CITY OF NOVATO

COMMUNITY GREENHOUSE GAS EMISSIONS INVENTORY FOR THE YEAR 2022

January 2024

Prepared by the
Marin Climate & Energy Partnership

MARIN CLIMATE & ENERGY PARTNERSHIP

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EXECUTIVE SUMMARY

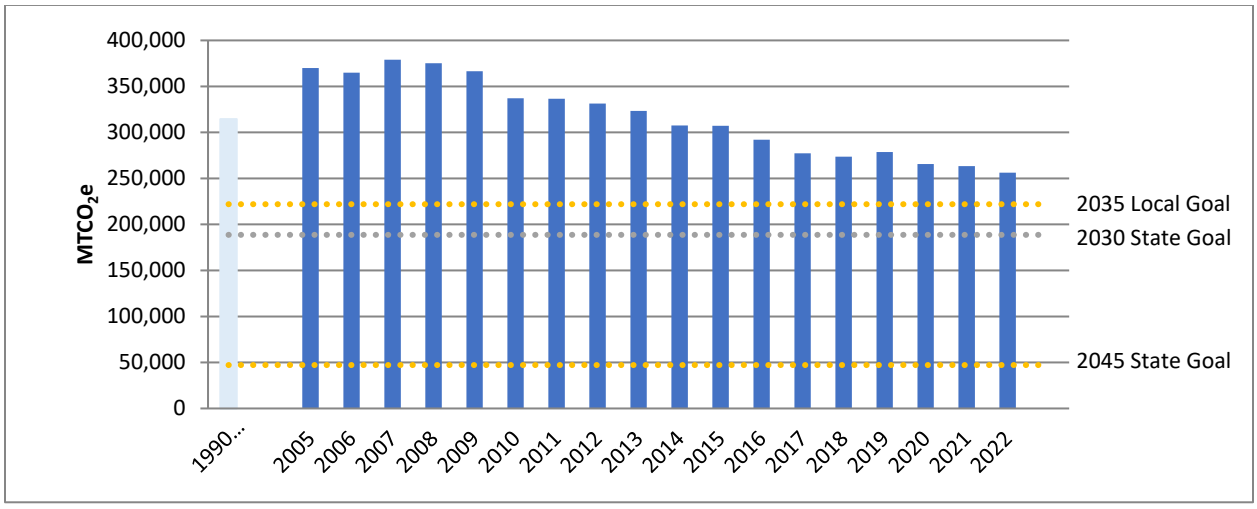
THE TAKEAWAY:

COMMUNITY EMISSIONS ARE DOWN 31% SINCE 2005, EQUIVALENT TO 18% BELOW 1990 LEVELS

Novato publishes annual community greenhouse gas (GHG) emissions estimates through the Marin Climate & Energy Partnership (MCEP). Annual inventories help the City to monitor its progress more closely in meeting its local goals to reduce community emissions and to meet the statewide goal to reduce emissions 40% below 1990 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 Novato community has reduced emissions 31%, which is equivalent to 18% below estimated 1990 emissions. Emissions dropped from about 369,971 metric tons carbon dioxide equivalents ($MTCO_2e$) in 2005 to 256,241 $MTCO_2e$ in 2022. The community emissions trend and targets are shown below. Novato needs to reduce emissions another 67,555 $MTCO_2e$ to meet the local and State target for 2030 and another 209,069 $MTCO_2e$ to meet the State net zero emissions goal for 2045, which includes a GHG mitigation target of 85% below 1990 levels.

FIGURE 1: NOVATO GHG EMISSIONS AND TARGETS



Recognizing the need for a collaborative approach to greenhouse gas reductions, City and county leaders launched the Marin Climate and Energy Partnership (MCEP) in 2007. The City of Novato 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 Novato 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. In particular, the Metropolitan Transportation Commission released an updated traffic model in 2023, which raised vehicle miles traveled (VMT) estimates after 2015.

