Marin County

Unincorporated Area

CLIMATE ACTION PLAN 2030

December 2020

COMMUNITY DEVELOPMENT AGENCY

COUNTY OF MARIN

SUSTAINABILITY TEAM

COUNTY of MARIN

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Marin Carbon Project

Marin City People's Plan

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Honoring the Land and Its Original Stewards

Marin County acknowledges that we are currently gathered on the ancestral homelands of the Coast Miwok. The Coast Miwok people have been the stewards and caretakers of these lands since time immemorial. Today, the Coast Miwok are one of two Tribal groups, alongside the Southern Pomo, who comprise the citizenship of the Federated Indians of Graton Rancheria.

This following Climate Action Plan makes clear that our collective climate goals cannot be realized without a commitment to community, consideration for and attention to the role we play in our local ecosystem, and a willingness to build a future that serves and protects all residents of Marin County.

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LOW CARBON TRANSPORTATION	
	• Drive an all-electric or plug-in hybrid vehicle. • Bike, walk, or take transit whenever possible. • Reduce the number of miles you drive by working from home when possible. • Shut your car off when waiting in line at the ATM or in the school pick up/drop off lane.
RENEWABLE ENERGY & ELECTRIFICATION	
	• Switch to MCE Deep Green or PG&E Solar Choice 100% renewable electricity. • Install a solar energy system on your home or business and consider battery storage. • Replace appliances that use natural gas for ones that use electricity. • Investigate heat pump technology so you can swap out heaters and furnaces that use natural gas when it's time to replace them.
ENERGY EFFICIENCY	
	• Replace indoor and outdoor lights with LED bulbs and turn them off when not in use. • Have an energy assessment done for your home or business. • Upgrade insulation, seal leaks, and install a programmable thermostat. • Purchase Energy Star appliances and equipment.
WASTE REDUCTION	
	• Buy only as much as you need. • Put your food scraps in the green can and/or compost them at home. • Donate extra food and used clothing and housewares. • Don't be a "wishful" recycler. Be scrupulous about how you sort your recycleables.
WATER CONSERVATION	
	• Replace your lawn with a drought-tolerant garden. • Install a drip irrigation system, program it to run early in the morning, and check it regularly for leaks. • Install low water flow faucets, showerheads, and toilets. • Buy water-efficient dishwashers and clothes washers when it's time to replace them.
CONSUMPTION-BASED EMISSIONS	
	• Be mindful of new materials used when renovating your home or office, and try to identify ways to repurpose existing materials • When purchasing new building materials, try to find ones with EPDs to compare the lifecycle footprint of a product
ADAPTATION AND COMMUNITY RESILIENCY	
	• Find out if your home or business is vulnerable to sea level rise at Our Coast Our Future. • Prepare for more wildfires. Join a Firewise Community, create a defensible space, harden your home, and have an emergency evacuation plan. Learn how at www.firesafemarin.org. • Install solar with battery storage to get through power outages.
COMMUNITY ENGAGEMENT AND EMPOWERMENT	
	• Sign up for Resilient Neighborhoods and join a Climate Action Team. • Calculate and commit to reducing your carbon footprint by taking the actions identified in this Plan. • Get your business certified as a Green Business with the Marin Green Business Program.
AGRICULTURE AND WORKING LANDS	
	• If you are a farmer or rancher, consider developing and implementing a carbon farm plan. • If you are a resident, grow your own vegetables and fruits, add compost to your garden soil and support local farms and ranches.

CHAPTER 1: INTRODUCTION

The need for local governments to act on climate change has never been more urgent, as demonstrated by 2020's devastating wildfires layered over a global pandemic. The County of Marin has long been dedicated to environmental leadership, and this plan continues that legacy by incorporating new ideas and ambitious targets.

The following plan outlines a path towards reducing local greenhouse gas (GHG) emissions through the year 2030. This policy guidance is invaluable. Annually, staff will develop an implementation plan and budget requirements for actions to be taken that year, using this plan for guidance and incorporating best available resources, technology, and funding sources. The first of these plans will be developed in early 2021.

WHAT IS A CAP?

A Climate Action Plan (CAP) is a public document which:

- Helps us to understand how our community contributes to climate change
- Sets targets for how much we want to reduce these contributions by a certain year
- Outlines a path for us to meet that goal.

This CAP is grounded in the County of Marin's understanding that climate change is already impacting California and the world and will continue to affect Marin's residents and businesses for the foreseeable future, as well as other communities around the world. The County also recognizes that local governments play a strong role in reducing GHG emissions in their municipal operations and communities and mitigating the future impacts of climate change.

This CAP, at its core, seeks to reimagine a community that is substantially less dependent on fossil fuels and provides a prosperous environment for both current and future generations, while not exporting environmental damage and GHG emissions to other parts of the Bay Area, nation, or world.

This CAP was developed in partnership with the local community. In 2017, the County Board of Supervisors launched Drawdown: Marin and in 2018, the County Community Development Agency began a two-year planning process called Drawdown: Marin that engaged residents, businesses, and subject matter experts in a comprehensive, science-based, county-wide campaign to identify actions that will dramatically reduce GHG emissions, address equity, and increase community resilience. Drawdown: Marin is still working to engage the entire community including traditionally marginalized communities in the initiative to ensure local actions are designed and implemented in a way that makes sense for all Marin residents. Over 150 volunteers identified 29 climate change solutions in six focus areas: Renewable Energy, Transportation, Buildings and Infrastructure, Local Food and Food Waste, Carbon Sequestration, and Climate Resilient Communities. These solutions, along with strategies for addressing equity, community empowerment, and countywide collaboration on climate change, were published in Drawdown Marin's Draft Strategic Plan in July 2020. The final Strategic Plan will be presented with this CAP update in December 2020. Of the final 29 solutions identified in the Strategic Plan (listed in Appendix A: Drawdown Marin Solutions), the Executive Steering Committee endorsed seven for immediate implementation by various entities; those endorsed solutions are incorporated into this CAP and are identified accordingly in each section. The County acknowledges that it has a role to play in achieving the Drawdown: Marin goals to (1) reduce emissions 60% below 2005 levels by 2030 (equivalent to 53% below 1990 levels) and (2) drawdown GHG emissions to below zero by 2045.

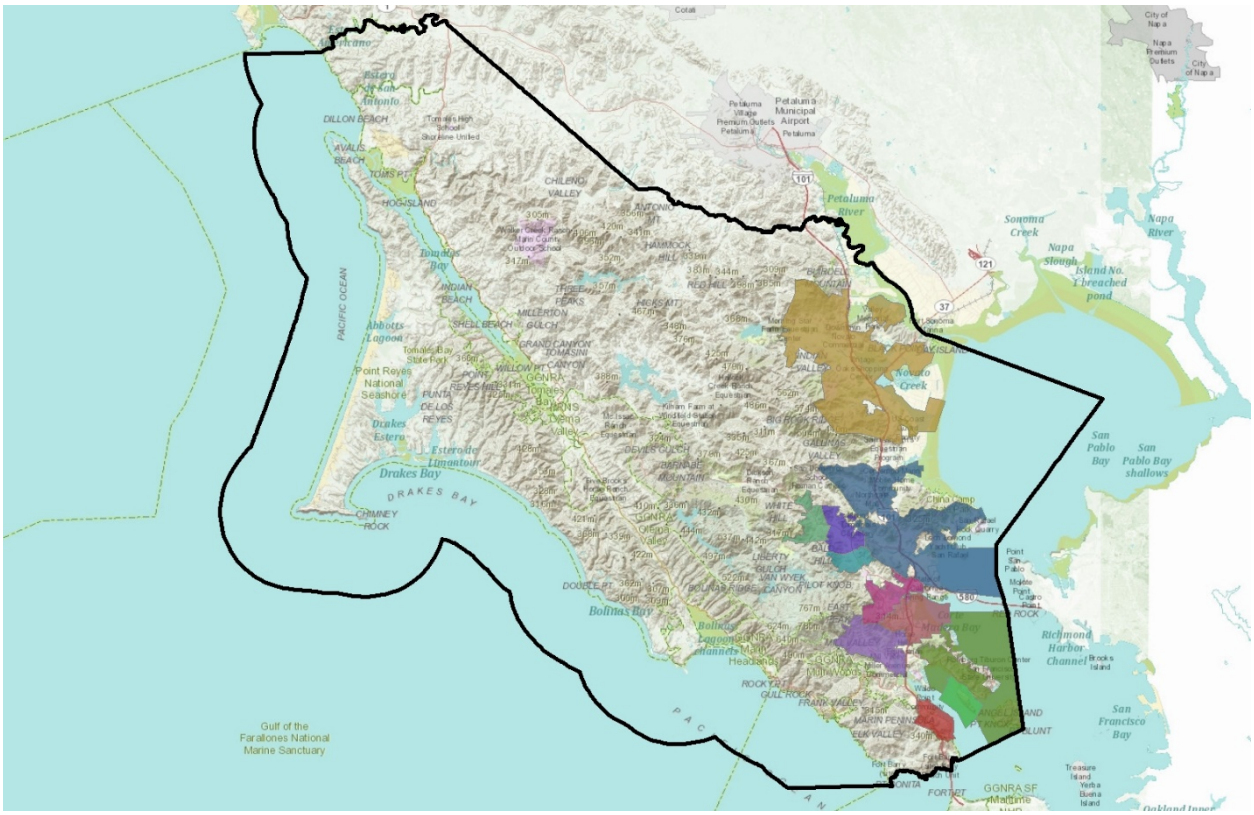
In addition to the detailed and important work of Drawdown: Marin, the general public was engaged through a CAP public workshop in February 2020 and a CAP Interest Survey on the County's Open Gov website from June through

August 2020. Details about feedback received and outcomes of these efforts can be found in Appendix C: Climate Action Planning Process.

WHO DOES THE CAP APPLY TO?

This CAP specifically addresses the unincorporated areas of Marin County, as shown in the unshaded areas in Figure 1.

FIGURE 1: UNINCORPORATED AREA OF MARIN



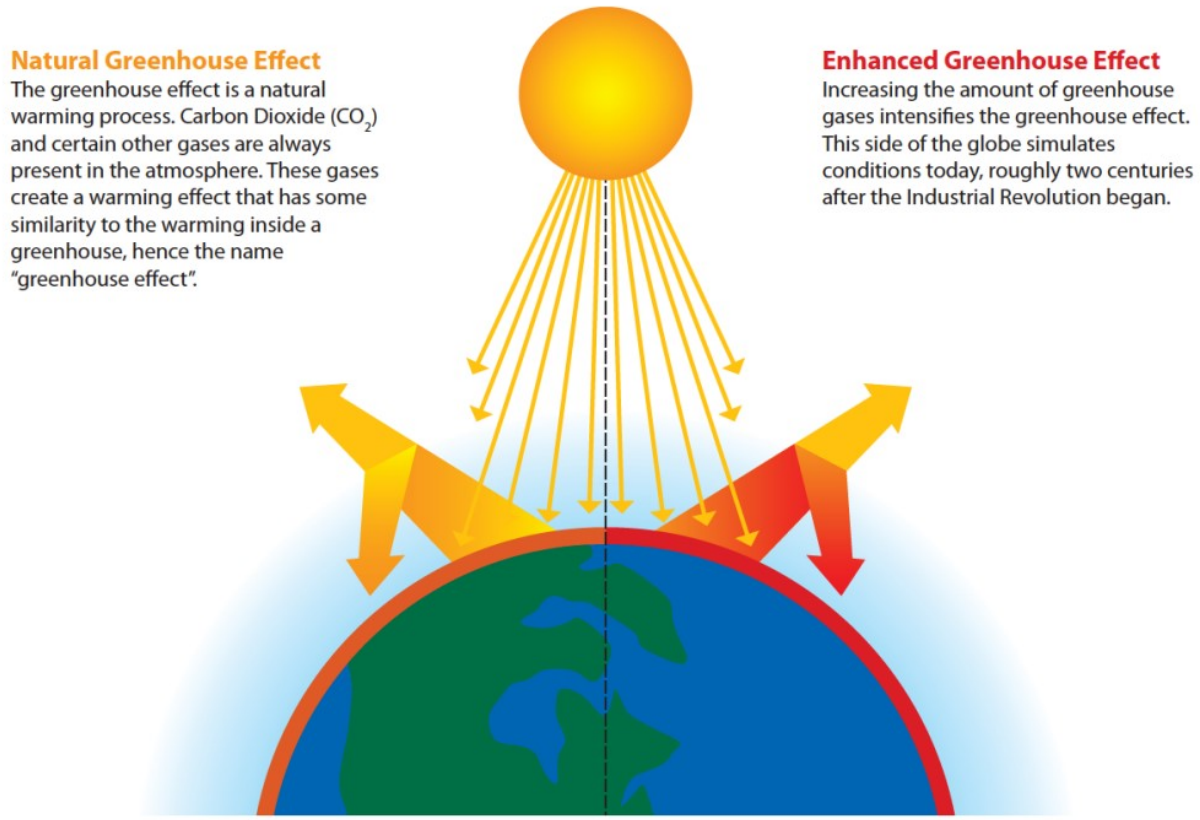
Some of these areas are adjacent to incorporated cities and towns. For this reason, many of the actions identified in this plan will require the coordinated effort of Marin's local governments. The actions included in this plan draw on a model climate action plan developed by the Marin Climate and Energy Partnership (MCEP), which is a partnership program of Marin cities and towns, the County, and Marin regional agencies. The MCEP model climate action plan is intended to support countywide implementation efforts. The model plan has already been adopted by San Rafael and San Anselmo and is currently being used to update additional Climate Action Plans for other cities and towns in Marin.

Through the actions outlined in this plan, such as increasing energy efficiency in buildings, electrifying buildings and appliances, accelerating zero emission vehicle adoption, and using clean, renewable energy sources, the community can experience lower fuel and energy bills, improved air quality, reduced emissions, and an enhanced quality of life. The County's preparation of GHG emissions inventories and Climate Action Plans are part of an ongoing planning process that includes assessing, planning, mitigating, and adapting to climate change.

What are Greenhouse Gas Emissions and How Do They Contribute to Climate Change?

Greenhouse gases (GHGs) are gases in Earth's atmosphere that allow the sun's rays to enter our atmosphere and trap the resulting heat generated by the rays. These gases are naturally occurring and make Earth suitable for life. While we depend a certain level on these gases to keep our earth habitable, certain human activities have been shown to emit GHGs, increasing their concentration in the atmosphere to unsustainable levels and trapping more heat, resulting in an increase in Earth's average temperature (Figure 2). This intensification of the natural greenhouse effect affects local and global climate patterns, and which in turn amplifies many hazards including flooding, wildfire, drought, and storms.

