COUNTY OF MARIN

INTERIM COMMUNITY GREENHOUSE GAS EMISSIONS ASSESSMENT

September 2019

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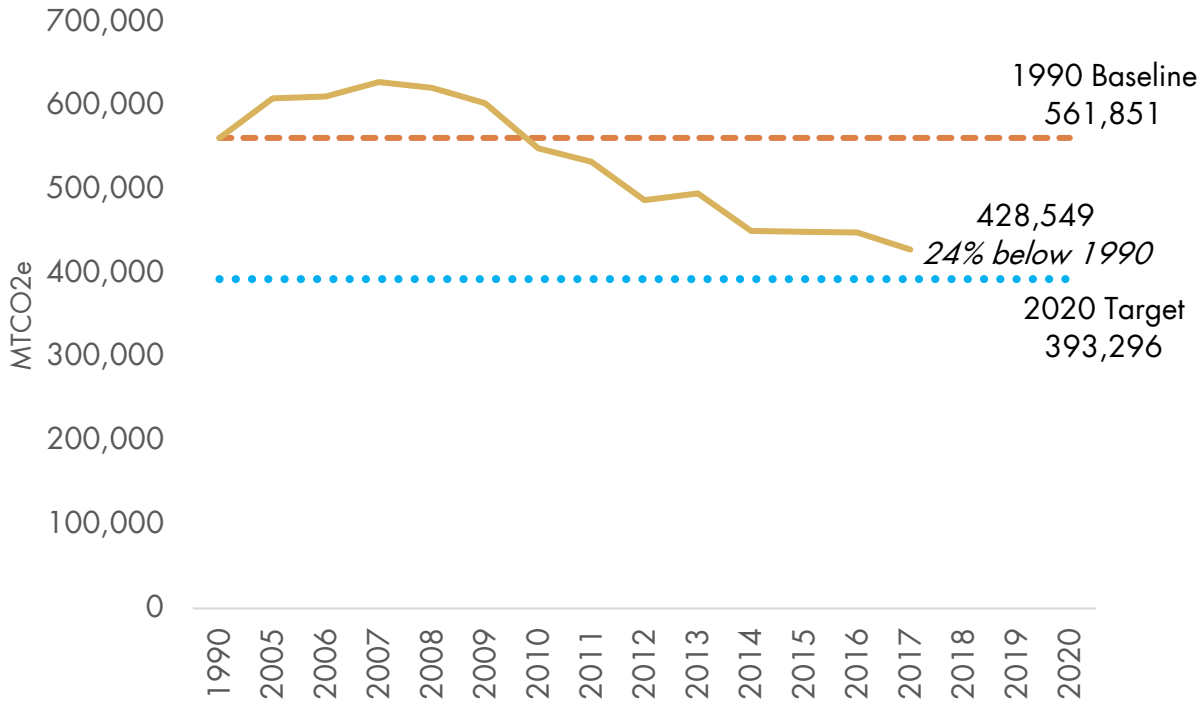
EXECUTIVE SUMMARY

The County of Marin's Climate Action Plan Update, adopted in November 2015, establishes a target of reducing community greenhouse gas (GHG) emissions in the unincorporated portions of the County 30% below 1990 levels by 2020. This report provides an overview of progress towards those goals.

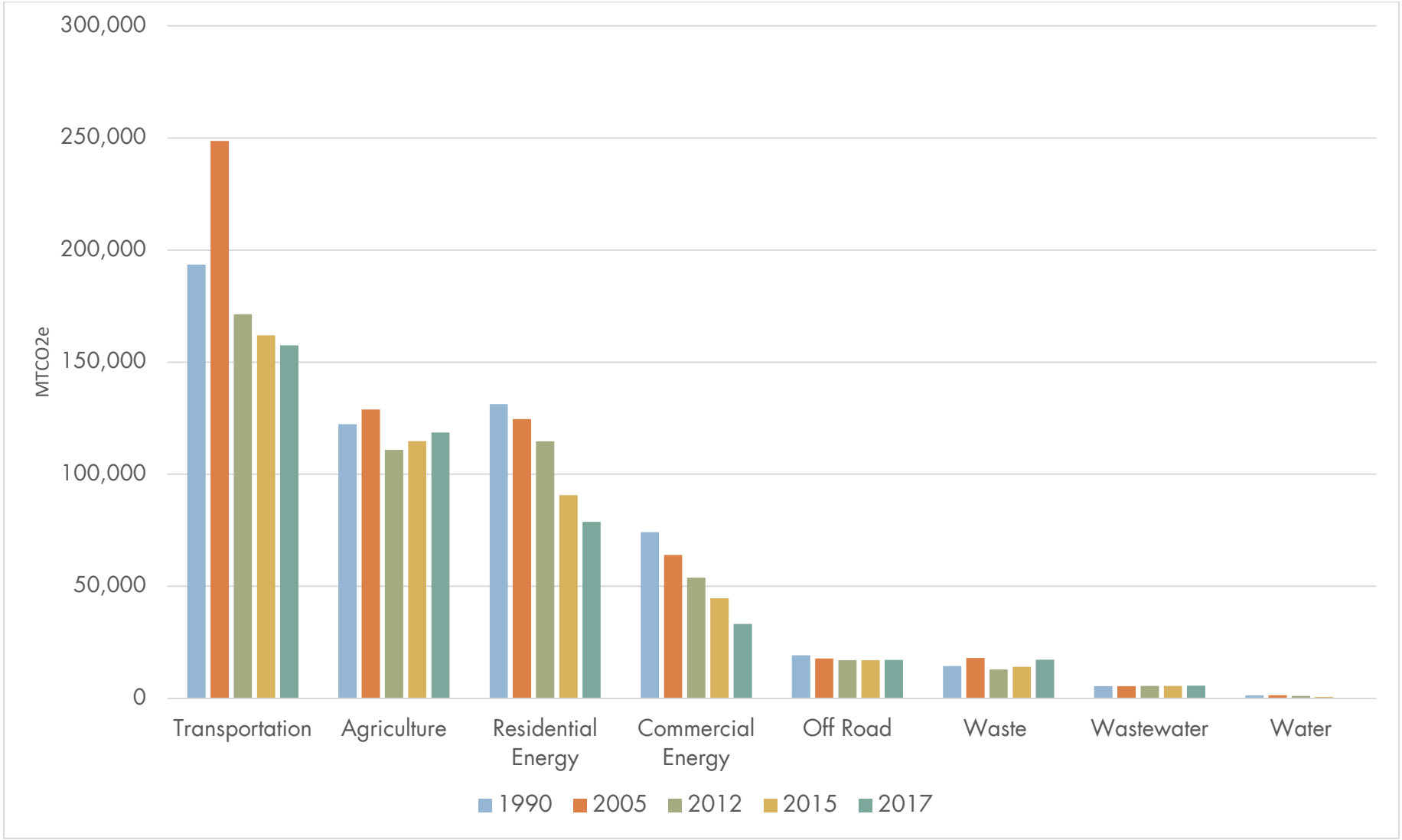
This GHG assessment uses data and estimates to provide a checkup on the County's reductions between inventory years. It shows that through 2017, community emissions in unincorporated Marin County were 24% below 1990 levels, from 561,851 metric tons of carbon dioxide equivalent ($MTCO_2e$) to 428,549 $MTCO_2e$ (Figure 1). This leaves an additional 6% (35,253 $MTCO_2e$) to reduce before the end of the 2020 target year.