GENERAL METHODOLOGY

This inventory uses the national standard for the accounting and reporting of community-wide greenhouse gas emissions, the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, version 1.2 (July 2019). 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, gallons of diesel or gasoline, etc. – by emissions factors specific to the greenhouse gas-generating 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 – i.e., 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 several 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 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 Novato community resulted in approximately 369,971 metric tons of CO_2e. In 2022, those activities resulted in approximately 256,241 metric tons of CO_2e, a reduction of 31% from 2005 levels. This is 18% below estimated 1990 emissions.

The community inventory tracks emissions in seven sectors:

- The **Built Environment – Electricity** sector represents emissions generated from the use of electricity in Novato 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 Novato 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 Novato, as well as a share of tailpipe emissions generated by medium and heavy-duty vehicles travelling on Marin County roads. The sector also includes emissions from Marin Transit and Golden Gate Transit buses and the SMART train as these vehicles travel within Novato's boundaries. Electricity used to power electric vehicles is embedded in electricity consumption reported in the Built Environment - Electricity sector.
- 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 the Novato water users.
- The **Wastewater** sector represents stationary, process and fugitive greenhouse gases that are created during the treatment of wastewater generated by the community. Emissions created from energy used to convey and treat wastewater are included in the Built Environment - Electricity sector.

Figure 2 shows the relative contribution of emissions from these sectors in 2022. The Transportation sector is responsible for the greatest share of communitywide emissions (64%), followed by the Built Environment – Natural Gas sector (28%). Table 2 shows how emissions in each sector have changed since 2005. The greatest reductions have occurred in the Built Environment – Electricity sector (63,082 $MTCO_2e$), followed by the Transportation sector (32,244 $MTCO_2e$). The likely reasons for the largest emissions decreases are described in the remainder of this report.