FIGURE 2: THE GREENHOUSE EFFECT



Source: California Waterboard/Marion Koshland Science Museum Of The National Academy Of Sciences

These GHGs include carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perflurocarbons, and sulfur hexafluoride (Table 1) [1]. Each one has a different degree of impact on climate change. To facilitate comparison across different emission sources with mixed and varied compositions of several GHGs, the term "carbon dioxide

[1] Water vapor is the most dominant greenhouse gas, but it is not measured as a part of a greenhouse gas inventory and for that reason is not included in this discussion.

equivalent" or CO_2e is used across this CAP. One metric ton of CO_2e may consist of any combination of GHGs and has the equivalent Global Warming Potential (GWP) as one metric ton of carbon dioxide (CO_2). As gathering data and quantifying emissions can be quite difficult for some sources, community inventories at the local government level typically concentrate on the three primary GHGs: CO_2, CH4, and N_20.

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, wastewater, and livestock	28
Nitrous Oxide	N_2O	Combustion, wastewater treatment	265
Hydrofluorocarbons	Various	Leaked refrigerants, fire suppressants	4 to 12,400
Perfluorocarbons	Various	Aluminum production, semiconductor manufacturing, HVAC equipment manufacturing	6,630 to 11,100
Sulfur Hexafluoride	SF_6	Transmission and distribution of power	23,500

Source: International Panel on Climate Change (IPCC) Fifth Assessment Report, 100-year values, 2014

According to the U.S. Environmental Protection Agency's 2019 "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2018," the majority of GHG emissions comes from fossil fuel combustion which in turn is used for electricity, transportation, industry, heating, etc. The burning of fossil fuels occurs across nearly every sector of the global economy, in ways that have become foundational to the ways that most people move, eat, and live.

It is the charge of this plan to diminish our community's dependence on fossil fuels and drastically decrease our associated GHG emissions.

How will Climate Change Impact California and Marin?

As described above, the Earth's climate is warming, mostly due to human activities such as changes in land cover and emissions of certain pollutants. GHGs are the major human-induced drivers of climate change. These gases warm the Earth's surface by trapping heat in the atmosphere.

California is already experiencing climate change impacts. Sea levels along the coast of southern and central California have risen about 6 inches over the past century and even moderate tides and storms are now producing extremely high sea levels.[2] Since 1950, the areas burned by wildfire each year has been increasing, as warming temperatures extend the fire season and low precipitation and snowpack create conditions for extreme, high severity wildfires to spread rapidly. Seventeen of the state's twenty largest fires have occurred since 2003, and the five largest fires have occurred since 2017.[3] The megafires of 2020, sparked in many cases by lightning strikes, have so far burned over 3.75 million acres across California.

As temperatures continue to rise, California faces serious climate impacts, including:

- More intense and frequent heat waves
- More intense and frequent drought
- More severe and frequent wildfires
- More severe storms and extreme weather events
- Greater riverine flows
- Shrinking snowpack and less overall precipitation
- Accelerating sea level rise
- Ocean acidification, hypoxia, and warming
- Increase in vector-borne diseases and heat-related deaths and illnesses
- Increase in harmful impacts to vegetation and wildlife, including algal blooms in marine and freshwater environments, spread of disease-causing pathogens and insects in forests, and invasive agricultural pests.

Overall temperatures are projected to rise substantially throughout this century. In Marin County, temperatures are expected to rise about 4°F by 2100 if global emissions peak around 2040 and then decline, the so-called "low emissions" scenario. If the world fails to act and we continue the path we are on, temperatures are projected to rise 10°F by the end of the century (the "high emissions" scenario).

As the climate changes, some of the more serious threats to public health will stem from more frequent and intense extreme heat days and longer heat waves. Extreme heat events are likely to increase the risk of heat-related illness, such as heat stroke and dehydration, and exacerbate existing chronic health conditions. Extreme heat days in Marin are expected to increase from 4 days to 9 days under the low emissions scenario and to as many as 25 days under the high emissions scenario.

Higher temperatures will make Marin more vulnerable to wildfire and sea level rise. By the end of the century, sea level is projected to rise 2.4 to 3.4 feet, and possibly as much as 10 feet. At 5 feet of sea level rise, flooding may inundate downtown San Rafael, Redwood High School in Larkspur, Town Center in Corte Madera, Mill Valley Middle

[2] Louise Bedsworth, Dan Cayan, Guido Franco, Leah Fisher, Sonya Ziaja, "Statewide Summary Report," in California's Fourth Climate Change Assessment, publication number: SUMCCCA4-2018-013, 2018, p. 31.
[3] Cal Fire, "Top 20 Largest Wildfires," 9/4/2020.

School, the Cove Shopping Center in Tiburon, and thousands of homes and businesses located near Marin's shorelines and creeks. Flooding will be even worse during storms, which are expected to increase in frequency and intensity.

What Role Does Government Play?

International, national, and statewide GHG reduction goals and policies affect the County's own goals and policies. Whether trying to meet or exceed those goals, California and Marin are known for their environmental stewardship and willingness to be leaders on the international and national stage.

International	• The United Nations coordinates global commitments and targets to reduce emissions (such as the Paris Climate Accord) • The United Nations also supports the advancement of climate science through the Intergovernmental Panel of Climate Change (IPCC). The IPCC coordinates the work of scientists across the world to continually update models and assess the science related to climate change. This work in turn informs the way that national, state, and local governments understand and address the human activities that contribute to climate change and the ways that climate change might impact earth's environment
National	• Currently, there is no federal legislation mandating comprehensive GHG emissions reporting or reduction in the United States.

State	• California first established statewide GHG emission reduction targets in 2005.
	• California has used its climate goals to develop regulations to reduce emissions across a variety of sectors, including:
	  ○ Setting more strict fuel economy standards for vehicle manufacturers that would like to sell cars in the state
	  ○ Establishing zero-net energy building requirements for all new homes constructed on or after January 1, 2020
	  ○ Direct management of emissions from power plants and other stationary sources
	• California has also used SB 375, which was passed in 2008, to reduce emissions from cars and light trucks by promoting compact mixed-use, commercial, and residential development. SB 375 required local governments in California to consider GHG emissions, leading to successful proliferation of climate action plan development throughout the state.

Local	• Looks at GHG emissions generated by their communities. • Sets long term GHG emission reduction targets that align meet or exceed statewide goals through local Climate Action Plans. • Develops policies and programs to achieve CAP GHG emission reduction goals.

Marin's CAP History & Climate Action to Date

The County first adopted a GHG Reduction Plan in 2006 based on a long-standing commitment to environmental stewardship and sustainability. The Plan established GHG emission levels for 1990 and established a goal to reduce emissions 15% below 1990 levels by 2020.

In 2015, the County adopted an updated Climate Action Plan that set a more aggressive target to reduce emissions 30% below 1990 levels. As of 2018, the County had reduced emissions 23% below 2005 levels, which is equivalent

to 9% below 1990 levels. Although the County has not yet met the 2020 targets established in the previous plans, it has met the statewide goal to reduce emissions to 1990 levels by 2020, which is 15% below 2005 levels.

In 2019, the County began an update to the CAP. This CAP builds on the successes of the 2015 document while integrating the work and goals of Drawdown: Marin.

Climate Action Timeline

2005	California Legislature adopts AB 32, establishing a statewide goal to reduce emissions to 1990 levels by 2020
2006	County adopts first Greenhouse Gas Reduction Plan *Sets goal to reduce emissions 15% below 1990 levels by 2020*
2015	Updated Climate Action Plan Adopted *Sets goal to reduce emissions 30% below 1990 levels by 2020, doubling original goal*
2016	California Legislature adopts SB 32, establishing a statewide goal to reduce emissions 40% below 1990 levels by 2030
2017	Drawdown: Marin launched by Board of Supervisors
2018	Governor issues Executive Order (EO) challenging California to achieve carbon neutrality by 2045; Drawdown: Marin 2-year community planning process starts
2020	2030 CAP Update and Drawdown: Marin Strategic Plan released for public review and proposed adoption

The County has been a pioneer in efforts to reduce GHGs and mitigate climate change impacts. This is a partial listing of the many actions the County has implemented since recognizing the critical need to act.

Renewable Energy & Electrification

- **Marin Clean Energy.** In 2010, the County joined several Marin cities and towns to form Marin Clean Energy (MCE), a Community Choice Energy agency. As a public agency, MCE is chartered to source clean, competitively priced electricity on behalf of residents and businesses in participating jurisdictions. MCE provide customers with 60% - 100% renewable energy and has plans to provide all customers with 100% renewable energy by 2022.
- **Deep Green Electricity**. In 2017, the County began purchasing 100% renewable electricity from MCE for all municipal facilities.
- **Solar Installation.** The County has installed 1,000 kW of solar PV in six locations to serve municipal electricity needs. Approximately 51.8 MW of solar PV have been installed in unincorporated areas across more than 700 solar electric arrays.
- **Electrify Marin.** Electrify Marin is a natural gas appliance replacement rebate program that the County launched in 2019. Rebates are available to single family property owners for the replacement of natural gas appliances with efficient electric units, including water heaters, furnaces, ranges, and cooktops.

Energy Efficiency

- **Energy Efficiency Upgrades.** The County has completed many energy efficiency projects in municipal buildings, including replacing inefficient lighting with light-emitting diode (LED) fixtures, upgrading mechanical and ventilation equipment with high efficiency units, and installing variable frequency drives.
- **LED Streetlights.** The County has converted 86% of its streetlights to LED fixtures. LED lighting uses about half the electricity of conventional lighting.
- **Green Building Ordinance.** The County has adopted green building incentives since 2001 and regulations that exceed State building code requirements since 2010. In 2019, the County adopted a model green building ordinance that encourages all-electric homes and commercial buildings and requires new buildings using natural gas to exceed State energy efficiency requirements.
- **Marin County Energy Watch Partnership.** Since 2004, the Marin Energy Watch Partnership has provided resources and incentives to residents, businesses, and public agencies to increase energy efficiency.
- **Bay Area Regional Energy Network (BayREN).** In 2012, the County and the eight other Bay Area counties united to create the BayREN which provides for energy efficiency resources and incentives to Bay Area residents, businesses and public agencies.

Low Carbon Transportation

- **EV Chargers.** The County has installed 66 publicly available charging stations at six County locations including 34 stations at the Civic Center and 24 stations at the Emergency Operations Facility. In addition, the County has installed 20 fleet charging units at three County locations.
- **Electric Vehicles (EVs).** The County's fleet includes 17 zero emission vehicles.
- **Bicycle and Pedestrian Network Improvements**. The County has completed pedestrian and bicycle infrastructure and safety improvements, including 11.3 miles of class I multiuse paths and 31.0 miles of class 2 bike lanes in the unincorporated County, to encourage residents, employees, and visitors to walk, bike and take transit rather than drive to their destinations.
- **Renewable Diesel.** The County has been purchasing renewable diesel for municipal vehicles and equipment since 2016. Renewable diesel reduces GHG emissions by about 60%.
- **RideGreen**. In October 2016, the Board of Supervisors approved the program to empower County employees, through resources and direct incentives, to reduce emissions and save directly on commute costs by using environmentally conscious alternatives to single occupancy vehicles.

Waste Reduction

- **Zero Waste Marin.** Zero Waste Marin is a joint powers authority comprised of representatives from Marin's local governments. Their mission is to help residents and businesses meet the county's Zero Waste goal by 2025 by reducing and recycling their solid waste and safely disposing of hazardous materials. Zero Waste Marin provides information on household hazardous waste collection, recycling, composting and waste disposal, and ensures the county's compliance with state recycling mandates.
- **Plastic Bag Ban.** In 2011, the County adopted an ordinance that prohibits stores from providing single-use carry-out bags to customers.
- **Polystyrene Ban.** In 2009, the County adopted an ordinance that prohibits the use of polystyrene foam disposable food packaging and require the use of environmentally preferable food packaging (by food vendors, restaurants, and County facilities.

Water Conservation

- **Water-Efficient Landscaping.** The County has replaced turf areas in County parks with native, drought tolerant plants to save on water and maintenance costs.
- **Water-Efficient Irrigation.** The County has installed smart irrigation controls at most County parks and landscaped areas to control watering levels based on weather and moisture content in the air.
- **Recycled Water.** The County is also using as much recycled water as the water districts can supply for landscaping water use and other non-potable water uses.

Agriculture and Carbon Sequestration

- **Marin Carbon Project.** This program seeks to identify and implement strategies for enhancing carbon sequestration on agricultural and rangelands in Marin County and beyond. The project focuses on carbon farming, which implements practices to increase the rate at which carbon dioxide is removed from the atmosphere and converted to plant material and soil organic matter on farms and rangelands. The goal of a carbon farming project is to sequester more carbon from enhanced land management and conservation practices than is emitted through farming operations making the agricultural ecosystem a net carbon sink that will be capable of offsetting emissions from both agriculture and other sectors. As of 2020, the Marin Resource Conservation District had completed 20 Carbon Farm Plans, and $1.5 million in State grants had been awarded to Marin ranchers to assist with the implementation of carbon farming practices across 16 different projects.

Community Collaboration

- **Green Business Program.** Businesses in the county can be certified with the Green Business Program if they pledge to stay green, and select measures to conserve water, conserve energy, reduce waste, and prevent pollution. Businesses that participate receive streamlined environmental assistance, money saving opportunities, marketing resources and promotion via the CA Green Business Network.
- **Marin Climate and Energy Partnership**. The County is a member of the Marin Climate & Energy Partnership (MCEP). Created in 2007, MCEP is a countywide partnership that allows its members to work collaboratively, share resources, and secure funding to: 1) discuss, study and implement overarching policies and programs, ranging from emission reduction strategies to adaptation, contained in each agency's Climate Action Plan; and 2) collect data and report on progress in meeting each partner member's individual GHG emission targets. MCEP'S website provides information on climate action plans and GHG emission in Marin and links to the Marin communities' plans and reports. MCEP's Marin Sustainability Tracker compares the progress Marin's jurisdictions are making on 11 metrics related to energy, waste, transportation, water, and GHG reduction.

CHAPTER 2: GREENHOUSE GAS EMISSIONS INVENTORY, FORECAST, AND REDUCTION TARGETS

UNINCORPORATED AREA PROFILE

Located just north of San Francisco, Marin County is a geographically diverse county with the Pacific Ocean to the west, San Pablo Bay and San Francisco Bay to the east, and Sonoma County to the north. Most of the county's population resides in the city-centered corridor along Highway 101 in the eastern part of the county in eleven incorporated cities and towns. Unincorporated developed areas are adjacent to nearly all of these cities and towns in communities such as Marin City, Tamalpais Valley, Strawberry, Greenbrae, Kentfield, Santa Venetia, Marinwood, Bel Marin Keys, Loma Verde, Wild Horse Valley, and Black Point. To the west of the city-centered corridor lies hundreds of thousands of acres of unincorporated agricultural land and protected open space, encompassing grasslands, woodlands, and wetlands, and dotted with rural and oceanfront communities such as Woodacre, Forest Knolls, Muir Beach, Stinson Beach, Point Reyes, Inverness, Dillon Beach, and Tomales.