Figure 1 Progress Towards Community Emission Reduction Targets ($MTCO_2e$)



In addition to demonstrating overall progress towards goals, this assessment helps the County understand how emissions have changed over time in different sectors. Sectors, the groups into which a GHG inventory is broken, include residential and commercial energy, transportation, agriculture, water and wastewater, off-road equipment, and waste disposal. Measuring the reduction or growth trends in each sector clarifies the County's understanding of past conditions and focuses implementation efforts going forward. Figure 2 shows the change of each of the CAP's seven sectors from 1990 (the CAP's baseline year) to 2017, specifically how emissions have increased or decreased in the intervening 25 years.

Figure 2 Change in Community Emissions by Sector, Baseline to 2017

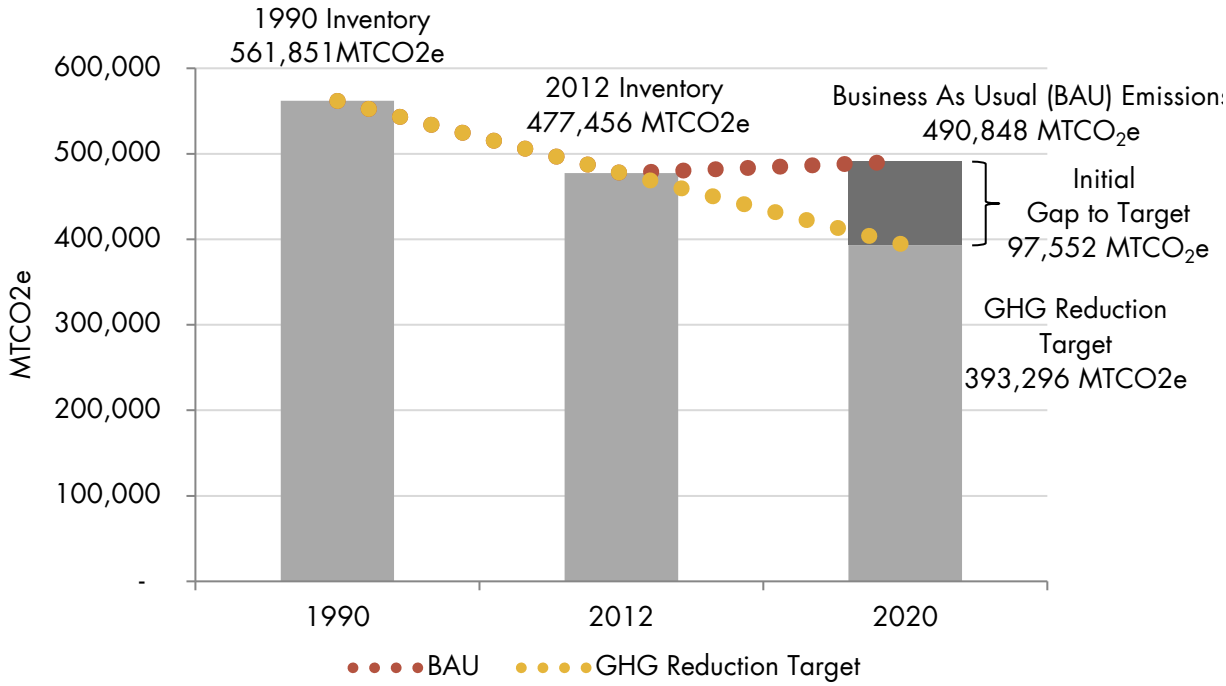


INTRODUCTION

CLIMATE ACTION PLAN

In November 2015, the Board of Supervisors adopted the County of Marin Climate Action Plan Update (the CAP). The CAP sets targets for the unincorporated County to reduce greenhouse gas (GHG) emissions from both community and municipal activities. The CAP includes an inventory of community and municipal GHG emissions generated in 2012, and establishes a 2020 target for the County to reduce metric tons of carbon dioxide equivalent ($MTCO_2e$) in the community to 30% below 1990 levels, double the state's reduction target. If no action is taken to reduce emissions, in a scenario called "Business as Usual" or BAU, the CAP forecasts that community emissions in 2020 will be nearly 100,000 $MTCO_2e$ above the adopted target (Figure 3).

Figure 3 County of Marin GHG Emissions Targets



This report provides an interim update to the CAP's 2012 community GHG inventory, providing a snapshot of the County of Marin's progress towards reduction targets. This assessment uses the best available data through 2017, but is not equivalent to the complete emission inventory completed for the CAP. This report uses projections and estimations for calculating portions of off-road emissions, vehicle miles traveled, and agricultural populations and emission factors. A complete inventory update for the community inventory will occur in late 2019/early 2020 as part of the County's effort to update the CAP to the year 2030 (CAP 2030 update). Completing a full inventory requires time-intensive and detailed data collection but will provide a critical assessment of progress before the 2020 target year. The information in this report illustrates

emission trends to help the County shape implementation efforts to respond to current conditions and meet GHG reduction targets.

INTERIM GHG ASSESSMENT

The CAP analyzes emissions from seven sectors:

- Building Energy: emissions from electricity generation and natural gas use by residential, commercial, and industrial buildings.
- On-Road Transportation: fuel consumption emissions from passenger and commercial vehicles operating within the unincorporated areas.
- Off-Road Vehicles and Equipment: fuel consumption emissions from use of off-road equipment, such as cranes, bulldozers, and lawnmowers.
- Solid Waste Generation: methane emissions from waste disposed by unincorporated communities.
- Water Conveyance: emissions from electricity and natural gas consumption associated with water conveyance, including groundwater pumping, local water distribution, and surface water diversion.
- Wastewater Treatment: process emissions from wastewater treatment.
- Agriculture: nitrogen oxide emissions from fertilizer application and methane emissions from manure management and enteric fermentation from livestock in the unincorporated areas.