FIGURE 2: EMISSIONS BY SECTOR, 2022

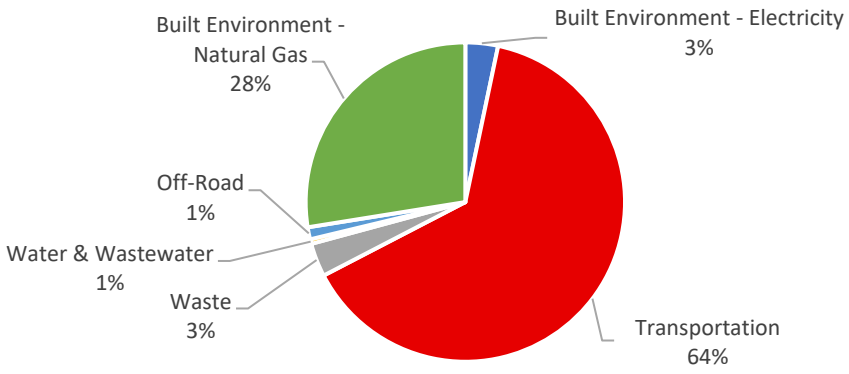


TABLE 2: EMISSIONS SUMMARY BY SECTOR ($MTCO_2E$), 2005 THROUGH 2022

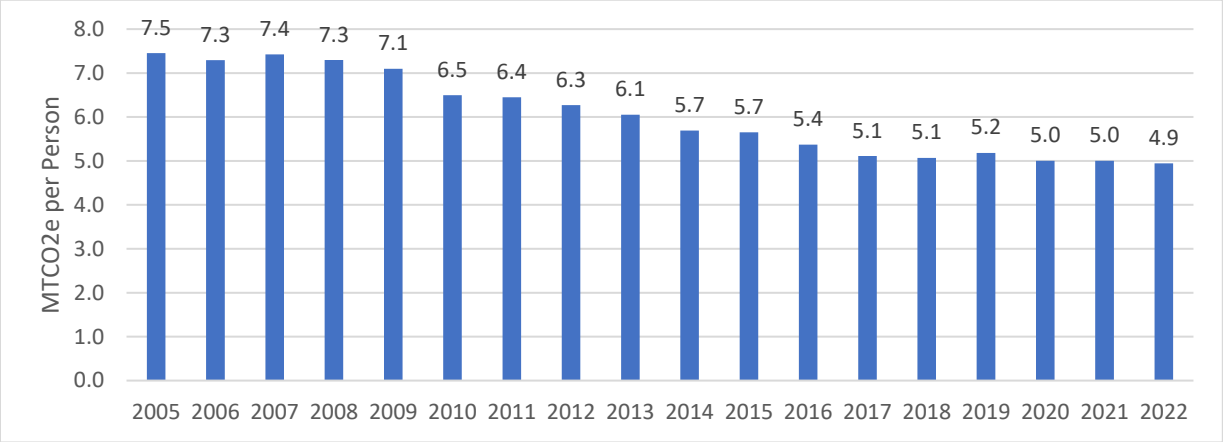
Year	Built Environment - Electricity	Built Environment – Natural Gas	Transportation	Waste	Off-Road	Water	Wastewater	Total	% Change from 2005
2005	71,538	75,742	196,458	16,835	4,391	3,875	1,133	369,971	0%
2006	68,690	77,826	191,930	16,795	4,628	4,003	1,142	365,014	-1%
2007	88,954	76,657	188,878	15,389	5,587	2,337	1,165	378,968	2%
2008	90,536	77,534	185,720	12,813	4,585	2,838	1,173	375,198	1%
2009	85,950	77,418	184,029	11,035	3,868	3,008	1,178	366,485	-1%
2010	65,990	78,505	175,942	10,797	3,441	1,230	1,184	337,090	-9%
2011	58,927	85,899	175,758	10,542	3,345	891	1,191	336,552	-9%
2012	61,833	78,454	174,929	10,941	3,279	774	1,206	331,417	-10%
2013	56,345	79,766	170,734	11,125	3,259	859	1,218	323,307	-13%
2014	52,010	65,417	173,514	11,261	3,242	938	1,233	307,615	-17%
2015	47,879	69,169	173,384	11,672	3,209	679	1,240	307,232	-17%
2016	37,975	66,597	168,803	13,688	3,156	568	1,240	292,027	-21%
2017	19,296	70,631	168,290	14,302	3,098	368	1,237	277,222	-25%
2018	20,251	70,350	166,103	12,689	3,016	0	1,233	273,641	-26%
2019	20,895	71,980	169,625	12,079	2,922	0	1,228	278,729	-25%
2020	14,747	69,053	166,781	11,001	2,835	0	1,212	265,629	-28%
2021	11,943	69,361	168,870	9,069	2,986	0	1,203	263,432	-29%
2022	8,456	70,536	164,214	8,711	3,140	0	1,185	256,241	-31%
Change from 2005	-63,082	-5,206	-32,244	-8,124	-1,252	-3,875	52	-113,730	
% Change from 2005	-88%	-7%	-16%	-48%	-29%	-100%	5%	-31%	

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 7.5 metric tons CO_2e per capita in 2005. Per capita emissions decreased 34% between 2005 and 2022, falling to 4.9 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 Novato, which would include lifecycle emissions, emissions resulting from air travel, the manufacturing and distribution of products and food, 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 use of electricity, natural gas, transportation, and water and the disposal 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.