Of the County's estimated total population of 260,831, approximately 68,659 live in unincorporated areas.[4] Approximately 73% of Marin County's housing stock was built before 1980, providing excellent opportunities to upgrade homes to include more energy-efficient and decarbonized features.[5]

The county spans two climate zones, with cooler temperatures along the ocean and southern bay coastlines and warmer temperatures in the inland and northern parts of the county. Electricity consumption generally spikes during the summer to cool buildings, while natural gas consumption rises in the winter months and fluctuates according to average low temperatures during the rainy season. Water use rises during the summer, and outdoor water use is largely dependent upon local rainfall patterns and weather conditions.

While there are no large employment centers, the unincorporated areas provide about 20,865 jobs.[6] Most people who work in Marin also live in the county (64%), while about 13% come from Sonoma County and the rest from other Bay Area counties.[7]

The commercial sector of the built environment, which includes retail and office buildings as well as public, government, and industrial facilities, uses about 43% of all electricity and 26% of all natural gas consumed in unincorporated Marin. As such, the commercial sector has a significant role to play in reducing GHG emissions.

Transit service is provided by Marin Transit and Golden Gate Transit, and commuter rail service is provided by the Sonoma-Marin Area Rail Transit (SMART). Golden Gate Transit has been using renewable diesel, which produces about 60% fewer GHG emissions than regular diesel, for its buses since 2016. Marin Transit uses renewable diesel in most of its fleet and began introducing electric buses in 2019. An estimated 8% of Marin County residents commute

[4] California Department of Finance, Report E-5, January 1, 2020.

[5] U.S. Census, American Community Survey 2018 ACS 1-Year Estimates. This is a countywide figure.

[6] Association of Bay Area Governments, Plan Bay Area 2040 Projections.

[7] Census Transportation Planning Products, 2012-2016 data set. These are countywide figures.

to work by public transportation. About 65% of employed Marin County residents drive to work alone and 7% carpool.[8]

The County's climate is conducive to walking and bicycling, and the County's growing network of bicycle and pedestrian facilities and amenities provides safe and convenient routes between certain destinations. Nonetheless, only 3% of Marin County residents walk or bike to work.[9] More residents walking and biking to destinations will help to reduce transportation emissions, improve public health, and build community. Understanding time, safety, and access constraints to biking and walking is essential to encourage residents to shift away from single occupancy vehicles.

With a median household income significantly higher than the average California household ($126,373 vs. $75,277) and a great majority of well-educated residents (62% have a bachelor's degree or higher), Marin residents, on average, have access to more resources, which may allow them to be early adopters of new eco-friendly technologies.[10] For example, Marin County is a leader in zero emission vehicles (ZEVs) in California – second only to Santa Clara County – with 8,600 ZEVs in Marin as of January 2020, or about 4% of registered automobiles. Public information campaigns, incentives, and regulatory mechanisms to accelerate solar and battery storage installation, electric vehicle adoption, and electrification of buildings and appliances are strategies that can be used to reduce GHG emissions. However, while Marin County may have a higher than average median household income and the ability to be early adopters of new technologies, the CAP and its policies and programs should not be designed just for the median Marin resident. Equitable access to programs and incentives are critical to ensuring that all residents can assist in the County's efforts to reduce our community emissions.

Finally, agriculture is an integral part of the County's economy and identity. While the agricultural sector is responsible for nearly one-third of the unincorporated area's emissions due to the large percentage of unincorporated acres dedicated to and protected for agricultural uses, [11] it also provides a unique opportunity to remove carbon from the atmosphere through management practices that build and retain soil organic matter on farms and ranches. There is also potential to reduce emissions through manure management, increasing the efficiency of water and energy use, and optimizing fertilizer application. See Chapter 4: Agriculture and Working Lands for detailed information on the agricultural sector emissions and opportunities.

Community Emissions Inventory

The first step toward developing a climate action plan is to identify sources of emissions and establish baseline levels. In 2020, the Marin Climate & Energy Partnership prepared a Greenhouse Gas Emissions Inventory for unincorporated community emissions for the years 2005 through 2018 consistent with the methodology used for other Marin cities and towns.[12] The inventory quantifies GHG emissions from a wide variety of sources, from the energy used to power, heat, and cool buildings, to the fuel used to move vehicles and power off-road equipment, to the decomposition of solid waste and treatment of wastewater. Emissions are quantified according to methodologies established by the

[8] U.S. Census, American Community Survey 2018 ACS 1-Year Estimates. These are countywide figures.

[9] U.S. Census, American Community Survey 2018 ACS 1-Year Estimates. These are countywide figures.

[10] U.S. Census, American Community Survey 2018 ACS 1-Year Estimates. These are countywide figures.

[11] Agricultural emissions make up 9% of Marin's countywide emissions which is in line with the California Air Resources Board 2019 inventory showing agricultural emissions making up 8% of the statewide GHG emissions.

[12] See Appendix D for additional information on emission sources and quantification methodologies.

U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (v. 1.2). The inventory provides a detailed understanding of where the highest emissions are coming from, and, therefore, where the greatest opportunities for emissions reductions lie. The inventory also establishes a baseline emission inventory against which to measure future progress.

Community emissions are quantified according to these eight sectors:

- The **Built Environment - Electricity** sector represents emissions generated from the use of electricity in homes and commercial, industrial, governmental buildings and facilities, and electric vehicle transportation in the unincorporated area.
- The **Built Environment – Natural Gas** sector represents emissions generated from the use of natural gas in homes and commercial, industrial, and governmental buildings and facilities in the unincorporated area. Propane used in homes is included in this sector, representing about 3% of emissions.
- The **Transportation** sector includes tailpipe emissions from passenger vehicle trips originating and/or ending in unincorporated areas, a share of tailpipe emissions generated by medium and heavy-duty vehicles travelling on Marin County roads, and emissions from transit vehicles and the SMART train when operating within the unincorporated limits. 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 from the operation of off-road vehicles and equipment used for construction, landscape maintenance, and agriculture.
- The **Water** sector represents emissions from energy used to pump, convey, treat, and distribute potable water from the water source to water users in the unincorporated area.
- The **Wastewater** sector represents stationary, process, and fugitive GHGs that are created during the treatment of wastewater generated by the community and emissions created from energy used to process wastewater. It also includes fugitive emissions from septic systems present within the unincorporated area.
- The **Agriculture** sector represents emissions from manure management, livestock enteric fermentation, and fertilizer application.

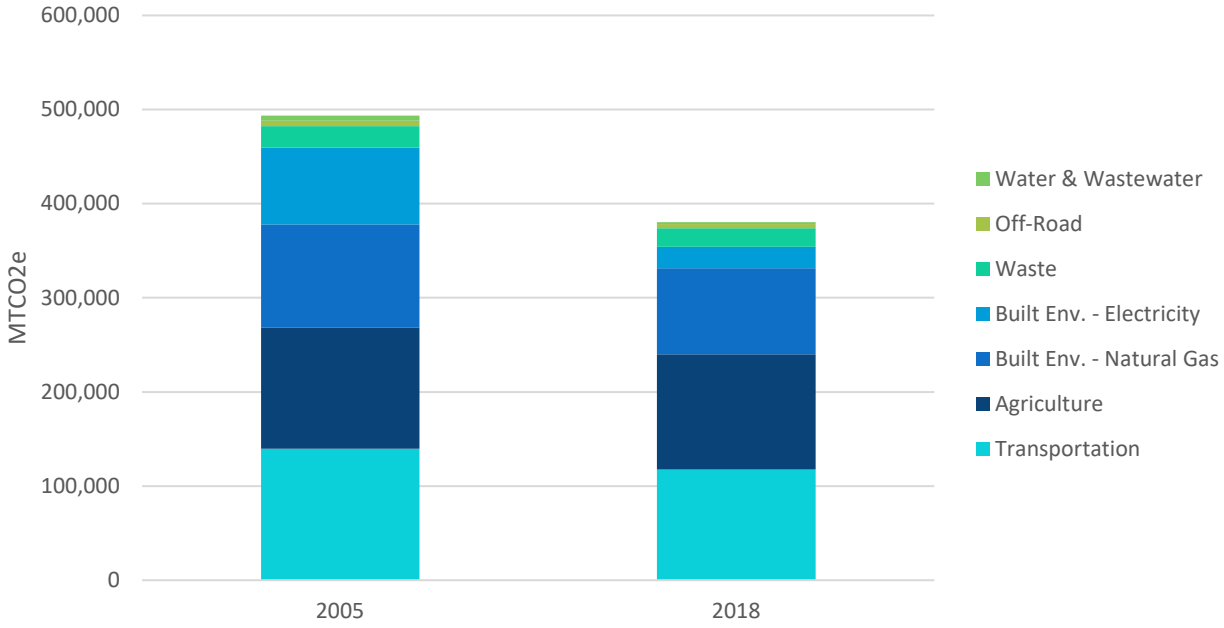
Community GHG emissions totaled 493,985 metric tons in 2005 and 380,318 metric tons in 2018, falling 23%, or 113,367 metric tons CO_2e. As shown in Table 2, reductions occurred in all inventoried sectors. The largest decline occurred in the Built Environment - Electricity sector, due to a 12% reduction in electricity consumption and a significant improvement in the carbon intensity of electricity. Emissions declined 72% in this sector and 58,474 metric tons between 2005 and 2018.

TABLE 2: COMMUNITY EMISSIONS BY SECTOR, 2005 TO 2018

Year	Built Env. – Electricity	Built Env. – Natural Gas	Transportation	Waste	Water	Wastewater	Off-Road	Agriculture	Total	% Change from 2005
2005	81,316	109,636	139,691	22,779	2,798	2,676	5,944	128,845	493,685	
2006	74,822	108,696	142,504	22,447	2,541	2,619	6,131	139,634	499,393	1%
2007	105,080	107,441	144,114	20,061	2,903	2,948	7,232	132,541	522,320	6%
2008	111,578	105,739	140,721	16,677	2,811	2,989	6,107	129,096	515,719	4%
2009	104,750	105,741	139,458	14,364	2,850	2,800	5,447	119,528	494,937	0%
2010	71,263	107,256	129,370	14,027	1,553	2,399	5,169	123,860	454,896	-8%
2011	64,367	108,712	129,161	13,748	1,124	2,430	5,139	118,147	442,828	-10%
2012	63,786	102,534	130,097	14,115	1,178	2,484	5,085	110,834	430,113	-13%
2013	61,408	103,780	129,957	14,173	1,356	2,479	5,001	129,132	447,287	-9%
2014	53,518	84,937	128,039	14,360	1,199	2,345	4,922	113,862	403,181	-18%
2015	51,221	84,951	126,599	14,901	969	2,313	4,830	114,823	400,608	-19%
2016	41,631	89,928	122,449	17,444	676	2,210	4,725	117,950	397,011	-20%
2017	19,660	92,079	120,182	18,250	221	1,983	4,608	118,665	375,648	-24%
2018	22,843	91,280	117,767	19,536	118	1,933	4,471	122,371	380,318	-23%
2005-2018	-58,474	-18,356	-21,924	-3,243	-2,680	-743	-1,473	-6,474	-113,367	
2005-2018	-72%	-17%	-16%	-14%	-96%	-28%	-25%	-5%	-23%	

Figure 3 compares sector emissions between 2005 and 2018. The chart shows how the share of emissions for the Built Environment – Electricity sector has shrunk over the years as energy use has declined and electricity has become cleaner. PG&E has been steadily increasing the amount of renewable energy in its electricity mix, which was 58% less carbon intensive in 2018 than it was in 2005. MCE Clean Energy (MCE), which began serving Marin in 2010, provides its customers with electricity that is generated from 60% and 100% renewable sources.

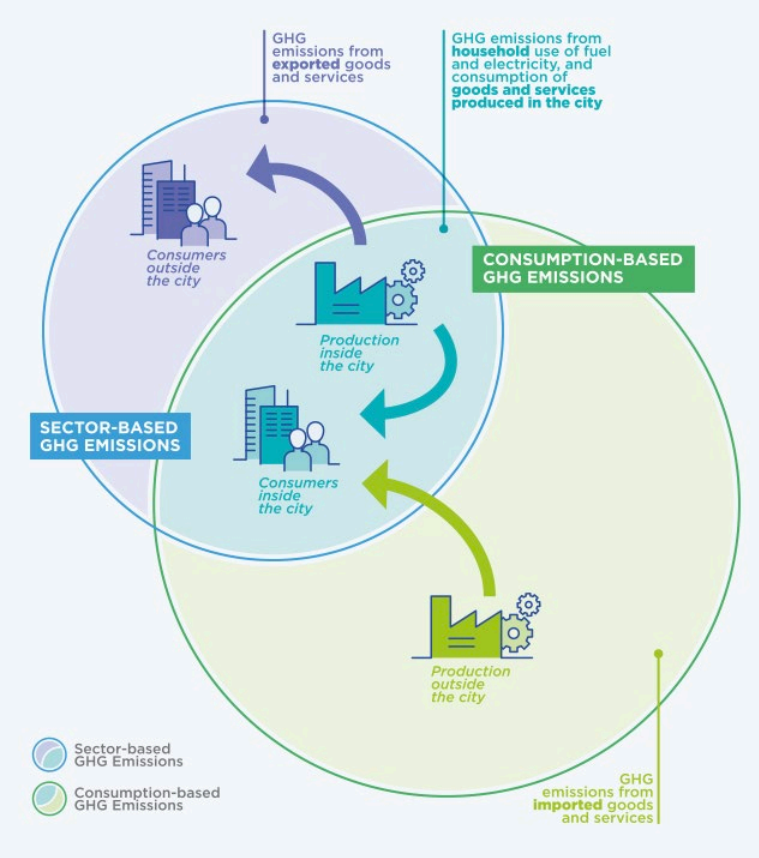
FIGURE 3: EMISSIONS BY SECTOR, 2005 AND 2018



CONSUMPTION-BASED INVENTORY

In addition to the sectors outlined above, which measures the emissions that are generated within the County's borders, there are also emissions associated with the goods and services that residents in Marin consume. These are referred to as "consumption-based emissions," or "embodied emissions" (both terms are used interchangeably in this document). Rather than assessing emissions that are generated within a jurisdictional boundary, consumption-based inventories estimate the emissions based on the goods and services consumed within a place. This includes emissions from raw material extraction, manufacturing, distribution, retail, and disposal. Historically, local governments have only included emissions that occur within their boundaries, including emissions associated with goods that will eventually be exported (Figure 4). However, in communities like Marin County (as in many other communities in the United States) where goods are more often imported than exported, consumption emissions can be up to 800% higher than their sector-based emissions inventory. Consumption emissions are harder to track and have fewer defined pathways for policy intervention from local governments, so the County continues to follow ICLEI's Community Protocol and focus on actionable programs and policies to address local emissions. This CAP, wherever possible, seeks to take into account the whole picture of local contributions to climate change and includes measures to address these emissions in the built environment.