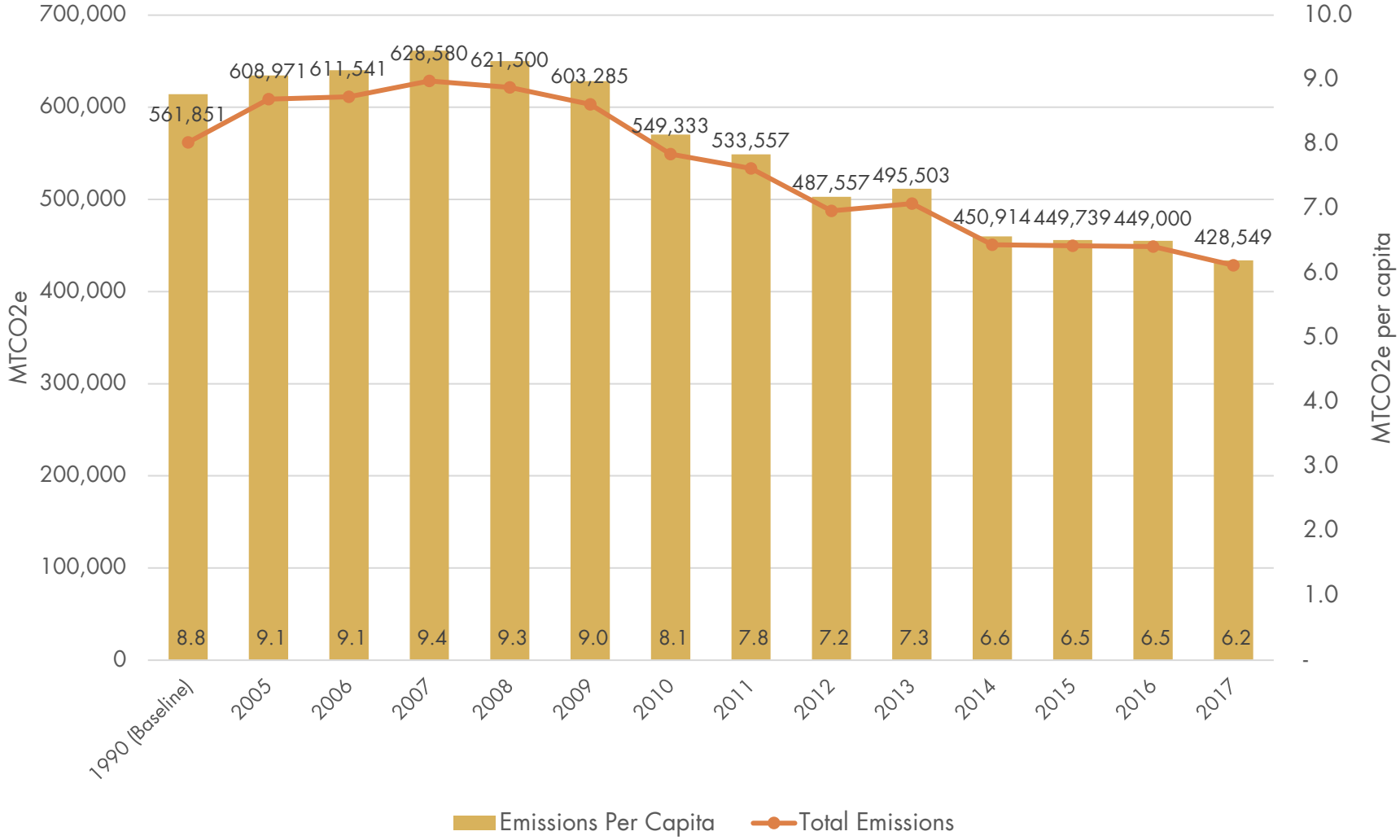
The interim assessment presented in this report, while not as comprehensive as a complete inventory, can provide an idea of how the share of emissions in each sector has changed over time. Table 1 shows how emissions in these sectors have changed since the CAP's baseline year (1990). Total community emissions in the unincorporated areas of the County decreased 24% between 1990 and 2017. Figure 4 shows the progress of emissions reductions since 1990 in total $MTCO_2e$ and in $MTCO_2e$ per capita.

Water consumption and building energy use have had the largest reductions in emissions since 1990, with an 80% decrease in water use emissions, 55% decrease in nonresidential energy emissions, and a 40% decrease in residential energy emissions. Each of these sectors have benefitted from the increased proportion of renewable electricity supply through both MCE and PG&E. Emissions from the water sector especially highlight the impact of shifting to renewable energy – in mid-2017, the Marin Municipal Water District switched all of their accounts to MCE Deep Green which resulted in a significant drop in the emissions associated with processing and pumping Marin's water supply. Increased capacity to divert waste to be recycled or composted in the County also allowed for a 31% decrease in waste emissions since 1990.

Table 1 County of Marin GHG Emissions by Sector, Baseline to 2017 ($MTCO_2e$)

	Residential Energy	Commercial Energy	Transportation	Waste	Water	Wastewater	Off Road	Agriculture	Total Emissions	Total Change from 1990
1990 (Baseline)	131,265	74,190	193,544	14,414	1,319	5,453	19,300	122,366	561,851	0%
2005	124,634	64,073	248,634	18,042	1,421	5,504	17,818	128,845	608,971	8%
2006	122,613	58,867	247,506	18,387	1,335	5,480	17,719	139,634	611,541	9%
2007	136,550	72,560	244,842	17,184	1,830	5,452	17,620	132,541	628,580	12%
2008	136,093	77,227	238,425	15,798	1,856	5,483	17,521	129,096	621,500	11%
2009	133,578	73,681	238,562	13,474	1,534	5,507	17,422	119,528	603,285	7%
2010	119,377	57,845	210,871	13,443	1,089	5,525	17,324	123,860	549,333	-2%
2011	119,171	52,917	206,495	13,063	964	5,575	17,225	118,147	533,557	-5%
2012	114,649	53,919	171,393	12,917	1,157	5,562	17,126	110,834	487,557	-13%
2013	109,940	52,940	166,222	13,576	1,011	5,556	17,126	129,132	495,503	-12%
2014	89,968	46,489	164,034	13,026	786	5,623	17,126	113,862	450,914	-20%
2015	90,673	44,669	161,998	14,085	707	5,658	17,126	114,823	449,739	-20%
2016	88,585	41,949	160,409	16,709	615	5,659	17,126	117,949	449,000	-20%
2017	78,732	33,278	157,523	17,301	260	5,663	17,127	118,665	428,549	-24%
Sector Change from 1990	-40%	-55%	-19%	20%	-80%	4%	-11%	-3%	-24%	

Figure 4 County of Marin GHG Emissions and Emissions per capita, Baseline to 2017