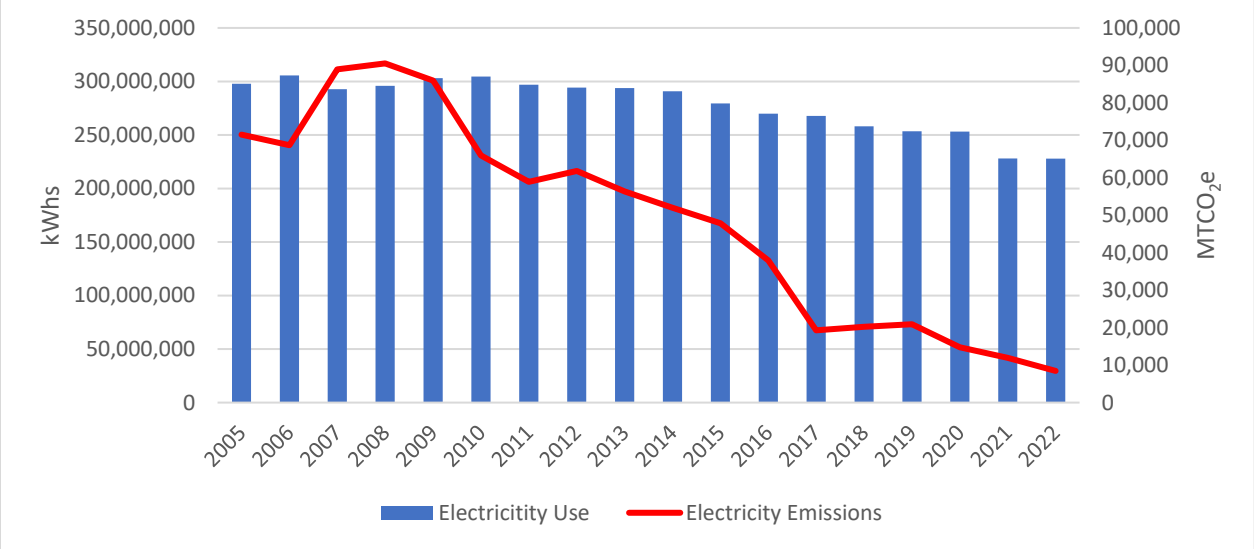
Built Environment - Electricity

Purchased electricity use in homes and businesses in Novato decreased about 23% between 2005 and 2022.[1] Greenhouse gas emissions from purchased electricity consumption decreased 88% since 2005, as shown in Figure 4. 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

[1] Due to California Public Utility Commission data privacy rules, PG&E-generated electricity usage by non-governmental, commercial customers was not reported in 2022. This artificially reduces the total amount of electricity purchased by the community, but most likely does not significantly affect the overall GHG emissions due to the high GHG-free content of PG&E electricity in 2022.

hydroelectric (8%), nuclear (49%), and natural gas (5%) energy sources and was 95% GHG-free.[2] MCE Light Green electricity came primarily from renewable (60%) and hydroelectric (40%) sources and was 95% GHG-free.[3] In 2022, about 4.7% of MCE electricity purchased by Novato customers was 100% renewable Deep Green electricity, including electricty purchased by the City government.

FIGURE 4: ELECTRICITY USE AND EMISSIONS



Built Environment - Natural Gas

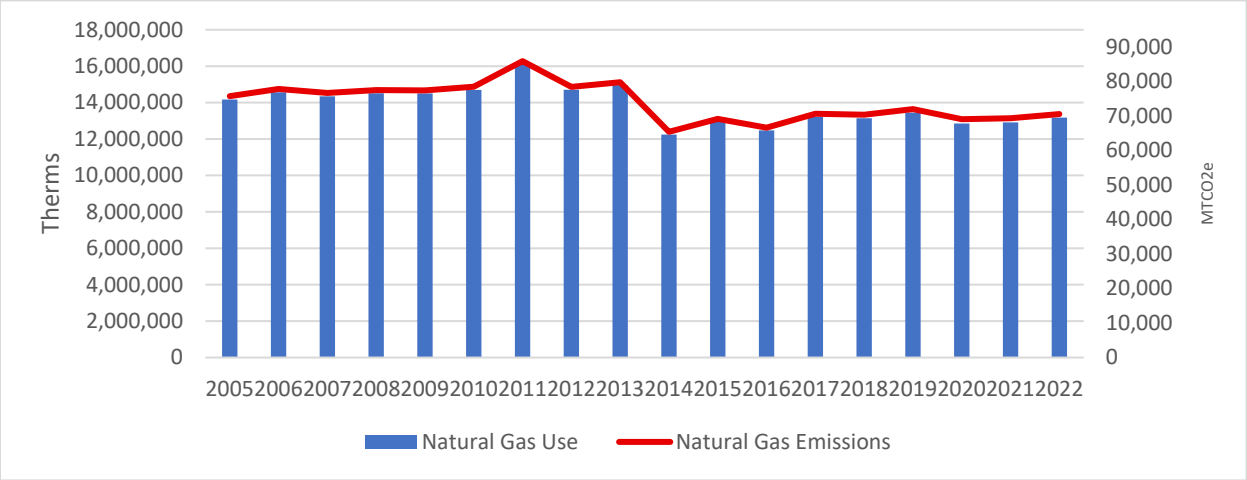
Natural gas is used in residential, commercial, and industrial buildings to provide space and water heating and power appliances. Use of natural gas is highly variable depending on the weather conditions each year. This variability has led natural gas use consumption in Novato to fluctuate from year to year, from a high of 16 million therms in 2011 to a low of 12.2 million therms in 2014. Reduction in energy use may also be attributed to energy efficiency programs and rebates, local green building ordinances, and State building codes.