FIGURE 4: SECTOR-BASED VS. CONSUMPTION-BASED GHG EMISSIONS

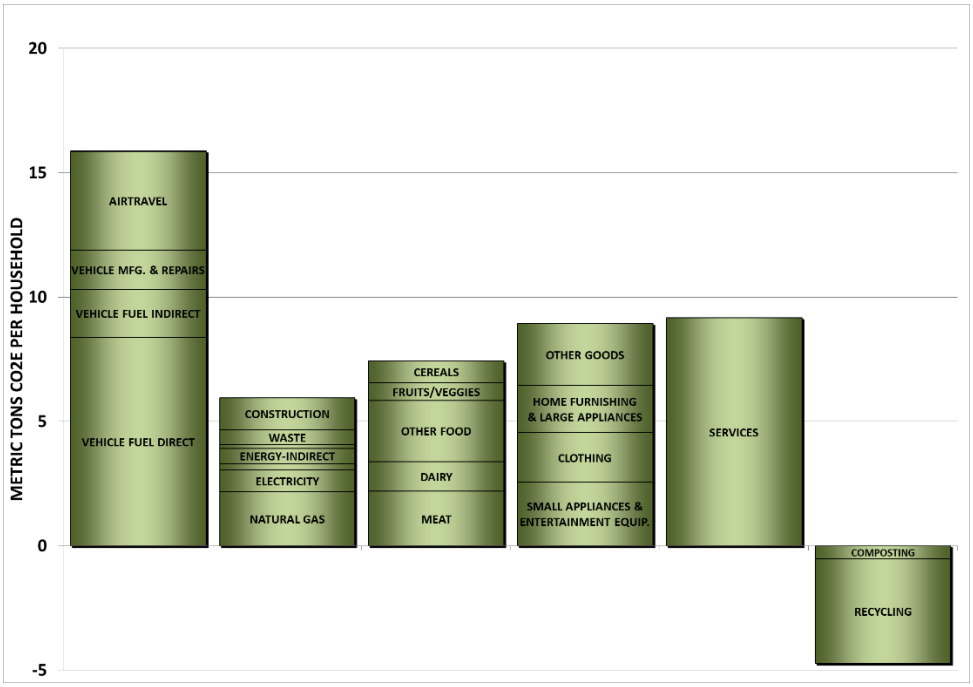


Source: C40 Cities, "Consumption-Based GHG Emissions of the C40 Cities"

In 2016, the Bay Area Air Quality Management District (BAAQMD) and U.C. Berkeley developed consumption-based inventories for Bay Area communities to better understand how purchasing habits contribute to global climate change. A consumption-based inventory includes emission sources that don't get counted in the typical "activity-based" GHG inventory, as well as other items that are difficult to quantify like airplane travel and upstream emissions from the production, transport, and distribution of food and household goods. Figure 5 shows the results of the consumption-based inventory for Marin households. According to this inventory, the average household generates 46.8 $MTCO_2e$ per year. Under the activity-based GHG inventory, the average Marin household generates 5.5 MTCO2e per year, about 12% of the consumption-based estimate. Similarly, the unincorporated County's community-wide emissions of 380,318 $MTCO_2e$ works out to about 5.5 $MTCO_2e$ per household. For more information on the consumption-based inventories, visit https://coolclimate.org/inventory.

Although this consumption-based inventory is informative, it is not updated regularly and therefore does not provide a useful way to track changes in emissions levels over time. The County's Greenhouse Gas Inventory instead focuses on emission sources that the County has some control over and that can be reliably quantified using established protocols and tracked annually in order to inform decision-making and measure progress. The County will continue to monitor the availability and applicability of consumption-based inventories and protocols to incorporate these tools into the annual inventory and implementation planning process.

FIGURE 5: AVERAGE MARIN HOUSEHOLD CARBON FOOTPRINT



Source: CoolClimate Network

Community Emissions Forecast

The Climate Action Plan includes a business-as-usual (BAU) forecast in which emissions are projected in the absence of any policies or actions that would occur beyond the base year to reduce emissions. The forecasts are derived by "growing" 2018 emissions by forecasted changes in population, number of households, and jobs. Transportation emissions are projected utilizing data provided by the Metropolitan Transportation Commission (MTC), which incorporate the vehicle miles traveled (VMT) reductions expected from the implementation of Plan Bay Area 2020 and the Regional Transportation Plan adopted in 2017. As shown in Table 3, emissions are expected to rise about 1.6% by 2030 and 0.9% by 2040. Because ABAG and MTC have not developed projections for 2050, the rate of population growth forecasted by the California Department of Finance for Marin County was used to project population, household, jobs, and VMT for 2050. The Department of Finance projects that Marin's population will decrease 3.6% between 2040 and 2050. As a result, emissions would be approximately 370,000 $MTCO_2e$ by 2050 under the BAU forecast, a decrease of 2.7% from 2018 levels.

TABLE 3: UNINCORPORATED MARIN FORECAST

Forecast Category	2018	2030	2040	2050
Population	71,314	73,490	75,190	72,502
Households	27,822	28,500	28,425	27,409
Jobs	20,638	21,315	21,645	20,871
Emissions ($MTCO_2e$)	380,318	386,316	383,712	369,997

COMMUNITY EMISSIONS REDUCTION TARGETS

The State of California has adopted goals to reduce California's GHG emissions. Passed in 2006, the California Global Warming Solutions Act (Assembly Bill 32) established the State's first target to reduce statewide emissions to 1990 levels by 2020. Because reliable activity data is generally not available to determine 1990 emissions levels for local governments, the California Air Resources Board (CARB) recommended local governments pursue a target, comparable to the statewide target, to reduce emissions 15% below "current" emissions in its *Climate Change Scoping Plan*, which was published in 2008. Given the unreliability of 1990 data, Marin cities and towns have historically used 2005 as the baseline for its emissions inventories and has set GHG reduction goals relative to that year.

In the 2015 CAP Update, the County attempted to complete a revised calculation for a 1990 inventory using the updated protocols. While an inventory was completed for that year and used in the 2015 CAP, it has since been determined that the 1990 inventory is unreliable given the protocol updates and lack of data. Additionally, the County would like to be in alignment with Marin's cities and towns' climate planning efforts in order to achieve countywide collaboration. Therefore, the baseline inventory for this CAP update has been revised to 2005. The inventory prepared for this CAP update demonstrates that the County has exceeded CARB's recommended target by reducing emissions 23% since 2005.

The State has established additional goals for future reductions. Senate Bill 32, passed in 2016, sets a target to reduce statewide emissions 40% below 1990 levels by 2030.

In 2015, Executive Order B-30-15 reaffirmed California's goal to reduce emissions to 80% below 1990 levels by 2050, and in 2018, former Governor Brown issued Executive Order (EO) B-55-18, which established a new statewide goal to achieve carbon neutrality by 2045. The Executive Order defines carbon neutrality as "the point at which the removal of carbon pollution from the atmosphere meets or exceed emissions" and states that carbon neutrality will require both GHG reductions consistent with existing statewide targets and carbon sequestration in forests, soils, and other natural landscapes. EO B-55-18 directs the California Air Resources Board to update future Scoping Plans to identify sequestration targets and recommend measures to achieve the new goal.

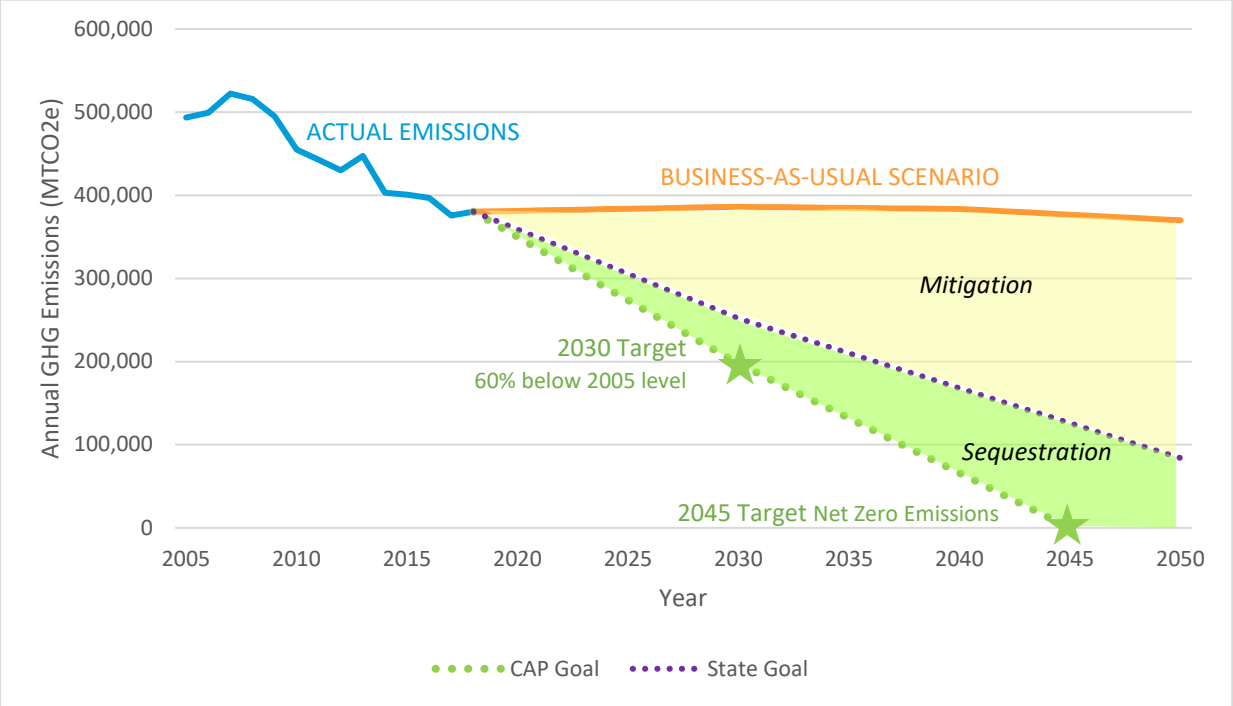
This climate action plan establishes targets that meet the state's guidance for local jurisdictions and Drawdown: Marin goals as shown in Table 4. Countywide, including incorporated areas (cities and towns), 482,629 $MTCO_2e$ needs to be reduced to meet the Drawdown: Marin 2030 goal of 767,859 $MTCO_2e$. Table 4 indicates what the unincorporated areas' (not cities and towns or "countywide") 2030 emissions must be to achieve a reduction equivalent to the Drawdown: Marin goal.

TABLE 4: GHG EMISSIONS TARGETS

	2030 Mitigation Only Target	2030 Mitigation + Sequestration Target	2045
Target	40% below 1990 level[13]	60% below 2005 level	Carbon Neutral
2030 Emissions Limit to Meet Target ($MTCO_2e$)	251,779	197,474	0
Reference	SB 32 Statewide Target	Drawdown Marin	Drawdown Marin
Measures Required to Achieve Target	Mitigation Only	Mitigation plus sequestration	Mitigation plus sequestration

Figure 6 shows the County's GHG emissions trend and forecast and how the local reduction targets (mitigation plus sequestration) compare to statewide targets (40% below 1990 levels by 2030 and 80% below 1990 levels by 2050).

FIGURE 6: COMMUNITY EMISSIONS TREND, FORECAST, AND TARGETS



[13] Consistent with the California Air Resource Board's guidance to local governments, the County is estimating 1990 levels as 15% below 2005 levels. The 2030 target is set at 40% below that level.

CHAPTER 3: STRATEGIES TO REDUCE GREENHOUSE GAS EMISSIONS AND ADAPT TO CLIMATE CHANGE

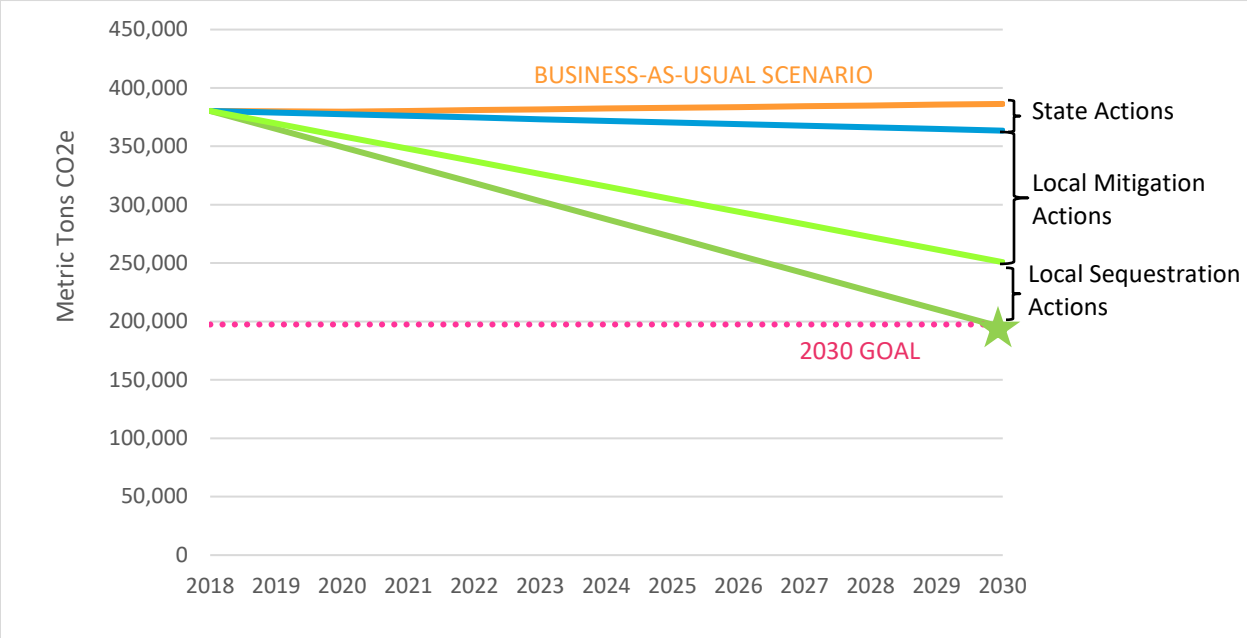
INTRODUCTION

The Climate Action Plan includes a variety of regulatory, incentive-based, and market-based strategies that are expected to reduce emissions from both existing and new development in the County. Several of the strategies build on existing programs while others provide new opportunities to address climate change. State actions will have a substantial impact on future emissions. Local strategies will supplement these State actions and achieve additional GHG emissions reductions. Successful implementation will rely on the combined participation of County staff and as well as residents, businesses, and community leaders.

The following sections identify the State and local strategies included in the CAP to reduce community emissions. The projected reductions from State and local emissions reduction actions total 135,675 $MTCO_2e$ by 2030. Community emissions based on emissions reduction measures only are projected to be 250,641 $MTCO_2e$ by 2030, which meets the SB32 target. However, if sequestration measures are also implemented along with the mitigation measures, community wide emissions reductions would be 191,533 $MTCO_2e$ by 2030. Community emissions are therefore projected to be 194,783 $MTCO_2e$ in 2030 with the full implementation of the CAP. This is 60% below 2005 levels and meets the Drawdown: Marin reduction target.

