthen material placed on the surface of the active face of a municipal solid waste landfill at the end of each operating day to control vectors, fires, odors, blowing litter, and scavenging.

Water Use

Per capita water use dropped 1% between 2021 and 2022 and has declined 30% since 2005 (based on water district-wide data). Emissions, which are based on an estimate of energy used to pump, treat, and convey water from the water source to the Town limits, dropped 100% between 2005 and 2022 due to the water agencies' use of carbon-free electricity. Marin Water purchases MCE Deep Green for its electricity needs, and the Sonoma County Water Agency, which supplies approximately 25% of Marin Water's water, uses renewable and carbon-free sources for its electricity.

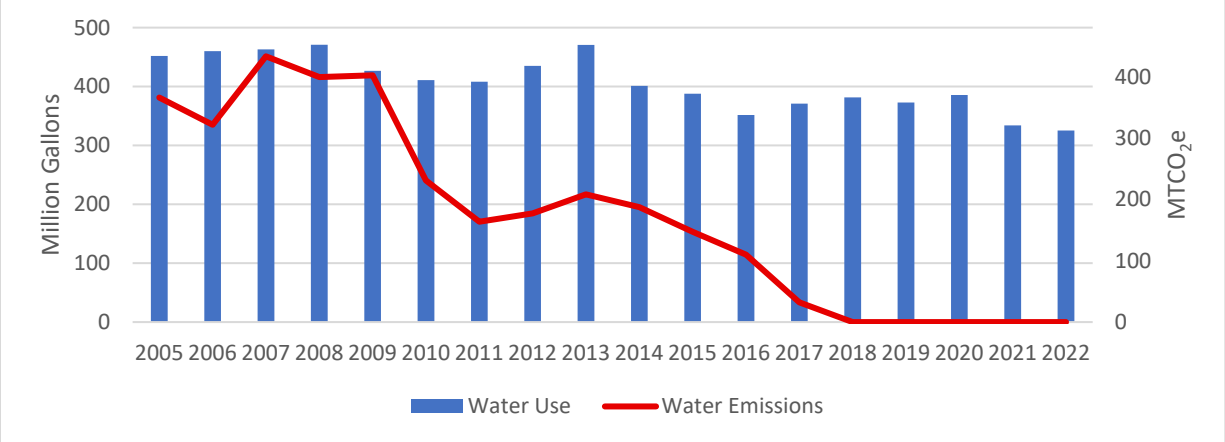
FIGURE 9: PER CAPITA WATER USE



Source: Marin Municipal Water District

Tiburon's Climate Action Plan's goal is to reduce annual water consumption 26% below the 2005 level to 334 million gallons, an amount achieved in 2021.

FIGURE 10: WATER USE AND EMISSIONS



MMWD provides rebates and programs to reduce water use. Rebates are available to replace fixtures with high-efficiency clothes washers and to purchase cisterns and rain barrels. MMWD provides free home and landscape water-use evaluations as well as free high-efficiency showerheads and faucet aerators.

APPENDIX: COMMUNITY INVENTORY

Community GHG Emissions Summary Table

Jurisdiction: Town of Tiburon
Population: 8,903 (CA Department of Finance)
Number of Households: 3,714 (CA Department of Finance)

Inventory Year: 2022
Date Prepared: February 12, 2024
Reporting Framework: Communitywide Activities

ID	Emissions Type	Source or Activity	Included, Required Activities	Included, Optional Activities	Excluded (IE, NA, NO or NE)	Notes	Emissions ($MTCO_2e$)
1.0	Built Environment						
1.1	Use of fuel in residential and commercial stationary combustion equipment	Both	●				15,348
1.2	Industrial stationary sources	Source			NE		
1.3	Power generation in the community	Source			NO		
1.4	Use of electricity in the community	Activity	●			Includes transmission and distribution losses	1,005
1.5	District heating/cooling facilities in the community	Source			NE		
1.6	Use of district heating/cooling facilities in the community	Activity			NE		
1.7	Industrial process emissions in the community	Source			NO		
1.8	Refrigerant leakage in the community	Source			NE		
2.0	Transportation and Other Mobile Sources						
2.1	On-road passenger vehicles operating within the community boundary	Source			IE	Obtained data for preferred activity-based method instead	
2.2	On-road passenger vehicles associated with community land uses	Activity	●				18,968
2.3	On-road freight and service vehicles operating within the community boundary	Source			IE	Obtained data for preferred activity-based method instead	
2.4	On-road freight and service vehicles associated with community land uses	Activity	●				1,524
2.5	On-road transit vehicles associated with community land uses	Activity		●			95
2.6	Transit rail vehicles operating with the community boundary	Source			NO		
2.7	Use of transit rail travel by the community	Activity			NE		
2.8	Inter-city passenger rail vehicles operating within the community boundary	Source			NO		
2.9	Freight rail vehicles operating within the community boundary	Source			NO		