Natural gas consumption increased 2% between 2021 and 2022 and was 7% below the 2005 level in 2022. Unlike electricity emissions which reflect the power content mix, natural gas emissions track the amount of natural gas consumed (Figure 5).

[2] 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.

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

FIGURE 5: NATURAL GAS USE AND EMISSIONS



TRANSPORTATION

Transportation activities accounted for approximately 64% of Novato's emissions in 2022. According to the transportation model the City uses to calculate passenger and commercial vehicle miles, vehicle miles traveled (VMT) have increased 1% since 2005.

On-road transportation emissions have decreased 17% since 2005 due to more fuel-efficient and alternatively fueled cars (Figure 6). As shown in Figure 7, most transportation emissions come from passenger vehicles, accounting for 72% 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. Novato had 2,588 ZEVs by the end of 2022, or 5.1% of registered light-duty vehicles.

FIGURE 6: ON-ROAD VEHICLE MILES TRAVELED AND TRANSPORTATION EMISSIONS

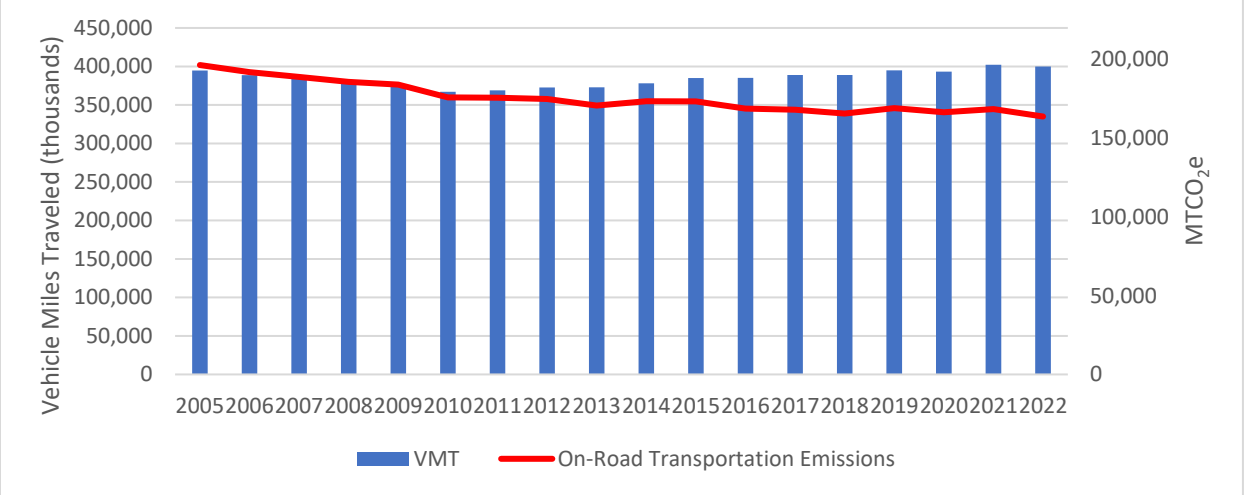
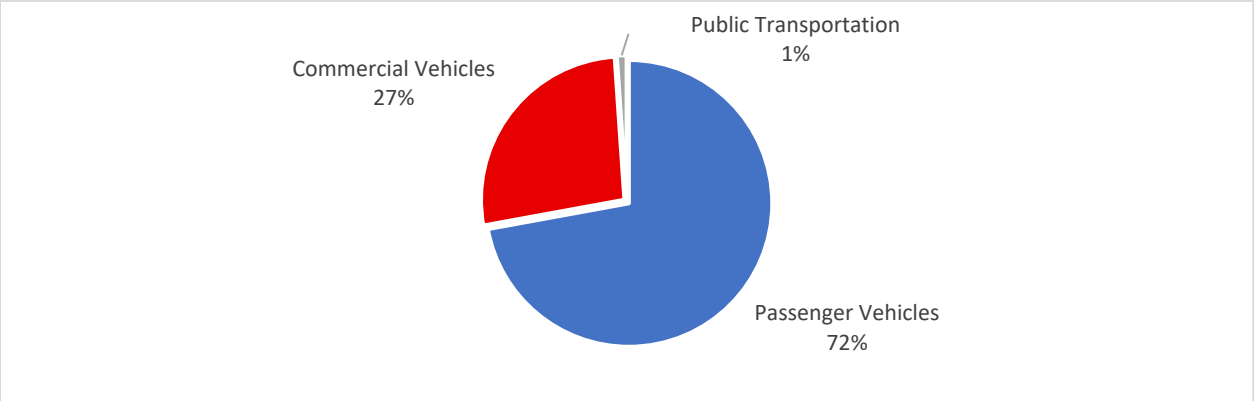