As shown in Figure 7, State actions represent about 12% of the reduction expected through implementation of the Climate Action Plan. Local mitigation actions designed to reduce emissions represent about 59% of the total and local sequestration emissions designed to drawdown carbon dioxide from the atmosphere represent 29%.

FIGURE 7: CUMULATIVE IMPACT OF REDUCTION STRATEGIES



State Actions

The Climate Action Plan incorporates State reduction strategies that have been approved, programmed, and/or adopted and will reduce local community emissions from 2018 levels. These programs require no additional local actions, although local actions may work to support these programs. State actions are quantified first and deducted from projected community emissions to provide a better picture of what still needs to be reduced at the local level to get to the overall reduction target. State actions, including regulations related to light and heavy-duty vehicles, renewable energy, and building energy codes, and their emissions reductions are shown in Table 5 and detailed in Appendix B: GHG Reduction Calculations.

TABLE 5: ESTIMATED EMISSIONS REDUCTIONS IN MARIN COUNTY FROM STATE ACTIONS

State Action	2030 Emissions Reductions $MTCO_2e$
Light and Heavy-Duty Vehicle Regulations	20,473
Renewable Portfolio Standard	1,476
Title 24 Building Energy Efficiency Standards	936
Total	**22,884**

Local Greenhouse Gas Emissions Reduction Strategies

The local strategies presented in the following sections, and as summarized in Table 6 below, achieve GHG emissions reductions in the community of approximately 168,649 $MTCO_2e$ in 2030. Carbon sequestration represents 55,752 $MTCO_2e$ of this total, or one-third of the total. Emissions reductions are for unincorporated Marin County only. For example, Drawdown: Marin solutions may achieve additional reductions if implemented in incorporated areas (cities and towns).

TABLE 6: LOCAL EMISSIONS REDUCTION STRATEGIES

Strategy	GHG Reductions by 2030 ($MTCO_2e$)
Low Carbon Transportation	37,370
Renewable Energy & Electrification	19,894
Energy Efficiency	16,726
Waste Reduction	12,595
Water Conservation	15
Consumption-Based Emissions	-
Adaptation and Community Resiliency	-
Community Engagement and Empowerment	-
Agriculture and Working Lands - Mitigation	26,297
Agriculture and Working Lands - Sequestration	55,752
Total	**168,649**

Each of the following sections provide a summary table of local measures and associated GHG reductions, followed by a description of the specific actions the County will undertake to implement each measure. The methodologies

and implementation targets used to calculate emissions reductions are described in Appendix B. Sometimes, there is no direct or reliable way to estimate GHG savings for a particular measure or the savings are embedded in another measure. In this case, the reason is noted below the table. For example: Community Engagement is essential for success in many of the measures set forth throughout the plan but counting savings in this section would then be double-counting savings from other measures such as those in Low Carbon Transportation or Energy Efficiency. People need to know about a program to take advantage of it, but the actual emissions reductions will come from participating in the program itself. Therefore, the savings is counted for that program.

Social Equity

Climate change and equity are interconnected. Often, the communities who have contributed the least to global warming, including low-income communities, communities of color, indigenous peoples, and developing nations, suffer first and most from climate change. The County acknowledges disadvantaged communities have existed and still exist in Marin County and seeks to design and implement solutions with them. This requires internal and external on-going work to normalize, organize, and internalize equity principles and approaches.

One definition of social equity is the "just and fair inclusion into a society in which all can participate, prosper, and reach their full potential."[14] Equity is the means to ensure equality for all. An example of how that might work with climate action measures is with energy efficiency. Giving rebates to homeowners to swap out natural gas appliances helps reduce to GHG emissions by switching to low carbon electricity. But if financial incentives are only available to those with means to purchase new appliances it leaves out a section of the community without means. Programs that acknowledge this disparity might offer bigger discounts to low-income households. Additionally, the County acknowledges that appliance upgrades may not be a high priority for all residents. Part of the County's on-going work is to build and nurture relationships with diverse community groups so that they can share what are their priorities and the County can attempt to integrate those priorities into its climate action efforts.

[14] PolicyLink, "The Equity Manifesto."

Low Carbon Transportation

Drawdown: Marin Focus Area: Transportation

Nearly one-third of the unincorporated area's emissions comes from transportation, and reducing these emissions continues to be a challenge. While improvements in fuel efficiency have assisted in reducing total emissions, as demonstrated by the passenger vehicle fleet in Marin County which is about 20% more fuel efficient than it was ten years ago, vehicle miles traveled by passenger cars have increased 9% over the same period. Surveys show that alternative transportation rates have remained stagnant, despite improvements in the bicycle and pedestrian network and public information campaigns to encourage residents to carpool, bicycle, walk, and take transit.

Improvements in the viability and availability of zero emission vehicles (ZEVs), however, has presented an additional tool for communities to reduce emissions significantly. This is especially true in areas such as Marin County where the majority of electricity generation comes from clean, renewable sources. ZEVs include all-battery as well as plug-in hybrid vehicles. Marin County is a leader in ZEV adoption rates across the state – second only to Santa Clara County – and ZEVs already comprise about 4% of registered passenger vehicles in Marin County and the County hopes to increase that rate to 45% by 2030 by building out the EV charging infrastructure and encouraging ZEV ownership through incentives, public education, and development requirements. This is an aggressive target, but one that fits into the State's goal to put 5 million ZEVs on the road by 2030 and to require all new passenger vehicles sold in California to be zero emission by 2035. Improvements in battery and charging technology, expected cost reductions, and automakers' commitments to significantly expand ZEV offerings point to an all-electric future. While purchasing new cars may present an obstacle for lower-income households, programs that incentivize used EV car purchases and installation of EV chargers in multi-family buildings can help ensure the benefits of EV ownership are shared by all.

However, ZEVs cannot alone meet the County's transportation emission reductions goals; reducing congestion, enabling better biking and walking opportunities, and incentivizing public transit all carry co-benefits and can be enjoyed by all.

What You Can Do

- Drive an all-electric or plug-in hybrid vehicle.
- Bike, walk, or take transit whenever possible.
- Reduce the number of miles you drive by working from home when possible and consolidating vehicle trips.
- Shut your car off when waiting in line at the ATM or in the school pick up/drop off lane.
- Better yet, encourage your child to walk or bike to school.

The County will take the following actions to reduce emissions from transportation sources.

TABLE 7: LOW CARBON TRANSPORTATION STRATEGIES

ID	Strategy	GHG Reduction by 2030 ($MTCO_2e$)
LCT-C1	Zero Emission Vehicles ***(Drawdown: Marin Endorsed Solution)***	32,132
LCT-C2	Bicycling and Micromobility	135
LCT-C3	Walking	35
LCT-C4	Safe Routes to School	347
LCT-C5	Public Transit	1,057
LCT-C6	SMART Train	950
LCT-C7	Employee Trip Reduction	72
LCT-C8	Traffic System Management and Vehicle Idling	73
LCT-C9	Smart Growth Development [1]	-
LCT-C10	Zero Emission Landscape Equipment	385
LCT-M1	Zero and Low Emission City Vehicles	1,139
LCT-M2	Low Carbon Fuels[2]	-
LCT-M3	County Employee Commute	1,020
LCT-M4	Municipal Zero Emission Landscape Equipment and Small Off-Road Engines	23
TOTAL		**37,370**

[1] *VMT reductions associated with smart growth development are reflected in MTC's VMT projections which are used to forecast County emissions under the business-as-usual scenario. GHG reductions are not credited here to avoid double counting.*

[2] *There are no emissions reduction because the County was purchasing renewable diesel for its fleet in 2018.*

Low Carbon Transportation Actions

LCT-C1: Zero Emission Vehicles

(Drawdown: Marin Endorsed Solution)

Take actions that will result in 45% of passenger vehicles in the County to be zero emission vehicles (ZEVs), including plug-in electric vehicles (EVs) and hydrogen fuel cell electric vehicles, by 2030. Actions include:

1. Work with Drive Clean Bay Area to develop a new collaborative campaign to accelerate widespread adoption of zero-emission vehicles by Marin's residents and employees. Promote the campaign, assist with securing funding, and help build relationships with schools, businesses, and other entities.
2. Support development of a countywide EV plan that can be adopted by all Marin jurisdictions that identifies strategies to accelerate EV adoption. The plan will identify the number and type of chargers needed in each jurisdiction to achieve a 45% ZEV penetration target; potential locations for public, workplace, and multi-family charging; best practices for charging station siting, installation and signage; and model code language and guides for permit streamlining and charging infrastructure requirements.
3. Provide directional signage to public EV chargers on local streets and, as appropriate, from state highways.
4. Work with the Transportation Authority of Marin (TAM), MCE, the California Energy Commission (CEC) and other entities to provide technical assistance and incentives, such as rebates, for multi-family and workplace charging sites.
5. Participate in a countywide effort by MCE, Pacific Gas & Electric (PG&E), and others to provide rebates for new or used electric vehicles.
6. Pursue and evaluate opportunities to expand the County's EV charging network through innovative programs, such as installing chargers at curbside, streetlight, and power pole locations.

7. As the County's Green Building Ordinance is updated, continue to require new and remodeled single-family, multi-family and commercial projects to install electrical service, add conduits and chargers, as appropriate, for potential electric vehicle use beyond state standards.
8. Investigate adopting an ordinance requiring new and remodeled gas stations to provide EV fast chargers and/or hydrogen fueling stations.
9. Participate in regional efforts and grant programs to encourage widespread availability of EV charging stations.
10. Ensure that programs supporting EV adoption and infrastructure include specific targets and resources for low income and disadvantaged communities.
11. Participate in programs to promote EV adoption, including "Drive an EV" events and other media and outreach campaigns.
12. Encourage or require, as practicable, ride hailing and delivery service companies to utilize zero emission vehicles.
13. Promote adoption of electric bicycles, scooters, and motorcycles.
14. Pursue and evaluate opportunities to establish EV sharing programs and sites.

LCT-C2: Bicycling and Micromobility

Encourage bicycling and micromobility as an alternative to vehicular travel.

1. Promote bicycling and micromobility, including e-bikes, electric scooters, and electric skateboards, through outreach channels and partner agencies.
2. Establish and maintain a system of bicycle facilities that are consistent with the Marin County's Unincorporated Area Bicycle and Pedestrian Master Plan and "complete streets" policies.
3. Implement the Marin County's Unincorporated Area Bicycle and Pedestrian Master Plan's recommendations to support and expand bicycling.
4. Support regional efforts to establish a bike and/or scooter share program.

Micromobility

Micromobility refers to forms of transportation, human-powered or electric, that can occupy space alongside bicycles. It includes electric scooters and skateboards, docked and dockless shared bikes, and other forms of small, lightweight devices operating at speeds typically below 20 mph. Micromobility devices do not have an internal combustion engine.

LCT-C3: Walking

Encourage walking as an alternative to vehicle use.

1. Establish and maintain a system of pedestrian facilities that are consistent with the Marin County's Unincorporated Area Bicycle and Pedestrian Master Plan and "complete streets" policies.
2. Implement the Marin County's Unincorporated Area Bicycle and Pedestrian Master Plan's recommendations to support and expand walking.

LCT-C4: Safe Routes to School

Continue to support the Safe Routes to School Program and strive to increase bicycling, walking, carpooling (especially in a ZEV), and taking public transit to school.

1. Work with TAM and other organizations to promote school and student participation.
2. Identify issues associated with unsafe bicycle and pedestrian facilities between neighborhoods and schools, apply for Safe Routes to School grants, and execute plans to improve pedestrian and bicycle facilities.

LCT-C5: Public Transit

Support and promote public transit by taking the following actions:

1. Work with Marin Transit and Golden Gate Transit to maximize ridership through expansion and/or improvement of transit routes, schedules, and services, such as Marin Transit Connect.
2. Work with TAM, employers, and others to provide and promote first and last mile programs to maximize utilization of public transit.
3. In conjunction with LCT-C2 and C3, provide safe routes to the ferry landing and other transit facilities that encourage bicycle and pedestrian connections.
4. Support a "Yellow School Bus" program and student use of regular transit to reduce school traffic.
5. Encourage transit providers, including school buses, to use renewable diesel as a transition fuel and to purchase electric buses whenever replacing existing buses.

LCT-C6: SMART Train

Encourage residents, commuters, employees, and visitors to take the SMART train.

1. Work with Sonoma-Marin Area Rail Transit (SMART), TAM, and local employers to promote ridership and provide shuttles and first and last mile programs.
2. Provide safe bicycle and pedestrian connections to the SMART station.
3. Encourage SMART to switch to renewable diesel for train operations.

LCT-C7: Employee Trip Reduction

Reduce vehicle miles traveled commuting to work through the following actions:

1. Work with the TAM, the Metropolitan Transportation Commission, and the Bay Area Air Quality Management District (BAAQMD) to promote transportation demand (TDM) programs to local employers, including rideshare matching programs, vanpool incentive programs, emergency ride home programs, telecommuting, transit use discounts and subsidies, showers and changing facilities, bicycle racks and lockers, and other incentives to use transportation other than single occupant vehicles.
2. Update the County's Trip Reduction Ordinance to reflect the most recent BAAQMD regulations and to increase the number of employers subject to the ordinance.
3. Embark on a behavior change and educational campaign to encourage employers and employees to reduce vehicle trips, including through the continuation of teleworking strategies developed in 2020.
4. Work with TAM on developing a county-wide Transportation Demand Management Program to encourage trip reduction throughout the county.

LCT-C8: Traffic System Management and Vehicle Idling

Implement signal synchronization to minimize wait times at traffic lights and to reduce congestion through increased traffic flow.

1. Utilize intelligent traffic management systems to improve traffic flow and guide vehicles to available parking.
2. Encourage drivers and autonomous vehicles to limit vehicle idling through implementing behavior change and engagement campaigns.
3. Investigate adopting an ordinance to regulate idling beyond State requirements.

LCT-C9: Smart Growth Development

Promote land use and development policies that prioritize infill housing and mixed-use development near commercial services and transit facilities.

LCT-C10: Zero Emission Landscape Equipment

Encourage the use of zero emission landscape equipment instead of gasoline-powered equipment, especially by commercial users.

1. Consider offering a discount on business license fees for businesses that use zero emission landscape equipment.
2. Explore building code modifications to support zero emission landscape equipment.

LCT-M1: Zero and Low Emission County Vehicles

Purchase or lease zero-emission vehicles for the County fleet whenever feasible, and when not, the most fuel-efficient models available.

LCT-M2: Low Carbon Fuels

Continue to use low-carbon fuel such as renewable diesel as a transition fuel in the County's fleet and encourage the County's service providers and joint powers agencies to do the same until vehicles are replaced with zero-emissions vehicles.

LCT-M3: County Employee Commute

Continue to provide County employees with incentives and/or reduce barriers to drive electric vehicles and use alternatives to single occupant auto commuting, such as discounted EV charging, transit use discounts and subsidies, bicycle facilities, showers and changing facilities, ridesharing services, vanpools, emergency ride home service, flexible schedules, and telecommuting when practicable.