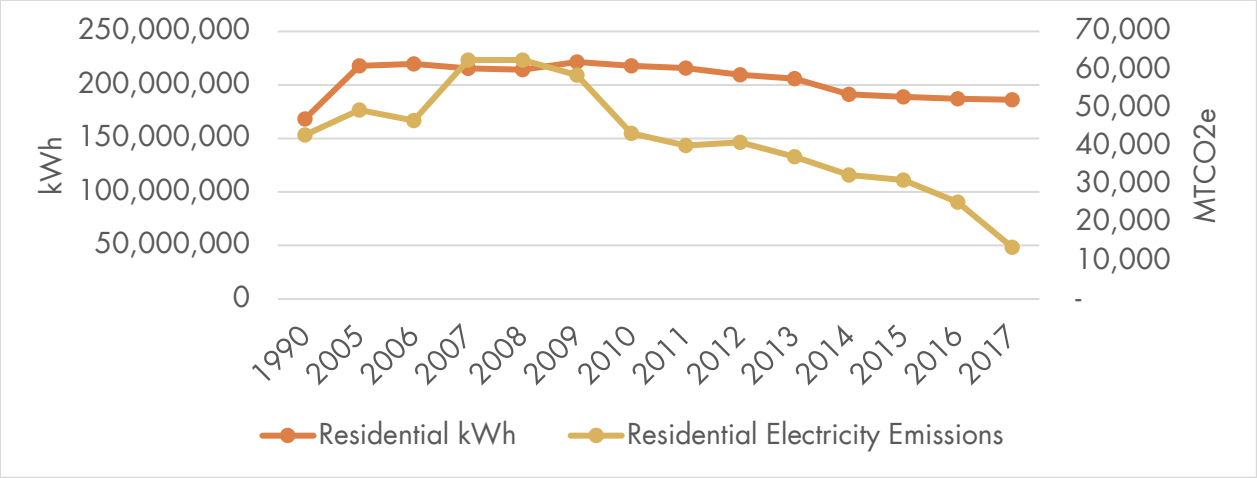


SECTOR SPOTLIGHT: BUILDING ENERGY USE

ELECTRICITY USE AND GHG EMISSIONS

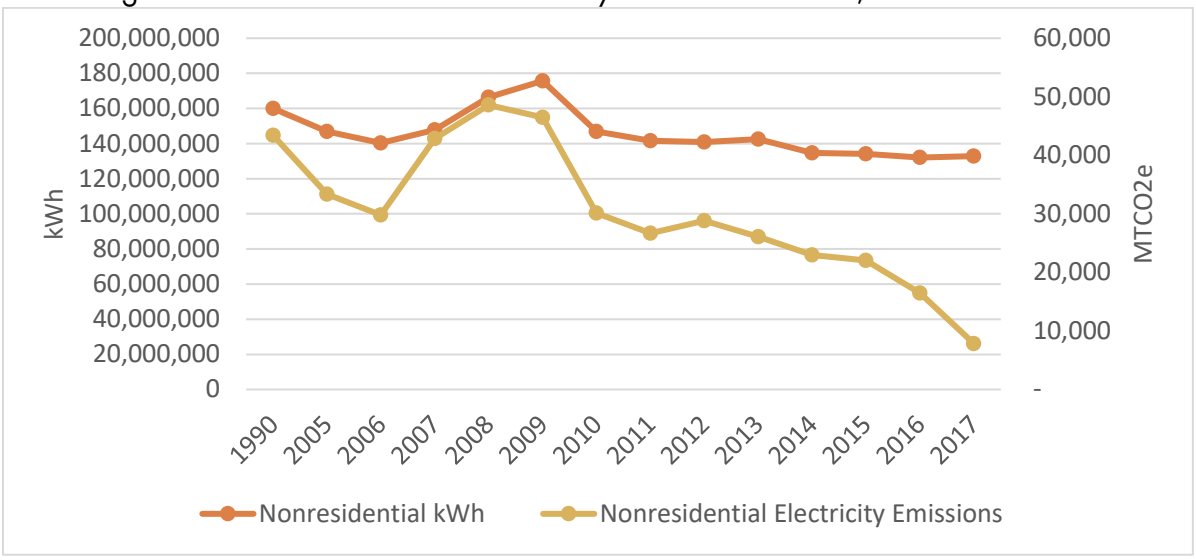
While residential electricity use in unincorporated Marin County has increased 11% since 1990, in the twelve years from 2005 to 2017, electricity use fell 15%. This reduction is assumed to be a result of conservation efforts, solar installations, and efficiency upgrades over the course of the last decade. Despite an increase in kWh consumption in homes since the baseline year, emissions from residential electricity use decreased 68% in the same period (Figure 5). This is possible due to the increased portion of renewables in Marin's electricity supply.

Figure 5 Residential Electricity Use and Emissions, Baseline to 2017



Electricity use in the nonresidential sector decreased 17% since 1990. In the same period, nonresidential electricity emissions decreased by 82% (Figure 6).

Figure 6 Nonresidential Electricity Use and Emissions, Baseline to 2017



The growing availability of low and zero carbon electricity has driven associated emission reductions in the unincorporated County. To comply with statewide renewable portfolio targets, a growing share of PG&E's electricity is sourced from renewable energy. MCE, which began serving customers in mid-2010, provides electricity that is less carbon intensive than PG&E's electric portfolio. In addition, MCE's Deep Green program offers customers the opportunity to purchase 100% renewable electricity (compared to 50% renewable in their standard option). PG&E has launched a Community Solar Choice program, which allows its customers similar flexibility to elect 100% renewable energy.

In 2017, PG&E provided 27.7% of residential electricity and 23.7% of nonresidential electricity in the unincorporated County (Table 2). MCE Light Green provides 70.1% of residential electricity, growing from 14.1% in 2010. Nonresidential electricity provided by Light Green has grown from 8.4% in 2010 to 63.0% in 2017. Residential Deep Green adoption has grown from 0.3% of residential electricity in 2010 to 2.2% in 2017. Nonresidential enrollment in Deep Green increased from 0.3% of nonresidential electricity in 2010 to 13.3% in 2017. The continued adoption of low and zero carbon electricity options is necessary to meet CAP goals.

Table 2 Electricity Supply by Provider (% of Total kWh)

	Residential Electricity			Nonresidential Electricity		
	PG&E	MCE Light Green	MCE Deep Green	PG&E	MCE Light Green	MCE Deep Green
1990	100%	0%	0%	100%	0%	0%
2005	100%	0%	0%	100%	0%	0%
2006	100%	0%	0%	100%	0%	0%
2007	100%	0%	0%	100%	0%	0%
2008	100%	0%	0%	100%	0%	0%
2009	100%	0%	0%	100%	0%	0%
2010	85.6%	14.1%	0.3%	91.4%	8.4%	0.3%
2011	71.3%	28.6%	0.1%	83.5%	15.4%	1.1%
2012	56.8%	42.1%	1.1%	50.1%	48.2%	1.7%
2013	29.0%	69.7%	1.3%	25.2%	73.0%	1.8%
2014	30.6%	67.9%	1.5%	25.8%	72.2%	2.1%
2015	29.3%	69.0%	1.7%	24.8%	71.8%	3.4%
2016	28.3%	69.7%	1.9%	24.3%	71.4%	4.3%
2017	27.7%	70.1%	2.2%	23.7%	63.0%	13.3%

NATURAL GAS USE AND GHG EMISSIONS

In addition to electricity use, emissions from natural gas use (measured in therms) are included in assessment of residential and nonresidential building energy sectors. In many homes and businesses, natural gas is used to provide space heating and power equipment (such as stoves and water heaters). Unlike electricity, natural gas does not have variable emission factors, so fluctuating therm usage and associated GHGs follow the same pattern, as shown in Figure 7 and Figure 8. From 1990 to 2017, residential therm usage and emissions decreased 22%. However, there has been a slight increase in residential natural gas use since 2014. Since the bulk of residential natural gas usage goes to space and water heating, it is highly responsive to weather – colder winters result in higher gas usage. Nonresidential therm usage and emissions decreased 10% from 1990 to 2015.