2.10	Marine vessels operating within the community boundary	Source			NE		
2.11	Use of ferries by the community	Activity		●		Public ferries only	814
2.12	Off-road surface vehicles and other mobile equipment operating within the community boundary	Source		●			572
2.13	Use of air travel by the community	Activity			NE		
3.0	Solid Waste						
3.1	Operation of solid waste disposal facilities in the community	Source			NO		
3.2	Generation and disposal of solid waste by the community	Activity	●			Includes alternative daily cover	1,451
4.0	Water and Wastewater						
4.1	Operation of water delivery facilities in the community	Source			IE	Energy use is included in 1.1 and 1.4.	
4.2	Use of energy associated with use of potable water by the community	Activity	●				0
4.3	Use of energy associated with generation of wastewater by the community	Activity	●				4
4.4	Process emissions from operation of wastewater treatment facilities located in the community	Source	●			Only emissions associated with wastewater generated by the community are included.	138
4.5	Process emissions associated with generation of wastewater by the community	Activity	●				61
4.6	Use of septic systems in the community	Source			NE		
5.0	Agriculture						
5.1	Domesticated animal production	Source			NE		
5.2	Manure decomposition and treatment	Source			NE		
6.0	Upstream Impacts of Communitywide Activities						
6.1	Upstream impacts of fuels used in stationary applications by the community	Activity			NE		
6.2	Upstream and transmission and distribution (T&D) impacts of purchased electricity used by the community	Activity			IE	Transmission and distribution losses included in 1.4.	
6.3	Upstream impacts of fuels used by water and wastewater facilities for water used and wastewater generated within the community boundary	Activity			IE	Included in 4.2 and 4.3.	
6.4	Upstream impacts of select materials (concrete, food, paper, carpets, etc.) used by the whole community.	Activity			NE		

Legend

IE – Included Elsewhere: Emissions for this activity are estimated and presented in another category of the inventory. The category where these emissions are included should be noted in the explanation.

NE – Not Estimated: Emissions occur but have not been estimate or reported (e.g., data unavailable, effort required not justifiable).

NA – Not Applicable: The activity occurs but does not cause emissions; explanation should be provided.

NO – Not Occurring: The source or activity does not occur or exist within the community.

Community Emissions Data Sources and Calculation Methodologies

Sector/ID	Emissions Source	Source and/or Activity Data	Emission Factor and Methodology
1.0 Built Environment			
1.1 Stationary Combustion	Stationary Combustion (CO_2, CH_4 & N_2O)	Known fuel use (meter readings by PG&E) and estimated fuel use (American Community Survey 5-Year Estimates, and U.S. Energy Information Administration Household Site Fuel Consumption data). Non-residential electricity consumption failed the CPUC 15/15 rule and was estimated using zip code data and subtracting estimated Belvedere consumption.	Default CO_2, CH_4 & N_2O emission factors by fuel type (U.S. Community Protocol v. 1.1 Tables B.1 and B.3). U.S. Community Protocol v. 1.1, Appendix C, Method BE.1.1 and BE.1.2.
1.4 Electricity Use	Electricity Use (CO_2, CH_4 & N_2O)	Estimated and known electricity use (meter readings by PG&E and MCE, subject to data privacy regulations) and estimated direct access electricity consumption.	Verified utility-specific emission factors (PG&E and MCE) and eGrid subregion default emission factors. U.S. Community Protocol v. 1.1, Appendix C, Method BE.2.1.
	Electric Power Transmission and Distribution Losses (CO_2, CH_4 & N_2O)	Estimated electricity grid loss for Western region from eGrid.	U.S. Community Protocol v. 1.1, Appendix C, Method BE.4.1.
2.0 Transportation and Other Mobile Sources			
2.2 On-Road Passenger Vehicle Operation	On-Road Mobile Combustion (CO_2)	Estimated passenger vehicle miles traveled associated with origin and destination land uses (Metropolitan Transportation Commission, CAPVMT Data Portal 2.0 (mtcanalytics.org)).	CO_2 for on-road passenger vehicles quantified in the EMFAC2021 v.1.0.2 model. Passenger vehicle emissions calculated according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.1.A.
	On-Road Mobile Combustion (CH_4 & N_2O)	Estimated vehicle miles traveled associated with origin and destination land uses (Metropolitan Transportation Commission, CAPVMT Data Portal 2.0 (mtcanalytics.org)).	CH_4 and N_2O for on-road passenger vehicles quantified in the EMFAC2021 v.1.0.2 model. Passenger vehicle emissions calculated according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.1.A.
2.4 On-Road Freight and Service Truck Freight Operation	On-Road Mobile Combustion (CO_2)	Estimated commercial vehicle miles traveled within the boundary (Metropolitan Transportation Commission utilizing the 2017 Regional Transportation Plan).	CO_2 for on-road commercial vehicles quantified in the EMFAC2021 v.1.0.2 model. Emissions allocated utilizing LEHD data according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.2.A.
	On-Road Mobile Combustion (CH_4 & N_2O)	Estimated commercial vehicle miles traveled within the boundary (Metropolitan Transportation Commission utilizing Plan Bay Area 2050).	CH_4 and N_2O for on-road commercial vehicles quantified in the EMFAC2021 v.1.0.1 model. Emissions allocated utilizing LEHD data according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.2.A.
2.5 On-Road Transit Operation	On-Road Mobile Combustion (CO_2)	Estimated vehicle miles traveled within the boundary (Marin Transit and Golden Gate Transit) and estimated diesel fuel efficiency for transit fleet (Golden Gate Transit). Fuel type provided by Marin Transit and Golden Gate Transit.	Renewable diesel emission factor provided by NEXGEN. U.S. Community Protocol v. 1.1, Appendix D, Method TR.4.A.
	On-Road Mobile Combustion (CH_4 & N_2O)	Estimated vehicle miles traveled within the boundary (Marin Transit and Golden Gate Transit) and estimated diesel fuel efficiency for transit fleet (Golden Gate Transit). Fuel type provided by Marin Transit and Golden Gate Transit.	Renewable diesel emission factor provided by NEXGEN. U.S. Community Protocol v. 1.1, Appendix D, Method TR.4.B.
2.11 Ferries	Mobile Combustion (CO_2)	Estimated vehicle miles traveled and fuel type provided by Golden Gate Transit.	Renewable diesel emission factor provided by NEXGEN. U.S. Community Protocol v. 1.1, Appendix D, Method TR.4.E.