LCT-M4: Municipal Zero Emission Landscape Equipment and Small Off-Road Engines

Replace gas-powered leaf blowers, mowers, brush cutters, hedgers, saws, and other landscape equipment and small off-road engines, including generators and pressure washers, with zero emission equipment.

Renewable Energy and Electrification

Drawdown: Marin Focus Area: Renewable Energy

Energy that comes from renewable sources, including solar, wind, geothermal, and small hydroelectric, are the cleanest and most-environmentally friendly energy sources. Marin County benefits from a high number of days with clear sunshine, making solar energy a particularly effective energy source. According to data provided by Project Sunroof, 86% of buildings in Marin County are equipped with roofs that are solar-viable. These 68,000 roofs could generate more than the total electricity used in Marin County in 2018. Additionally, reductions in solar and battery system costs make these systems an attractive option for home and commercial building owners. The Climate Action Plan projects that the unincorporated area can get about 38% of its electricity from locally produced solar energy systems by 2030, up from about 19% currently, just by maintaining the current growth rate.

When solar is not an option, residents and business owners can purchase 100% renewable electricity from MCE and PG&E. MCE and PG&E electricity have a high percentage of renewable content, making it some of the cleanest electricity in the country. MCE's Light Green electricity was 74% GHG free in 2018, while MCE's Deep Green electricity comes from 100% renewable sources and is 100% GHG-free. The County has been purchasing Deep Green electricity for governmental operations since 2017.

Since much of the electricity in Marin County comes from renewable sources, consumers can assist with emission reduction efforts by replacing appliances and heating and cooling systems that use natural gas for ones that use electricity. For residents constructing a new home or building, the County's green building ordinance encourages building all-electric buildings. Rebates are also available to replace natural gas appliances with efficient electric units, including water heaters, furnaces, ranges, and cooktops. Replacing the majority of natural gas appliances and equipment in existing buildings in the County will be an important goal for the County in its efforts to achieve emission reduction goals.

What You Can Do

- Switch to MCE Deep Green or PG&E Solar Choice 100% renewable electricity.
- Install a solar energy system on your home or business and consider battery storage.
- Replace appliances that use natural gas for ones that use electricity.
- Investigate heat pump technology so you can swap out heaters and furnaces that use natural gas when it's time to replace them.

Reductions in battery prices may also soon prove to be a feasible and cost-effective option. Local concerns about losing electric service during a Public Safety Power Shutoff event, may be mitigated through solar energy combined with battery storage, and presents a cleaner choice than generators running on natural gas or fossil fuel. Ongoing research and development of energy storage systems are creating new business opportunities and making an all-electric, 100% renewable future possible.

The County will take the following actions to reduce emissions from energy use.

TABLE 8: RENEWABLE ENERGY & ELECTRIFICATION STRATEGIES

ID	Strategy	GHG Reduction by 2030 ($MTCO_2e$)
RE-C1	Renewable Energy Generation and Storage	5,370
RE-C2	GHG-Free Electricity	7,078
RE-C3	Building and Appliance Electrification	7,424
RE-C4	Innovative Technologies[1]	-
RE-C5	Community Resilience Hubs[1] ***(Drawdown: Marin Endorsed Solution)***	-
RE-C6	Microgrid Pilot Project[1] ***(Drawdown: Marin Endorsed Solution)***	-
RE-M1	Solar Energy and Storage Systems for County Buildings[2]	-
RE-M2	Municipal 100% Renewable Electricity[2]	-
RE-M3	All-Electric Municipal Buildings	22
TOTAL		**19,894**

[1] There is no emissions reduction because this is a supportive action.

[2] There is no emissions reduction associated with the action because the County was purchasing Deep Green electricity in 2018.

Renewable Energy & Electrification Actions

RE-C1: Renewable Energy Generation and Storage

Accelerate installation of solar and other renewable energy systems and energy storage systems.

1. Provide solar permit streamlining and reduce or eliminate fees, as feasible.
2. Amend building codes, development codes, design guidelines, and zoning ordinances, as necessary, to facilitate small, medium, and large-scale solar installations.
3. Encourage installation of solar panels on carports and over parking areas on commercial projects, schools, and large-scale residential developments through ordinance, engagement campaigns, and/or agency incentives.
4. Identify and promote financing and loan programs for residential and non-residential projects.
5. Encourage installation of battery storage in conjunction with renewable energy generation projects through engagement campaigns and partner agency incentives.
6. Maintain an online hub that provides information and connects users to resources on solar and battery storage system options, design, installation, permitting, and financing.
7. Work with Marin Municipal Water District and MCE to pursue in-pipe microturbines as way of generating renewable energy that can be used during evening peak energy demand periods when renewable energy sources are less available on the grid.

RE-C2: GHG-Free Electricity

Encourage residents and businesses to switch to 100% renewable electricity (MCE Deep Green, MCE Local Sol, and PG&E Solar Choice) through engagement campaigns and partner agency incentives and work with MCE Clean Energy to assure that it reaches its goal to provide electricity that is 100% GHG-free by 2022.

RE-C3: Building and Appliance Electrification

Accelerate electrification of building systems and appliances that currently use natural gas, including heating systems, hot water heaters, stoves, ranges, and clothes dryers.

1. Explore opportunities to continue existing rebate programs, such as Electrify Marin.
2. Consider adopting an ordinance in 2024 that requires homeowners to replace natural gas appliances, such as water heaters, stoves, cooktops, clothes dryers, and heating systems with high-efficiency electric appliances at time of replacement where feasible. Evaluate the financial impact on households at different income levels and consider offering rebates or subsidies, in partnership with electricity providers if available, for disproportionately impacted households.

RE-C4: Innovative Technologies

Investigate and pursue innovative technologies such as micro-grids, battery storage, and demand-response programs that will improve the electric grid's resiliency and help to balance demand and renewable energy production in cooperation with local and regional partners such as MCE and PG&E, as feasible.

RE-C5: Community Resilience Hubs

(Drawdown: Marin Endorsed Solution)

The County of Marin will work with the City of San Rafael to develop two community resilience hubs at the Albert J. Boro Community Center/Pickleweed Park and the County Health and Wellness Campus. Working with Canal District-based community organizations and non-profits and the County's Health and Human Services Department, the County and City will build hubs that serve the community and coordinate communication, distribute resources, reduce GHG emissions, and help prepare the community for emergencies. The hubs will include community gardens, health clinics, communications center, green power, and recreational/educational opportunities.

RE-C6: Microgrid Pilot Project

(Drawdown: Marin Endorsed Solution)

Work with the Town of Fairfax and its partners to build a Community Resilience Center at the Fairfax Pavilion. The project will leverage existing solar photovoltaic systems at the Fire and Police Stations and the Pavilion and will add additional solar, batteries, and a new inverter. The project will leverage Self-Generation Incentive Program funding, the MCE Resilience Fund, and other funding sources to build the project. When complete, it will serve as a community gathering space during emergency events such as public safety power shut-off (PSPS) events, showcase the latest battery storage technology, and educate and inspire other cities and towns to pursue similar projects. Provide technical support to the project as needed, assist with identifying funding sources, promote the project's successes and lessons learned, and help identify additional microgrid locations.

RE-M1: Solar Energy and Storage Systems for County Buildings

Continue to install solar energy systems at municipal buildings and facilities where feasible and investigate and pursue innovative technologies such as battery storage and demand response programs.

RE-M2: Municipal 100% Renewable Electricity

Continue to purchase 100% renewable energy through programs such as MCE Deep Green.

RE-M3: All-Electric Municipal Buildings

1. Exclude natural gas, propane, and other fossil fuel infrastructure from newly developed County of Marin buildings as feasible.
2. Conduct an inventory of natural gas end uses in existing County facilities and identify timelines for electrification in concert with planned system replacements contingent on funding availability.

Energy Efficiency

Drawdown: Marin Focus Area: Buildings and Infrastructure

Increasing the efficiency of buildings is often the most cost-effective approach for reducing GHG emissions. Energy efficiency upgrades, such as adding insulation and sealing leaks in heating ducts, have demonstrated energy savings of up to 20%, while more aggressive "whole house" retrofits can result in even greater energy savings. Many of these improvements can be made inexpensively and without remodeling yet can be extremely cost-efficient, such as swapping out incandescent bulbs to LED bulbs, sealing air leaks, and installing a programmable thermostat. Energy Star-certified appliances and office equipment, high-efficiency heating and air conditioning systems, and high-efficiency windows not only save energy but reduce operating costs in the long run. Rebates, financing, and tax incentives are often available for residents and businesses to help defray the cost of upgrades.

The unincorporated Marin community has been doing a good job reducing energy use. Since 2005, electricity consumption has declined an average of 0.9% per year and natural gas consumption has declined about 1.3% each year. The County is seeking to work with the utilities and other partners to promote energy efficiency and electrification programs to reduce energy use by 1% each year.

New construction techniques and building materials, known collectively as "green building," can significantly reduce the use of resources and energy in homes and commercial buildings. Green construction methods can be integrated into buildings at any stage, from design and construction to renovation and deconstruction. The State of California requires green building and energy-efficiency through the Title 24 building codes. The State updates these codes approximately every three years, with increasing energy efficiency requirements since 2001. The State's energy efficiency goals are to have all new residential construction to be zero net electricity by 2020 and all new residential and commercial construction to be zero net energy by 2030. Local governments can accelerate this target by adopting energy efficiency standards for new construction and remodels that exceed existing State mandates, or by providing incentives, technical assistance, and streamlined permit processes to enable quicker adoption.

What You Can Do

- Replace indoor and outdoor lights with LED bulbs and turn them off when not in use.
- Have an energy assessment done for your home or business.
- Upgrade insulation, seal leaks, and install a programmable thermostat.
- Purchase Energy Star appliances and equipment.
- Unplug electronic appliances when not in use and set the thermostat to use less heat and air conditioning.

As part of the triennial update to the state building code in 2019, the County of Marin adopted an energy efficiency reach code that encourages all-electric homes and commercial buildings and requires new buildings using natural gas to exceed State energy efficiency requirements. The County has also taken several actions to reduce energy consumption in governmental operations, including converting streetlights to LED and upgrading inefficient lighting and mechanical and ventilation equipment in buildings. Our plan assumes the County can continue to reduce energy use through retrofit of existing systems and equipment, as well as behavioral changes.

The County will take the following actions to reduce emissions through energy efficiency.

TABLE 9: ENERGY EFFICIENCY STRATEGIES

ID	Strategy	GHG Reduction by 2030 ($MTCO_2e$)
EE-C1	Energy Efficiency Programs	15,323
EE-C2	Energy Audits	160
EE-C3	Cool Pavement and Roofs	383
EE-C4	Green Building Reach Code	830
EE-M1	Public Lighting[1]	-
EE-M2	Energy Efficiency Audit and Retrofits in County Buildings	20
EE-M3	Energy Conservation in County Buildings	10
TOTAL		**16,726**

[1] *There is no emissions reduction associated with this action because the County was purchasing GHG-free electricity in 2018.*

Energy Efficiency Actions

EE-C1: Energy Efficiency
Promote and expand participation in residential and commercial energy efficiency programs.

1. Work with organizations and agencies such as the Marin Energy Watch Partnership, the Bay Area Regional Network (BayREN), MCE, Resilient Neighborhoods, and the Marin Climate & Energy Partnership to promote and implement energy efficiency programs and actions.
2. Continue and expand participation in energy efficiency programs as they become available.
3. Promote utility, state, and federal rebate and incentive programs.
4. Participate and promote financing and loan programs for residential and non-residential projects such as Property Assessed Clean Energy (PACE) programs, BayREN financing programs, PG&E on-bill repayment, and California Hub for Energy Efficiency Financing (CHEEF) programs.

EE-C2: Energy Audits
Investigate requiring energy audits for residential and commercial buildings at time of sale or major remodel. Requirements could include identification of electrification and energy efficiency opportunities and supporting programs could connect building owners to potential rebates and financing options. Consider including energy audits with a Residential Resale Report program that would also inspect septic systems and determine any hazards to health and safety, potential violation to County codes, and accuracy of County records.

EE-C3: Cool Pavement and Roofs
Use reflective, high albedo material for roadways, parking lots, and sidewalks and cool roofs to reduce the urban heat island effect and save energy.

1. Evaluate the use of high albedo pavements when resurfacing County streets or re-roofing County facilities.
2. Adopt mandatory building code measures to require new development to use high albedo material for driveways, parking lots, walkways, and patios, and cool roofing.

EE-C4: Green Building Reach Code

1. Continue to adopt a green building ordinance for new and remodeled commercial and residential projects that requires green building methods and energy efficiency savings above the State building and energy codes.
2. Prohibit the use of natural gas end uses in new residential buildings in the County's green building ordinance that aligns with the 2022 California Building Standards code update. Extend the same prohibition to new nonresidential buildings in the 2025 code cycle.

EE-M1: Public Lighting

Replace remaining inefficient street, parking lot, and other outdoor lighting with LED fixtures as they burn out.

EE-M2: Energy Efficiency Audit and Retrofits in County Buildings

Work with the Marin Energy Management Team to identify and implement energy efficiency projects in municipal buildings and facilities and electrification of existing building systems and equipment that use natural gas.

EE-M3: Energy Conservation in County Buildings

Reduce energy consumption through behavioral and operational changes.

1. Establish energy efficiency protocols for building custodial and cleaning services and other employees, including efficient use of facilities, such as turning off lights and computers, thermostat use, etc.
2. Incorporate energy management software, electricity monitors, or other methods to monitor energy use in municipal buildings, where feasible.

Waste Reduction

Drawdown: Marin Focus Areas: Carbon Sequestration, Local Food and Food Waste, Climate-Resilient Communities

Consumption and disposal of goods generates significant GHG emissions during manufacturing, transport, distribution, and disposal. The best way to reduce emissions is to purchase and consume less in the first place, and then find someone who can reuse whatever you no longer need before considering recycling or disposal.

Due to the way the County accounts for community emissions, the County's Climate Action Plan does not take credit for reducing upstream emissions. Instead, our GHG accounting is directly concerned with emissions that are created from the anaerobic decomposition of organic waste in the landfill. The decomposition process creates methane, which is 28 times more potent as a GHG than carbon dioxide. Although landfills capture most of the methane, and some use that methane to create biogas or electricity, about one-quarter of it escapes into the atmosphere.

Diverting organic material from the landfill is a clear and viable option for reducing these emissions. Paper and cardboard can be recycled. Food scraps, some paper (like napkins and paper towels), and yard waste can be composted, either at home or at the landfill. Surplus food can be donated to non-profits that distribute it to those in need. The measures below are designed to maximize diversion of organic waste from the landfill by 2030, starting with encouraging residents and businesses to recycle and compost organic waste. To meet our diversion target, the County will consider adopting an ordinance that mandates recycling and, as a last resort, setting trash collection fees that enable the waste haulers to invest in machinery that can sort trash and recover all compostable and recyclable materials before they are sent to the landfill.