FIGURE 7: TRANSPORTATION EMISSIONS BY VEHICLE CATEGORY, 2022

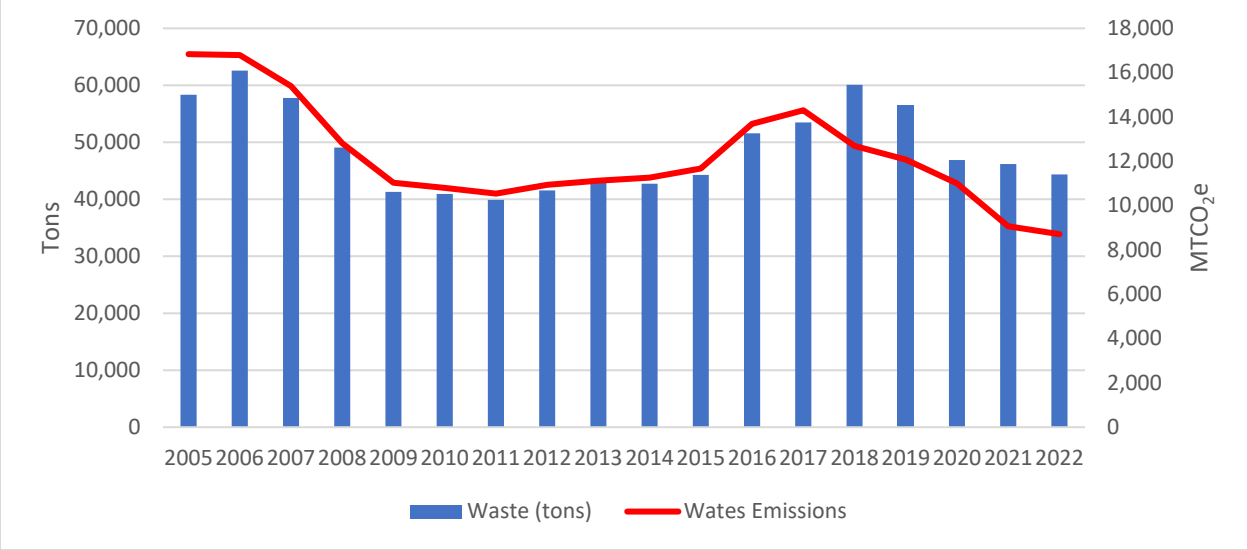


While it is difficult to pinpoint exactly how each land use and transportation policy affects emissions, the City has undertaken many efforts to reduce transportation emissions. The City encourages workforce housing and has made improvements to the transportation network to make it easier for residents to bicycle, walk, and take public transportation. The City has also promoted electric vehicle adoption by installing EV chargers.

Waste Disposal

Waste generated by the community decreased 4% between 2021 and 2022 and was 24% below the 2005 level by 2022 as shown in Figure 8 (based on countywide disposal data). Total landfilled waste includes alternative daily cover.[4] Emissions from waste disposal decreased 48% due to the lower organic content of landfilled waste (based on statewide waste characterization studies) and material used for alternative daily cover.