Figure 7 Residential Natural Gas Use and Emissions, Baseline to 2017

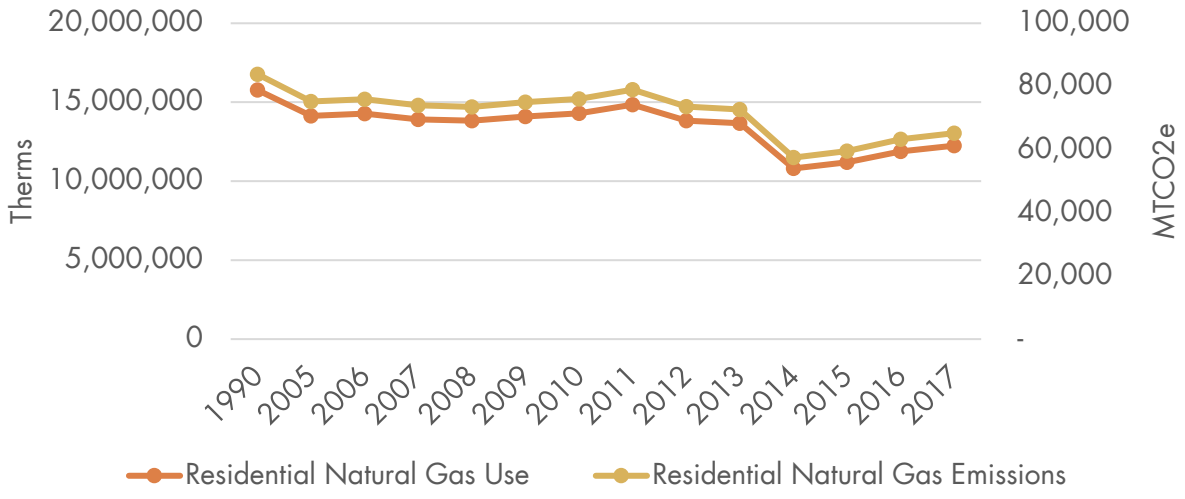
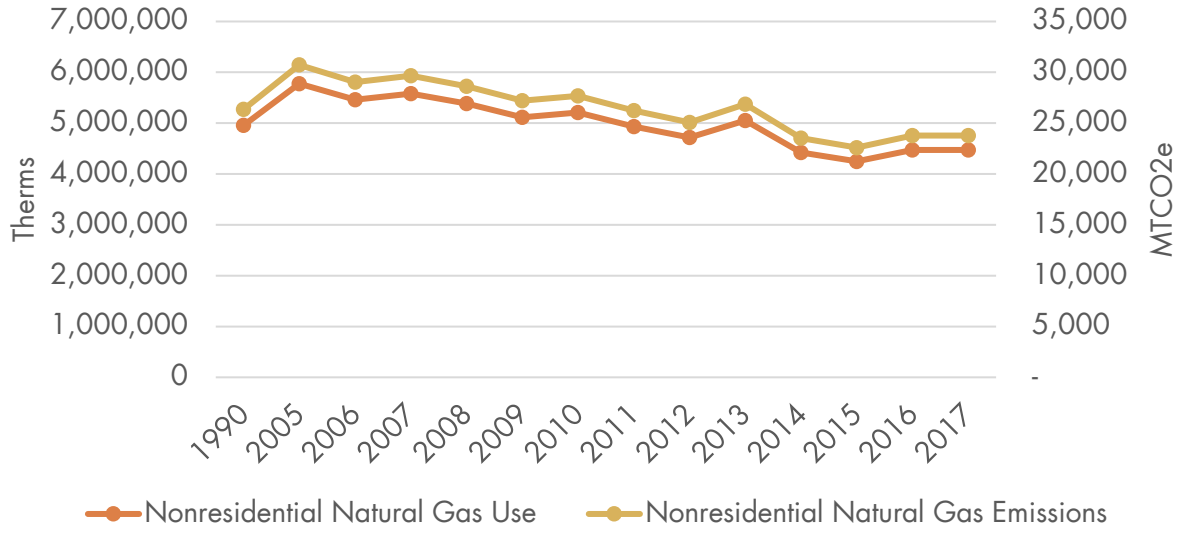


Figure 8 Nonresidential Natural Gas Use and Emissions, Baseline to 2017



WHAT THE COUNTY IS DOING

100% RENEWABLE ELECTRICITY

In July 2017, the County of Marin opted in all their municipal accounts to MCE's Deep Green. To date, all of Marin's cities and towns have also opted up to Deep Green's 100% renewable electricity. The County continues to install additional local solar capacity at County facilities that undergo major upgrades. Since 2015, the County has completed solar projects at five additional sites bringing the County's total installed solar to 1.1 MW at ten facilities.

ENERGY EFFICIENCY AT THE CIVIC CENTER

In 2017, the County replaced 2,054 existing fluorescent fixtures in the Administration Wing of the Civic Center with LED fixtures. The new fixtures use approximately 50% less electricity and save the County approximately $23,000 per year.

WHAT YOU CAN DO

OPT FOR 100% RENEWABLE ELECTRICITY

Residents and businesses in Marin can purchase 100% renewable electricity, reducing emissions associated with fossil-fuel generated energy. These options are available through MCE's Deep Green program or PG&E's Solar Choice program.

GO SOLAR

The Marin Solar Program can help you begin the process of evaluating whether the installation of a solar system is suitable for your home or business. Staff can answer questions you may have before contacting a contractor, including about available incentives, financing opportunities, and local regulations. Or visit Bay Area SunShares to lean about group purchasing and discount opportunities.

INCREASE BUILDING EFFICIENCY

Installing insulation, sealing duct leaks, and upgrading to energy-efficient windows, lighting and appliances can reduce costs and energy use in homes, apartments and businesses. Residents and business owners in Marin County can take advantage of technical resources as well as financial incentives. Visit The Sustainability Team's site to learn more.

GO ELECTRIC

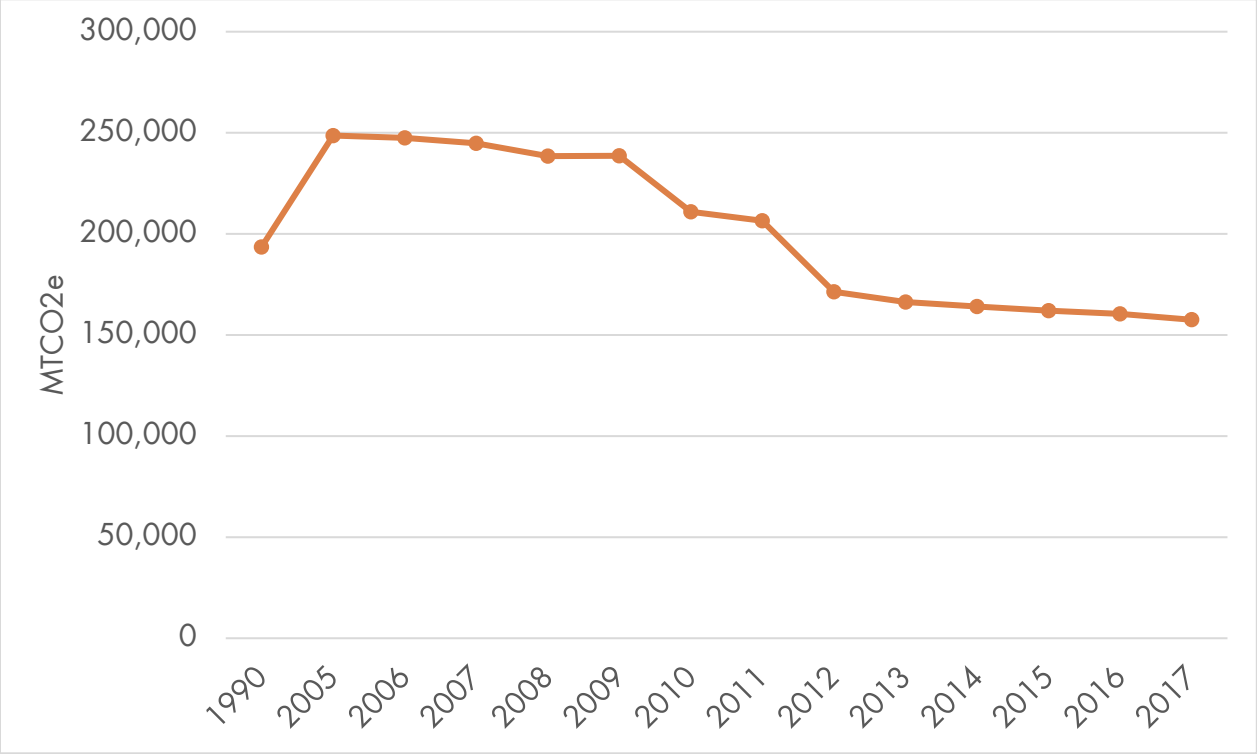
Via a grant from the Bay Area Air Quality Management District, the County of Marin is offering rebates to single family property owners for the replacement of natural gas appliances with efficient all-electric units, including water heaters, furnaces, ranges and cooktops. The Electrify Marin program helps homeowners replace natural gas appliances with electric models which will reduce greenhouse gas emissions, improve indoor air quality, and make their home a safer environment.