What You Can Do

- Buy only as much as you need.
- Buy locally grown food and eat less meat.
- Put your food scraps in the green can and/or compost them at home.
- Donate extra food and used clothing and housewares.
- Don't be a "wishful" recycler. Be scrupulous about how you sort your recyclables. Check the Recycle Right Guide for tips.

These local measures also support state legislation to significantly reduce emissions from organic waste disposal. Senate Bill (SB) 1383 establishes targets to achieve a 50% reduction in statewide for waste disposal from the 2014 level by 2020 and a 75% reduction by 2025. The law also establishes a target that not less than 20% of currently disposed edible food is recovered for human consumption by 2025. In 2022, CalRecycle may begin to issue penalties for non-compliance. On January 1, 2024, the regulations may require local jurisdictions to impose penalties for non-compliance on regulated entities subject to their authority.

In addition, Assembly Bill (AB) 1826 requires businesses to recycle their organic waste, depending on the amount of waste they generate per week. The law phases in mandatory recycling of commercial organics over time. As of January 2019, businesses that generate 4 or more cubic yards of commercial solid waste per week are required to arrange for organic waste recycling services. If statewide disposal targets are not met by 2020, the law will be extended to cover businesses that generate 2 cubic yards or more of commercial solid waste

The County will take the following actions to reduce emissions from waste.

TABLE 10: WASTE REDUCTION STRATEGIES

ID	Strategy	GHG Reduction by 2030 ($MTCO_2e$)
WR-C1	Commercial Organic Waste	1,730
WR-C2	Residential Organic Waste	2,806
WR-C3	Construction & Demolition and Self-Haul Waste	261
WR-C4	Mandatory Waste Diversion	4,567
WR-C5	Waste Processing Infrastructure	3,231
WR-C6	Extended Producer Responsibililty[1]	-
WR-C7	Inorganic Waste[1]	-
WR-C8	Biomass Study/Recovery Pathways[1]	-
WR-M1	Waste from County Operations[2]	-
TOTAL		12,595

[1] *There is no emissions reduction associated with this action because it is a supportive action.*

[2] *To the extent the County's operations are located in the unincorporated area, the emissions reduction is included in the community actions above.*

Waste Reduction Actions

WR-C1: Commercial Organic Waste

Work with Zero Waste Marin, the County's waste haulers and special districts, and nonprofits such as Extra Food to divert commercial organic waste from the landfill through recycling, composting, and participation in waste-to-energy and food recovery programs.

1. Conduct outreach and education to businesses subject to State organic waste recycling mandates (AB 1826 and SB 1383) and encourage or enforce compliance with the law.
2. Refer new and major remodel commercial and multi-family residential project proposals to the County's waste haulers for review and comment and require projects to provide adequate waste and recycling facilities and access as feasible.
3. Encourage and facilitate commercial and multi-family property owners to require responsible use of on-site recycling facilities in lease and rental agreements and to train and regularly evaluate janitorial, landscape, and other property management services.
4. Assess capacity of existing food recovery programs, expand existing food recovery infrastructure if needed, monitor commercial generators for compliance, and conduct education and outreach.
5. Evaluate expansion of existing waste-to-energy programs, such as working with the Central Marin Sanitation Agency to expand their food-to energy program.

WR-C2: Residential Organic Waste

Work with Zero Waste Marin, the County's waste haulers and special districts, and other organizations to educate and motivate residents to utilize curbside collection services and home composting for food waste.

WR-C3: Construction & Demolition Debris and Self-Haul Waste

1. Require all loads of construction & demolition debris and self-haul waste to be processed for recovery of materials as feasible.
2. Investigate creation of an ordinance requiring deconstruction of buildings proposed for demolition or remodeling when materials of significant historical, cultural, aesthetic, functional or reuse value can be salvaged.

WR-C4: Mandatory Waste Diversion

Adopt an ordinance by January 1, 2022 requiring all commercial and residential accounts to subscribe to and fully participate in waste diversion activities, including recycling and organics collection provided by the County's waste haulers. Consider including phased implementation of the ordinance, penalties, and practical enforcement mechanisms.

WR-C5: Waste Processing Franchise Agreement and Infrastructure

1. Review and revise the County's franchise agreement with waste haulers to ensure adequate recycling and composting capacity is available and waste reduction and diversion targets are met.
2. Ensure organic waste collection service (including green waste, food waste, fibers, and manure) that complies with SB 1383 regulations is provided to all residents and businesses.
3. Conduct a feasibility study (including cost estimates and estimated GHG reduction metrics) and consider investing in new solid waste processing infrastructure to remove recoverable materials (recycling and organics) from the waste stream and reduce contamination.
4. Require regular residential and commercial waste audits and waste characterization studies to identify opportunities for increased diversion and to track progress in meeting targets.

WR-C6: Extended Producer Responsibility

1. Encourage the State to regulate the production and packaging of consumer goods and take-back programs.
2. Encourage on-demand delivery services like Amazon and Blue Apron to reduce packaging waste and investigate requirements and incentives for same through ordinance or engagement campaigns.

WR-C7: Inorganic Waste

1. Complete adoption of draft Reusable Foodware Ordinance that was begun in early 2020.
2. Promote reuse, repair, and recycling of inorganic materials, and encourage reduced use of packaging and single use items through engagement campaigns.
3. Investigate supporting a local building material reuse center.

WR-C8: Biomass Study/Recovery Pathways

(Drawdown: Marin Endorsed Solution)

Study existing biomass sources and uses and their potential impacts on GHG emissions and wildfire protection. The study will assess the types of biomass currently generated and estimate increases due to the passage of Measure C – Marin Wildfire Prevention Authority. Generally, the purpose of the study is to identify type and quantity of biomass generated countywide and determine all beneficial second-uses of this material, e.g. biomass to energy or reuse of woody material as ground cover on ranches. Funding is needed to conduct the study and implement any actions identified. The County will help connect multiple entities currently investigating biomass quantities and potential re-uses and help develop a cohesive vision and plan. It will help identify outside funding resources needed for study and implementation and provide technical assistance.

WR-M1: Waste from County Operations

Increase opportunities to reduce waste at County facilities.

1. Embark on an educational and social marketing-based campaign to increase recycling, composting, reuse, and waste reduction at County facilities.
2. Conduct periodic waste audits to understand where opportunities for increased diversion lie and to track progress.

Water Conservation

Drawdown: Marin Focus Area: Climate Resilient Communities

Marin is no stranger to periodic droughts and the need to conserve water, and the community has responded by reducing per capita water use by about 23%, from 144 gallons per person per day (gpcd) in 2005 to 111 gpcd in 2018. In addition to installing low-flow fixtures (showerheads, faucets, and toilets) and water-efficient appliances (clothes washers and dishwashers), residents and businesses are planting native, drought-tolerant species and even replacing lawns with attractive, low-water use gardens. Good thing, because as temperatures continue to rise, we will experience more droughts and more intense heat waves than before.

Our Greenhouse Gas Inventory counts emissions that are generated from the energy used to pump, treat, and convey water from the water source to water users in the unincorporated area. Far more emissions are created from the energy that is used to heat water, but those emissions are counted in the residential and commercial energy sectors. Therefore, the water sector comprises a much smaller share of community emissions than one might expect.

What You Can Do

- Replace your lawn with a drought-tolerant garden.
- Install a drip irrigation system, program it to run early in the morning, and check it regularly for leaks.
- Install low water flow faucets, showerheads, and toilets.
- Buy water-efficient dishwashers and clothes washers when it's time to replace them.

Water agencies that supply the County's water are committed to using 100% renewable energy in their operations. Marin Municipal Water District (MMWD) began purchasing Deep Green electricity from MCE in 2017, and Sonoma County Water Agency, which provides 20-25% of MMWD's water and about 70% of North Marin Water District's water, started purchasing 100% renewable electricity in 2015. As a result, although we are targeting a 1% reduction in water consumption each year through 2030, emissions reductions are relatively small.

The County will take the following actions to reduce emissions from water use.

TABLE 11: WATER CONSERVATION STRATEGIES

ID	Strategy	GHG Reduction by 2030 ($MTCO_2e$)
WC-C1	Community Water Use	15
WC-M1	Municipal Water Use[1]	Included in above

[1] *To the extent the County's operations are located in the unincorporated area, the emissions reduction is included in the community action above.*

Water Conservation Actions

WC-C1: Community Water Use

Reduce indoor and outdoor water use in residential and commercial buildings and landscaping.

1. Work with water districts and other organizations to promote water conservation programs and incentives.
2. Educate residents and businesses about local and State laws requiring retrofit of non-compliant plumbing fixtures during remodeling and at resale.
3. Ensure all projects requiring building permits, plan check, or design review comply with State and water district regulations.
4. Encourage the installation of greywater and rainwater collection systems and the use of recycled water where available through ordinance and/or engagement campaigns.
5. Investigate potential on-bill financing for water conservation measures, such as BayREN's Water Upgrades Save Program.
6. Encourage water districts to upgrade water meters to facilitate more granular and real-time water tracking data to better understand water use and detect leaks.

WC-M1: Municipal Water Use

Reduce indoor and outdoor water use in municipal facilities and operations.

1. Replace high water use plants and inefficient irrigation systems with water-efficient landscaping.
2. Investigate site appropriateness and life cycle impacts of synthetic turf that uses organic infill for ball fields and parks to reduce water, herbicide use, and maintenance costs, while increasing field use throughout the year.
3. Replace inefficient plumbing fixtures with high-efficiency fixtures.
4. Use recycled water as available and practicable for parks and outdoor landscaping.

Consumption-Based Emissions

Drawdown: Marin Focus Areas: Applicable to all Focus Areas

The Waste Reduction section above outlines essential actions to reduce greenhouse gas emissions from disposal in Marin County, and certain measures to address upstream waste generation through extended producer responsibility. When this conversation ends at only discussing waste, an opportunity is missed to examine Marin County's role in an economy that is centered upon natural resource extraction. This CAP focuses on activity-based emissions in unincorporated Marin, over which the County has more direct control. However, Marin County has already demonstrated opportunities to develop well-researched policies and programs to reduce embodied emissions, and this chapter includes additional opportunities for exploration over the CAP period to provide further leadership around embodied emissions.

Through a 2018 grant from the Bay Area Air Quality Management District, and in partnership with stakeholders from across the region, the County of Marin developed practical requirements for the composition of concrete that maintains adequate strength and durability for the intended application and at the same time reduces GHG emissions by reducing cement content and encouraging alternative cementitious materials. This work provides a template for understanding the lifecycle emissions of building materials and outlines a process to work with expert partners to develop fair and feasible building requirements to reduce embodied emissions.

What You Can Do

- Be mindful of new materials used when renovating your home or office and try to identify ways to repurpose existing materials.
- When purchasing new building materials, try to find ones with EPDs to compare the lifecycle footprint of a product.
- Purchase used or repurposed products when possible.

Consumption based inventories for the Bay Area show that Marin's per capita consumption based emissions are over eight times larger than per capita activity emissions measured in this inventory (see a detailed description of consumption-based inventories on page 14). This represents emissions from a larger economic system that is dependent on fossil fuels and natural resource extraction that cannot be solved by individual actions and local governments alone. However, there is an important role for cities and counties to play in demonstrating what is possible and leading state and federal governments to consider industry regulations that address the whole lifecycle of manufacturing on the environment.

TABLE 12: CONSUMPTION-BASED EMISSIONS STRATEGIES

ID	Strategy	GHG Reduction by 2030 ($MTCO_2e$)
CBE-C1	Low-Embodied Emission & Carbon Sequestering Building Materials	-
CBE-C2	Deconstruction	-
CBE-M1	Buy Clean Requirements	-

CBE-C1: Low-Embodied Emission & Carbon Sequestering Building Materials

Consider developing policies and programs that build on the success of the low carbon concrete ordinance, including:

1. Exploring similar policies to those developed for low carbon-concrete for steel, glass, and other high-embodied emissions materials. This could include the development of whole-building lifecycle emission targets, which are increasingly feasible with the advancement of Environmental Product Declaration (EPD) software. Vancouver, B.C. has explored similar policies of setting "carbon caps" for common building types, similar to how the State has used modeled buildings to set limits on energy consumption.
2. Encourage the use of building materials that store carbon, such as wood, through agency partnerships and engagement campaigns. Review the County's building code to ensure there are not barriers to new technologies such as Cross-Laminated Timber, which can replace traditional steel building frames and sequester carbon.

CBE-C2: Deconstruction of Buildings

Deconstruction is the process of taking apart, rather than demolishing, buildings to salvage components and minimize landfill disposal. Deconstruction policies can vary based on common building types in a given community. The County will explore the development of a deconstruction ordinance. Similar policies adopted in Portland, Oregon focus on single-family residences built prior to 1940, which tend to have high quality materials such as old growth wood and decorative finishes. A deconstruction policy must be paired with economic development work to ensure that there are qualified contractors who can fulfill the requirements of an ordinance, and a market for the materials recovered. The County will participate in relevant regional working groups seeking to explore Bay Area-wide policies and programs for deconstruction, which may offer economies of scale.

In addition, explore policies that outline new building standards with end of life in mind, and opportunities to promote adaptive reuse, which can decrease the development of new buildings that will be directed to the landfill at the end of their life.

CBE-M1 Buy Clean Purchasing

On October 15, 2017, California's Governor signed Assembly Bill 262, known as the "Buy Clean California Act" to require EPDs for certain materials being specified for state building projects, meaning that suppliers' emissions performance will be taken into account when an agency is contracting to buy steel, flat glass, and mineral wool insulation for infrastructure projects. Consider adopting mirrored policies for County of Marin purchasing.

Adaptation and Community Resiliency

Drawdown: Marin Focus Area: Climate Resilient Communities

California is already experiencing the effects of climate change. Every year, it seems like the news gets grimmer: more wildfires, more heat waves, longer droughts, more intense storms, less snowpack, and less fresh water. Annual average air temperatures have already increased by about 1.8 °F in California, and that number will likely double even if the world can reduce emissions 80% by 2050. Marin needs to be prepared for the likely impacts of climate change, including flooding from sea level rise and more intense storms, health impacts from heat exposure and wildfire smoke, safety risks from the increased likelihood of wildfires and landslides, impacts to groundwater levels from sea level rise, and negative impacts to agriculture, species, and natural resources.

Sea level rise is a particular concern to Marin, where many homes, businesses, roads, utilities, and natural resources are at risk for flooding. Sea level has already risen 8" in San Francisco Bay and is expected to rise another 10 inches by 2040. Within this short time period, homes and facilities along the eastern shoreline in Waldo Point, Greenbrae, and Paradise Cay, as well as Shoreline Highway through Almonte, could be exposed to tidal flooding. As sea level rises, other bayside unincorporated areas become vulnerable, including Bel Marin Keys, Santa Venetia, Tamalpais Valley, Greenwood Cove, Strawberry, and Kentfield. On the ocean coast, Stinson Beach neighborhoods, downtown Bolinas, and the Tomales Bay shorelines in Inverness and East Shore are vulnerable.