FIGURE 8: DISPOSED WASTE AND EMISSIONS



[4] 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 declined 39% since 2005. Emissions, which are based on an estimate of energy used to pump, treat, and convey water from the water source to the City limits, dropped 100% between 2005 and 2022 due to the water agencies' use of carbon-free electricity. The North Marin Water District (NMWD) purchases MCE Deep Green for its electricity needs, and the Sonoma County Water Agency, which supplies approximately 80% of NMWD's water, uses renewable and carbon-free sources for its electricity.

FIGURE 9: PER CAPITA WATER USE

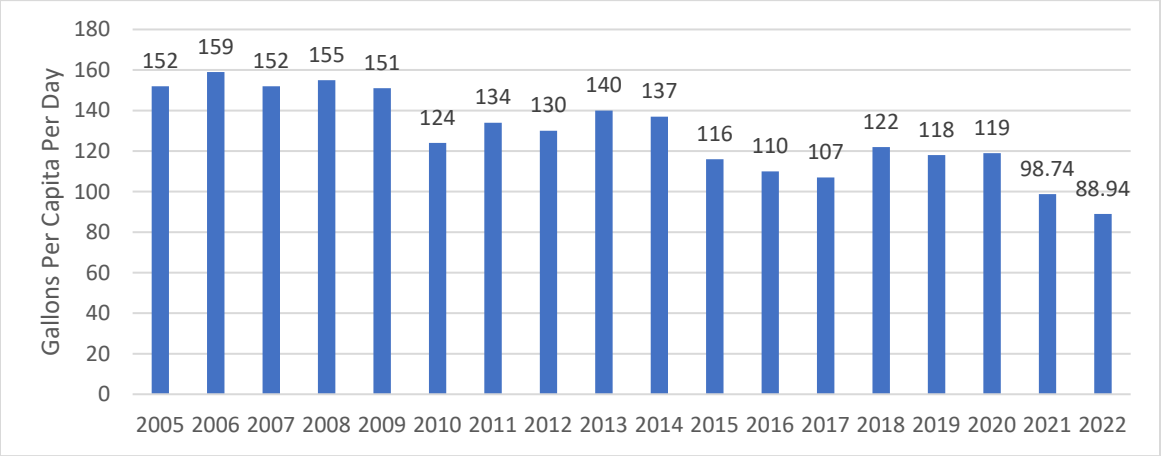
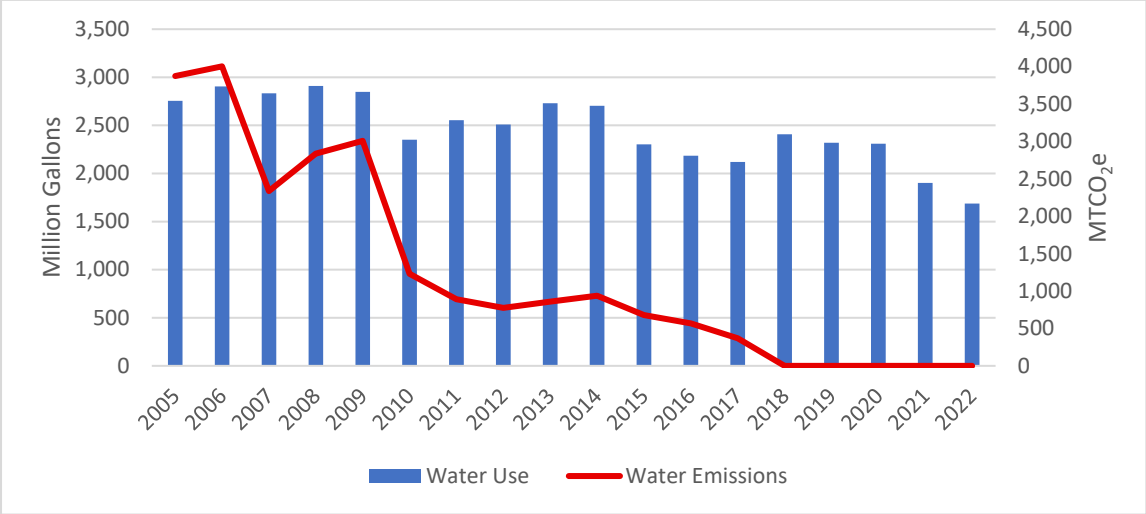