SECTOR SPOTLIGHT: TRANSPORTATION

Emissions from on-road transportation are estimated to have decreased 19% from 1990 to 2017 (Figure 9). This is a combination of a decrease in vehicle miles traveled (VMT) and, improved mileage standards, and cleaner fuels. The State of California's Low Carbon Fuel Standard (LCFS), as well as increased adoption of fuel efficient and zero emission vehicles, helps reduce emissions associated with vehicle travel. Since 2010, 4,300 EV rebates have been issued in the County, one of the highest per capita adoption rates in the Bay Area.

This interim GHG assessment uses estimation methods consistent with the 2012 GHG inventory to allow for comparison to the baseline year. Still, there remains a need for better data on vehicle miles traveled in the unincorporated County. The CAP's 1990 baseline year uses CalTrans data, which is the only data available from the time, yet still increases the risk of inaccuracy due to the gap of nearly 30 years between the baseline year and the present. The County will continue to explore the most appropriate approach to baseline calculation in future inventories. The County is also working with the Transportation Agency of Marin (TAM) to learn about best available methods to measure annual VMT data for increased accuracy. In the meantime, continuing to implement CAP measures targeted at reducing emissions from on-road transportation can ensure that the County moves forward towards CAP targets.

Figure 9 On-Road Emissions, Baseline to 2017



WHAT THE COUNTY IS DOING

ELECTRIC VEHICLE CHARGING STATIONS

In September 2018, the County installed 31 additional public charging stations at the Civic Center. The new stations bring the County's total of publicly available chargers to 45 at six locations including the Civic Center, Marin Center Exhibition Hall, Health and Wellness Center, 20 North San Pedro Road campus, West Marin Service Center, and 1600 Los Gamos Drive campus. The County also installed 10 additional fleet charging stations for a total of 18 stations. The County has 15 fully electric and plug-in electric vehicles.

RIDEGREEN - EMPLOYEE COMMUTE ALTERNATIVES

The RideGreen Commute Alternatives Program aims to address the greenhouse gas impacts of County of Marin employees driving to work alone. In October 2016, the Board of Supervisors approved the program to empower employees to ride green and save directly on commute costs by using environmentally conscious alternatives to single occupancy vehicles. The program provides incentives for employees that carpool, take transit, vanpool and bike to work.

WHAT YOU CAN DO

DRIVE LESS

Can you bike instead? Can you carpool with your friends? Can you walk even though you may not want to? What about public transit? Cars are convenient but pollute our air and cause traffic congestion in and outside of Marin County. Alternative transit options do not work for everyone, but there are multiple options to consider including casual carpool, taking the SMART train (Marin/Sonoma only), riding the ferry, or taking the bus. Employers often offer incentives if you drive less. TAM's Marin Commutes program is available to assist commuters and businesses identify alternatives to driving to work/school alone.

PURCHASE OR LEASE AND ELECTRIC VEHICLE

If you cannot drive less, bike, walk, or take public transit, consider leasing or purchasing an EV. Because the energy used in Marin County comes from renewable resources, powering a vehicle with electricity is far cleaner than gasoline. Explore the cost (and available rebates) and type of EVs by visiting Drive Clean Marin, the Clean Vehicle Rebate Project, or Bay Area SunShares (EV and solar system discounts).

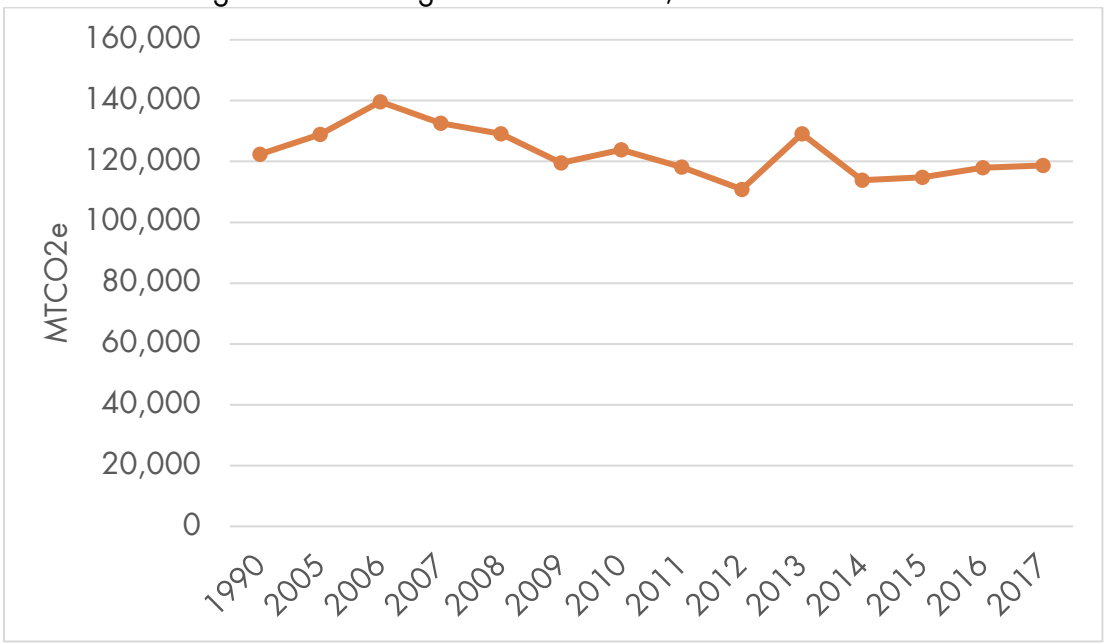
SECTOR SPOTLIGHT: AGRICULTURE

Of all the local CAPs in Marin, the unincorporated County's is the only one to include emissions from agriculture. Chapter 6 of the CAP focuses on the role of agricultural activities in Marin County on countywide emissions. This sector includes GHG emissions from manure management (fugitive emissions of methane and nitrous oxide), enteric fermentation (fugitive emissions of methane and nitrous oxide), and fertilizer use (fugitive emissions of nitrous oxide). Agricultural emissions have decreased 3% since the baseline year, from 122,366 $MTCO_2e$ in 1990 to 118,665 $MTCO_2e$ in 2017 (Figure 10).