	Mobile Combustion (CH_4 & N_2O)	Estimated vehicle miles traveled and fuel type provided by Golden Gate Transit.	Renewable diesel emission factor provided by NEXGEN. U.S. Community Protocol v. 1.1, Appendix D, Method TR.4.E.
2.12 Off-Road Vehicles and Equipment	Off-Road Mobile Combustion (CO_2)	Estimated fuel use from OFFROAD 2021 v.1.0.1 for Lawn and Garden and Construction equipment. All categories are allocated by share of countywide households.	CO_2 emissions calculated according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.8. Emission factors provided in Table TR.1.6.
	Off-Road Mobile Combustion (CH_4 & N_2O)	Estimated fuel use from OFFROAD 2021 v.1.0.1 for Lawn and Garden and Construction equipment. All categories are allocated by share of countywide households.	CH_4 and N_2O emissions calculated according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.8. Emission factors provided in the Local Government Operations Protocol Table G.11 and G.14.
3.0 Solid Waste			
3.2 Solid Waste Generation and Disposal	Fugitive Emissions from Landfilled Waste (CH_4)	Estimated landfilled tons based on reporting to CalRecycle by Marin County Solid and Hazardous Waste JPA and allocated to jurisdiction based on share of countywide population. Waste characterization based on the Statewide Waste Characterization Study (2008, 2014, 2018 and 2021) and Alternative Daily Cover by Jurisdiction of Origin and Material Type as reported to CalRecycle.	Emission factors calculated utilizing U.S. Community Protocol for Accounting and Report of Greenhouse Gas Emissions, Version 1.1, July 2013, Appendix E, Method SW.4.
4.0 Water and Wastewater			
4.2 Water Supply & Conveyance, Treatment and Distribution	Electricity Use (CO_2)	Water consumption (district-wide gpcd) and electricity usage provided by Marin Municipal Water District (MMWD). Sonoma County Water Agency (SCWA) water delivery amount provided by SCWA.	Verified utility-specific emission factors (PG&E, MCE and SCWA). Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.14.
	Electricity Use (CH_4 & N_2O)	Water consumption (district-wide gpcd) and electricity usage provided by Marin Municipal Water District (MMWD).	eGrid subregion default emission factors. Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.14.
4.5 Treatment of Wastewater	Stationary Emissions from Combustion of Digester Gas (CH_4)	Known amount of digester gas produced per day and known percent of methane in digester gas provided by Sewerage Agency of Southern Marin (SASM). Estimated service population and percent of methane in digester gas provided by Sanitary District No. 5.	SASM emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.1.a. Sanitary District No.5 emissions calculated according to Method WW.1.(alt).
	Stationary Emissions from Combustion of Digester Gas (N_2O)	Known amount of digester gas produced per day and known percent of methane in digester gas provided by Sewerage Agency of Southern Marin (SASM). Estimated service population and percent of methane in digester gas provided by Sanitary District No. 5.	SASM emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.2.a. Sanitary District No.5 emissions calculated according to Method WW.2.(alt).
	Process Emissions from Wastewater Treatment Plant without	Estimated population served by wastewater treatment plant provided by SASM.	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.8.

	Nitrification or Denitrification		
	Process Emissions from Wastewater Treatment Plant with Nitrification or Denitrification	Estimated population served by wastewater treatment plant provided by Sanitary District No. 5.	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.7.
	Fugitive Emissions from Effluent Discharge (N_2O)	Estimated population served by wastewater treatment plant provided by SASM and Sanitary District No.5. Assumed significant industrial or commercial input.	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.12(alt).