FIGURE 10: WATER USE AND EMISSIONS



Source: NMWD

NMWD provides rebates and programs to reduce water use. Rebates are available to replace lawns with low water use planting and for the purchase and installation of mulch. NMWD also provides rebates for pool covers, rainwater catchment, greywater systems, weather-based irrigation controllers, and replacement of washing machines and toilets with high-efficiency fixtures. NMWD provides free home and landscape water-use evaluations.

APPENDIX: COMMUNITY INVENTORY

Community GHG Emissions Summary Table

Jurisdiction: City of Novato
Population: 51,936 in 2022 (CA Department of Finance)
Number of Households: 20,566 (CA Department of Finance)

Inventory Year: 2022
Date Prepared: January 31, 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	●				70.536
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	8,456
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	●				118,439
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	●				43,993
2.5	On-road transit vehicles associated with community land uses	Activity		●			1,338
2.6	Transit rail vehicles operating with the community boundary	Source		●			444
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			NE		
2.12	Off-road surface vehicles and other mobile equipment operating within the community boundary	Source		●			3,140
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			NE		
3.2	Generation and disposal of solid waste by the community	Activity	●			Includes alternative daily cover	8,711
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	●			Energy use is included in 1.1 and 1.4	
4.4	Process emissions from operation of wastewater treatment facilities located in the community	Source			NE	Wastewater treatment facilities are located in the community but only process emissions associated with generation of wastewater by the community are reported in 4.5	
4.5	Process emissions associated with generation of wastewater by the community	Activity	●				1,185
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		
6.4	Upstream impacts of select materials (concrete, food, paper, carpets, etc.) sued 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 estimated 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).	Default CO_2, CH_4 & N_2O emission factors by fuel type (U.S. Community Protocol v. 1.1, Appendix C, 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)	Known electricity use (meter readings by PG&E and MCE) and estimated direct access electricity consumption. Non-governmental, commercial PG&E electricity consumption failed the CPUC 15/15 rule and was not reported or included in this report.	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 2021.	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 Plan Bay Area 2050.	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 2040.	CH_4 and N_2O 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.
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	Estimated vehicle miles traveled within the boundary (Marin Transit and Golden Gate Transit) and estimated diesel fuel	Renewable diesel emission factor provided by NEXGEN. U.S. Community Protocol v. 1.1, Appendix D, Method TR.4.B.

	(CH_4 & N_2O)	efficiency for transit fleet (Golden Gate Transit). Fuel type provided by Marin Transit and Golden Gate Transit.	
2.6 Passenger Rail	Mobile Combustion (CO_2, CH_4 & N_2O)	Estimated train-miles by multiplying the number of train cars per day (in both directions, according to the SMART published schedule) by the railway track mileage located within the community boundary (Marin Map). Average Diesel Multiple Unit fuel efficiency provided by SMART.	U.S. Community Protocol v. 1.1, Appendix D, Method TR.5. Emission factors from Equation TR.5.2.
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 the 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 data provided by North Marin Water District (NMWD). Sonoma County water supply data from NMWD Annual Reports. Estimated electricity use for NMWD water from CEC report, "Refining Estimates of Water-Related Energy Use in California."	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 data provided by North Marin Water District (NMWD). Sonoma County water supply data from NMWD Annual Reports. Estimated electricity use for NMWD water from CEC report, "Refining Estimates of Water-Related Energy Use in California."	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 estimated percent of methane in digester gas (65%) provided by Novato Sanitary District.	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.1.(alt).

	Stationary Emissions from Combustion of Digester Gas (N_2O)	Known amount of digester gas produced per day and estimated percent of methane in digester gas (65%) provided by Novato Sanitary District.	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.2.a.
	Process Emissions from Wastewater Treatment Plant with Nitrification or Denitrification	Estimated population served by wastewater treatment plant provided by Novato Sanitary District.	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 Novato Sanitary District. Assumed significant industrial or commercial input.	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.12(alt).