Certain agricultural variables, such as composition of feed for cattle or chickens, can significantly alter livestock emissions factors. Detailed data on how feed proportions have changed since 2012 was not collected for the interim GHG assessment. As a proxy, emissions factors used in the 2012 inventory are assumed to remain the same through 2017. Emissions reductions from carbon sequestration, which were quantified in the CAP as an informational item, are not included here.

Additionally, the County of Marin's Department of Agriculture, Weights and Measures, which tracks livestock and crop populations in the County, has recently changed some of the data it collects, in order to protect farmer privacy. This most specifically impacts counts of poultry, hogs, and goats, which are based on voluntary data or has been removed from crop reports to increase anonymity. In instances where no data was available, an average of the prior 5 years of data was used.

Figure 10 Agriculture Emissions, Baseline to 2017



WHAT IS HAPPENING IN THE COUNTY

MARIN CARBON PROJECT

The Marin Carbon Project (MCP) is a consortium of the leading agricultural institutions and producers in Marin County, university researchers, county and federal agencies, and nonprofit organizations that seek to understand and demonstrate the potential of enhanced carbon sequestration in Marin's agricultural and rangeland ecosystems. MCP has helped draft 12 carbon farm plans covering 9,054 acres.

MARIN RESOURCE CONSERVATION DISTRICT

The Marin Resource Conservation District (RCD) works to preserve agricultural lands and advance carbon-smart farming practices. The RCD has administered over $20 million dollars in government and private foundation grants for watershed-wide erosion control, creek restoration and road repair projects.

COMMUNITY GARDENS

Community Gardens in Marin are a source of community and local food. With more than 120 gardens in neighborhoods, schools, connected to institutions such as hospitals, and on residential housing grounds, Marin residents have access and opportunity to grow their own fruits and vegetables.

WHAT YOU CAN DO

SHOP LOCAL

Purchasing locally-grown produce and food from farmer's markets minimizes emissions from transportation of food and supports the local economy. A number of organizations in Marin County, such as the Marin Carbon Project and the Marin Agricultural Land Trust, work to preserve and enhance working agricultural lands. Their research continues to seek new ways to modify existing farms to sequester more carbon and provide a model for carbon-friendly agriculture.

COMPOST WHENEVER POSSIBLE

Composting organic waste (food scrapes, yard and garden waste, soiled paper goods, bamboo utensils, and wooden stir sticks) reduces methane emissions and may save you money on your garbage bill. Visit Zero Waste Marin Composting Info and UC Master Gardener Composting Info.

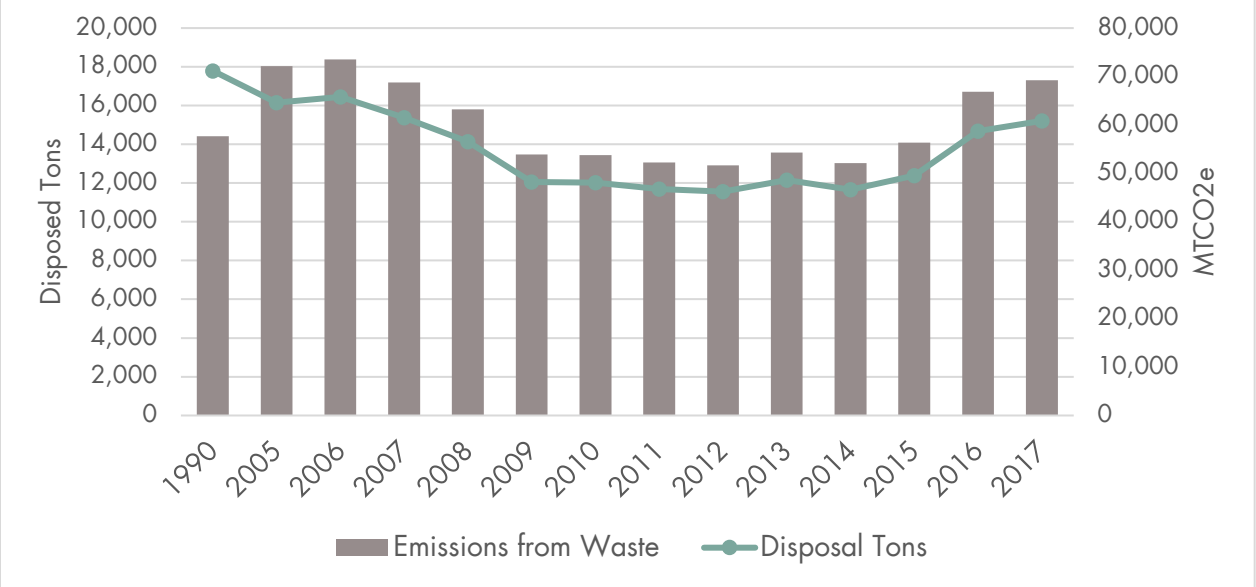
SECTOR SPOTLIGHT: WASTE

Communitywide waste disposal decreased 15% between 1990 and 2017 (Table 3 and Figure 11). This reduction occurred in the same period that population increased 14% in unincorporated Marin, indicating an overall per person reduction in waste disposal. This is likely attributable to an increased availability of recycling and composting services, reducing the amount of waste that ends up in the landfill each year. Emissions from waste disposal decreased 20% from 1990 in 2017, corresponding with disposal reduction.

Table 3 Waste Disposal Tons, Baseline to 2017

	Disposal Tons	Change from Baseline
1990	71,179	0%
2005	64,573	-9%
2006	65,809	-8%
2007	61,505	-14%
2008	56,542	-21%
2009	48,224	-32%
2010	48,112	-32%
2011	46,754	-34%
2012	46,231	-35%
2013	48,591	-32%
2014	46,623	-34%
2015	49,514	-30%
2016	58,737	-17%
2017	60,820	-15%

Figure 11 Waste Disposal (Tons) and Associated Emissions, Baseline to 2017



WHAT THE COUNTY IS DOING

ZERO WASTE MARIN

Zero Waste Marin, comprised of representatives from all over Marin County, adopted a zero waste by 2025 goal. The program helps residents and businesses reduce waste with trainings, recycling guides and hauler information.

WHAT YOU CAN DO

REDUCE, REUSE, RECYCLE, ROT

Start by shopping smart – buy only what you need and will use – that goes for food as well as durable goods. When you are done with the item donate to one of Marin's local thrift stores or if it can't be donated then recycle or compost it. You can learn all about the various ways to reduce your waste at Zero Waste Marin.

DONATE EXCESS FOOD LOCALLY

ExtraFood is a Marin-based nonprofit that will pick up your extra fresh food and get it to those in need. The SF Marin Food Bank accepts donations of non-perishable and unexpired food items.

SECTOR SPOTLIGHT: WATER USE

The total water delivered in unincorporated Marin County increased 13% from1990 to 2017 (Figure 12). To account for population growth since the baseline year, Table 4 shows per capita water use (in million gallons). By this measure, County residents use 4% more water per person than in 1990. Total water use has decreased 22% in the twelve years between 2005 and 2017, demonstrating more significant decreases in recent history. Despite the slight increase in water use from the CAP's baseline year, emissions associated with water consumption have fallen by 80% 1990 (Figure 12). The decrease in emissions, despite an increase in usage, is the result of a cleaner electricity supply from both PG&E and MCE.

Figure 12 Total Water Delivered and Associated Emissions, Baseline to 2017

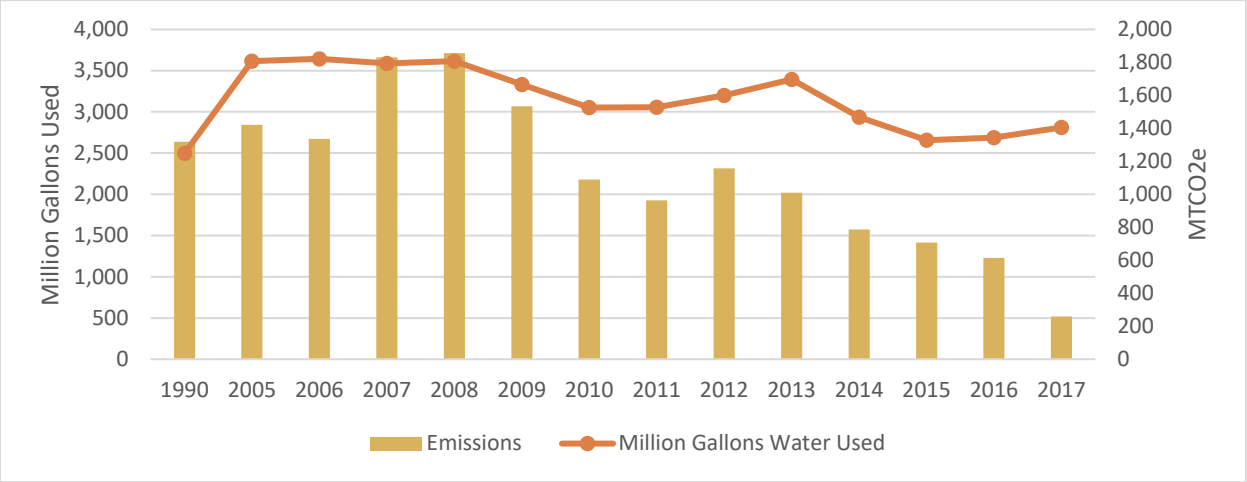


Table 4 Water Use (Million Gallons), Baseline to 2017

	Per Capita Water Use (million gallons)	Change in Per Capita Water Use, Baseline to 2015
1990	0.039	0%
2005	0.054	38%
2006	0.054	40%
2007	0.054	38%
2008	0.054	39%
2009	0.050	27%
2010	0.045	16%
2011	0.042	15%
2012	0.047	21%
2013	0.050	28%
2014	0.043	10%
2015	0.038	-1%
2016	0.039	0%
2017	0.041	4%

WHAT THE COUNTY IS DOING

RECYCLED WATER

The County of Marin uses Marin Municipal Water District's recycled water for irrigation and other non-potable uses at County facilities located in San Rafael. The use of recycled water reduces the need for additional potable water and reduces the amount of wastewater discharged to the bay.

WHAT YOU CAN DO

USE WATER MORE EFFICIENTLY

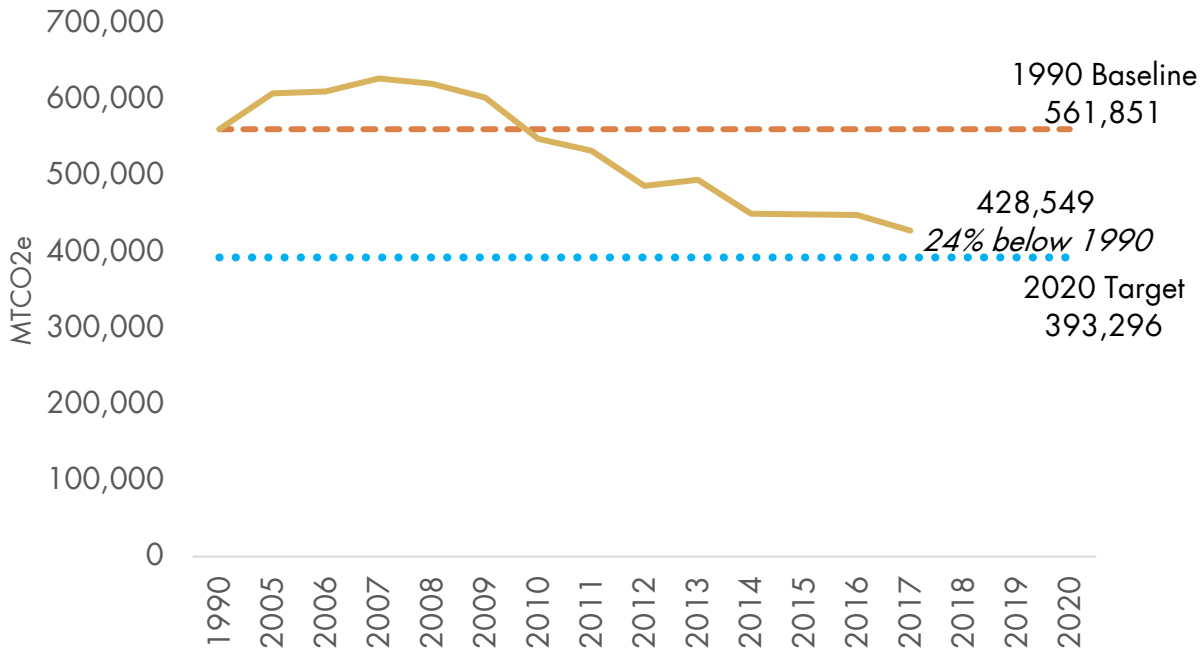
The delivery, treatment, and removal of water and wastewater require a significant amount of energy. Reducing water use not only supports conservation and reduces drought impacts, but also reduces associated energy use. Look for the WaterSense label when purchasing appliances and reach out to your water provider to find out about available rebates for water efficiency upgrades. Schedule a no-cost water use consultation with Marin Municipal Water District or North Marin Water District, or a no-cost energy and water assessment with Rising Sun Center for Opportunity (the program occurs during the summer each year).

SUMMARY AND NEXT STEPS

OVERVIEW OF ASSESSED PROGRESS

The observed reduction of 24% from 1990 to 2017 (Figure 13) reflects the impacts of community action, state, regional, and local policy choices, and an increase in availability of clean, low emission energy. The County has a 35,253 $MTCO_2e$ (6%) gap remaining to meet the 2020 target.

Figure 13 Progress Towards Emission Reduction Targets



NEXT STEPS

The County is coordinating efforts to ensure CAP targets are achieved by 2020 and looking beyond towards our 2030 goals and programs. Specific actions to be taken in the coming months include:

- Continue to coordinate with Marin Climate and Energy Partnership to increase engagement of County residents, within and outside of the County's sphere of influence, to support sustainability and emission reduction efforts.
- Begin inventory, goal setting and measure develop for an update to the Climate Action Plan that extends work to 2030.
- Integrate solutions developed via Drawdown: Marin into CAP 2030 process.