A comprehensive assessment of potential sea level rise scenarios and Marin's vulnerable assets was completed in 2017 and 2018 through the County's BayWAVE and C-SMART efforts. According to the studies, by the end of the century, sea level is projected to rise 2.4 to 3.4 feet, and possibly as much as 10 feet. At 5 feet of sea level rise, nearly 2,900 buildings in the unincorporated areas along Marin's eastern shoreline and 20% of buildings along the ocean coast could face some level of tidal flooding. For more information, see the Marin Shoreline Sea Level Rise Assessment and the Marin Ocean Coast Sea Level Rise Adaptation Report.

What You Can Do

- Find out if your home or business is vulnerable to sea level rise at Our Coast Our Future.
- Prepare for more wildfires. Join a Firewise Community. Create a defensible space, harden your home, and have an emergency evacuation plan. Learn how at www.firesafemarin.org.
- Install solar with battery storage to get through power outages.

Many of the recommended actions incorporated in this Climate Action Plan will help the community prepare for the effects of climate change. Reducing water use will ease competition for limited water supplies expected from higher temperatures and reduced snowmelt, while reducing electricity use will help ease demand for diminishing hydroelectric power. Other expected effects from climate change – such as higher frequency of damaging fires and pest and insect epidemics – must be anticipated through adequate public safety, emergency, and public health responses.

The County will take the following actions to adapt to climate change and make the unincorporated communities more resilient.

Adaptation Actions

AD-C1: Climate Change and Sea Level Rise Adaptation

1. Ensure fair and robust inclusion of lower-income households and diverse communities in the planning and response to climate change impacts, including sea level rise, wildfire, public health, and emergency preparedness.
2. Support and integrate Climate Action Planning and implementation with the ongoing adaptation efforts of C-SMART and BayWAVE.
3. Coordinate and integrate Climate Adaptation Planning consistently throughout related County plans, including but not limited to the Countywide Plan and its Safety Element, Local Hazard Mitigation Plan (LHMP), sea level rise adaptation plans, Community Wildfire Protection Plan, Local Coastal Plan and emergency and capital improvement plans.
4. Collaborate with cities within the County, as well as special districts, and subregional bodies such as Transportation Authority of Marin to coordinate and integrate planning.
5. Adopt a comprehensive climate change adaptation plan that prepares for and responds to the expected impacts of climate change.

COMMUNITY ENGAGEMENT AND EMPOWERMENT

DRAWDOWN: MARIN FOCUS AREAS: APPLICABLE TO ALL FOCUS AREAS

The Climate Action Plan contains actions that the County will undertake to reduce community emissions. While the County can compel some action by adopting ordinances and building regulations, much of the success of our plan will depend on informing community members and encouraging them to take action on their own. This section details the ways in which the County will seek public engagement and work with local businesses and community groups to achieve the emissions reductions identified for actions in other sections of the plan.

The County has been partnering with Resilient Neighborhoods since 2011 to educate and empower residents to reduce their carbon footprints. The program consists of a free 5-session covers a range of action including consumption, support of local business, diet, water, waste, home energy, transportation including air travel, and being prepared to adapt to a changing climate. To start, participants calculate their household carbon footprint and then take actions to reduce their GHG emissions by at least 5,000 pounds or 25% while also earning Resilience Points for actions like being prepared for wildfires. Nearly 1,500 Marin County residents have participated in the program as of 2020.

What You Can Do

- Sign up for Resilient Neighborhoods and join a Climate Action Team.
- Calculate and commit to reducing your carbon footprint by taking the actions identified in this Plan.
- Get your business certified as a Green Business with the Marin Green Business Program.

The County will take the following actions to engage the community to reduce emissions.

TABLE 13: COMMUNITY ENGAGEMENT AND EMPOWERMENT STRATEGIES

ID	Strategy
CE-C1	Community Education
CE-C2	Resilient Neighborhoods – Climate Protection and Resilience (CPR) for the Planet ***(Drawdown: Marin Endorsed Solution)***
CE-C3	Community Engagement via Drawdown Marin
CE-C4	Advocacy
CE-C5	Green Businesses
CE-C6	Carbon Offsets

COMMUNITY ENGAGEMENT ACTIONS

CE-C1: Community Education

Work with community-based organizations, such as Resilient Neighborhoods, the Canal Alliance, Multicultural Center of Marin, West Marin Community Services, Shore up Marin City, and Marin City People's Plan, to educate and motivate community members to start or continue to reduce GHG emissions in their homes, businesses,

transportation mode choices, and other activities, and increase community resilience through community-building activities.

CE-C2: Resilient Neighborhoods – Climate Protection and Resilience (CPR) for the Planet Initiative

(Drawdown: Marin Endorsed Solution)

The CPR for the Planet Initiative will adapt Resilient Neighborhoods' proven program to engage residents throughout Marin in reducing consumption-based GHG emissions and becoming resilient to climate-linked emergencies. CPR for the Planet will provide a replicable model to engage 3,713 Marin County residents by 2030. CPR for the Planet will test five pilot programs, designed with community input, to equitably reach audiences including Spanish speakers, low-income, older adults, parents, individuals with high carbon footprints, and others, through online and offline programs that emphasize consumption, address climate anxiety, and engage everyone in achieving climate protection goals. The County will promote the Resilient Neighborhoods programs and help develop a new pilot program that reaches underserved, non-English speaking communities and programs that incorporate mental well-being/trauma resilience. The County may identify outside funding sources to support the Resilient Neighborhoods Program implementation and expansion.

CE-C3: Community Engagement and Empowerment via Drawdown Marin

1. Work with the Drawdown: Marin Community Outreach Partnership, Drawdown: Marin Ambassadors, and community-based organizations to implement a community-wide behavior change campaign to engage residents, businesses, and consumers in new and existing programs that reduce their GHG emissions and create a more sustainable, resilient, and healthier community. Connect community priorities to climate change, incorporate community stories, and develop programs based on this input. Continue meeting with a wide variety of neighborhood, business, educational, faith, service, and social organizations and understand how the County can support them.
2. Continue partnering with the Canal Alliance, Multicultural Center of Marin, and West Marin Community Services to reach Hispanic and Latinx communities. Develop culturally sensitive outreach materials and approaches and translate into multiple languages, e.g. Spanish, Vietnamese, and Farsi.
3. Work with third-party community empowerment/behavior change experts to design online and print materials for a variety of end-users around different climate actions.
4. Partner with local and regional agencies like MCE, PG&E, water districts, sanitary districts, Transportation Authority of Marin, Marin Transit, Golden Gate Transit, SMART, Zero Waste Marin, Health and Human Services, SF-Marin Foodbank, and other entities to promote available financing, assessments, rebates, incentives, and services to the community.
5. Utilize the County's website, newsletters, social media, and public service announcements to promote County- and community-based organization-led programs and initiatives.
6. Create "shareable content", e.g. Facebook posts, that can be used by cities and towns, bloggers, businesses, non-profits, social media, and traditional media.
7. Host trainings for the community that empower individuals to connect with friends, family, and neighbors around climate change, e.g. Drawdown: Marin's Storytelling Training (Center for Story Based Strategy).
8. Identify additional community leaders to serve as Ambassadors; compensate Ambassadors for their time and provide a process for community priorities to be incorporated in climate action planning and implementation.

CE-C4: Advocacy

Work with the County Administrator's Office (CAO) consistent with the Board of Supervisors' Legislative Platform to advocate at the state and federal levels for policies and actions that support the rapid transition to GHG-free energy

sources, electrification of buildings and transportation fleets, and other impactful measures to sharply reduce GHG emissions and increase community resilience.

CE-C5: Green Businesses
Partner with local Chambers of Commerce and local community groups to encourage local businesses to participate in the Marin County Green Business Program and other GHG reduction and resilience programs such as RestoreCA.

CE-C6: Carbon Offsets
Reduce the impact of GHG emissions through the purchase of carbon offsets.

1. Encourage community members to purchase carbon offsets to reduce their carbon footprint through engagement campaigns.
2. Consider partnering with a local non-profit organization to promote a carbon offset program.
3. Focus on offsetting emissions that are difficult to mitigate otherwise, such as airplane travel.

CHAPTER 4: AGRICULTURE AND WORKING LANDS

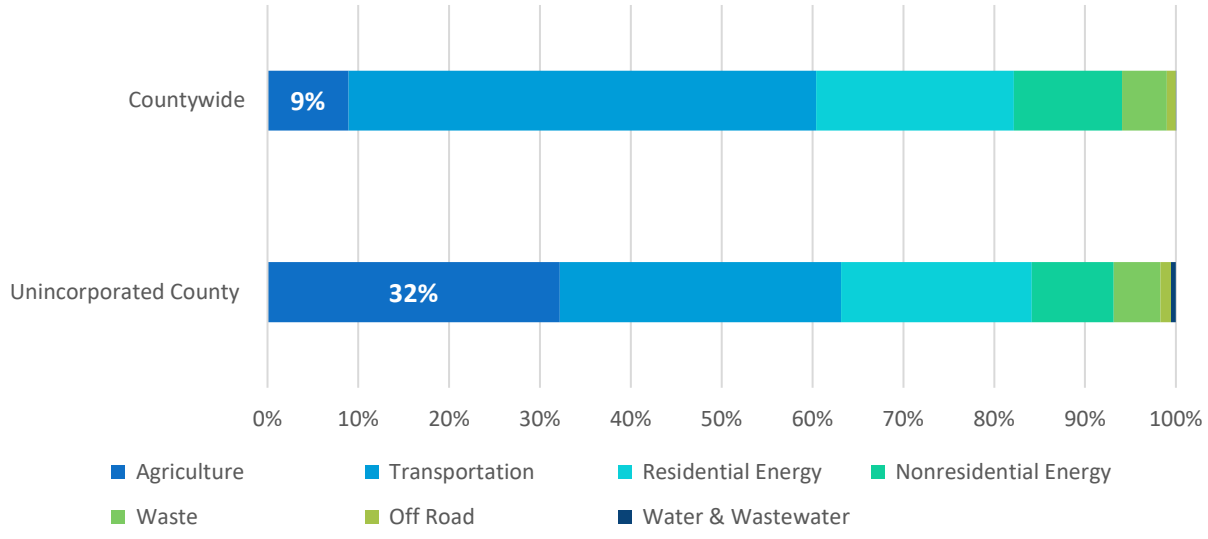
DRAWDOWN: MARIN FOCUS AREA: CARBON SEQUESTRATION

Agriculture is an integral part of Marin County's economy, identity, and climate future. Over 300 small family farms cover approximately 170,876 acres of Marin County with an estimated gross value of $97,929,000. Livestock agriculture, in the form of dairy and rangeland, represents 74% of this total value with field crops and aquaculture representing the remainder. Historically, Marin County's agricultural producers have been an important local food source to the Bay Area community, providing milk, butter, eggs, meat, vegetables, shellfish, and other products. The benefit of having this local food source has the capacity to both generate and mitigate emissions. As the County works to meet emissions reduction goals, the agricultural sector can reduce emissions from production, sequester carbon and build soil carbon stocks, and play a role in cross-sectoral efforts to enhance the ecological benefits to natural lands. Preservation of working lands and the agricultural economy in Marin County is imperative to the success of the measures outlined in this chapter.

AGRICULTURAL EMISSION SOURCES

Agriculture generates an estimated 32% of greenhouse gas emissions in the unincorporated area of Marin County, one of the largest sources of emissions. However, countywide, agriculture generates only 9% of total county emissions, as shown in Figure 8.

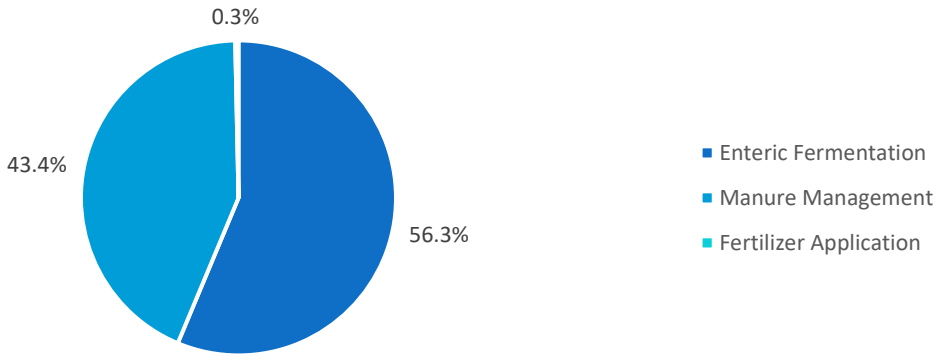
FIGURE 8: COMPARISON OF UNINCORPORATED VERSUS COUNTYWIDE AGRICULTURE EMISSIONS



Agricultural emissions are calculated in the CAP using ICELI's Community Protocol, which provides a framework for local governments to assess GHG emissions from activities within their boundaries. Agricultural emissions in Marin are assessed in three main categories:

- **Enteric Fermentation**, which is the process of microbial fermentation through which methane is produced during animal digestion. Ruminants like cows, sheep, and goats produce higher amounts of methane than non-ruminants because of their unique digestive systems.
- **Manure Management**, which counts emissions from animal waste. When manure decomposes in an environment without oxygen, such as a manure pond, methane is produced as a byproduct. Livestock manure has high organic content and bacterial populations and generates both methane and nitrous oxide during storage and treatment.
- **Fertilizer Application**, which accounts for emissions from the use of nitrogen (N) fertilizer. Fertilizer emissions estimated here are based on national application rates and may over-estimate actual use of synthetic N by Marin's agricultural producers.

FIGURE 9: SOURCES OF AGRICULTURAL EMISSIONS IN GHG EMISSIONS INVENTORY



As shown in Figure 9, enteric fermentation and manure management are assumed to generate over 99% of agricultural GHG emissions in Marin County. The County's inventory relies on guidance from the ICLEI community protocol to quantify the estimated impact that agricultural activities have on the annual GHG emissions released in the County. ICLEI assigns methane a 100-year global warming potential 21 times that of CO_2., regardless of its origin. However, emerging research indicates that biogenic methane, such as that released from Marin's grass-based livestock agriculture, and fossil methane (such as natural gas) have different global warming potentials (GWP). Under well managed pasture conditions, biogenic methane (CH4) at the soil-atmosphere interface is oxidized to CO2 by methanotrophic ("methane eating") microbes (Rotz 2018, Wang et al 2014). It is thus part of a short-term carbon cycle with little, if any, impact on global warming because it is not "additional" for purposes of GHG accounting (Figure 10). New research further indicates that the relatively short life span of methane in the atmosphere (roughly 12 years vs 100s to 1000s of years for CO2) means that a given source of biogenic methane contributes to additional global warming only if those emissions are increasing over time (Allen et al 2018, Mitloehner et al 2020). Fossil methane will always aggravate global warming, as it is always a "new" source, while biogenic methane may or may not be "new" and thus may or may not be further aggravating global warming, based on emerging research.

FIGURE 10: ILLUSTRATION OF THE BIOGENIC CARBON CYCLE

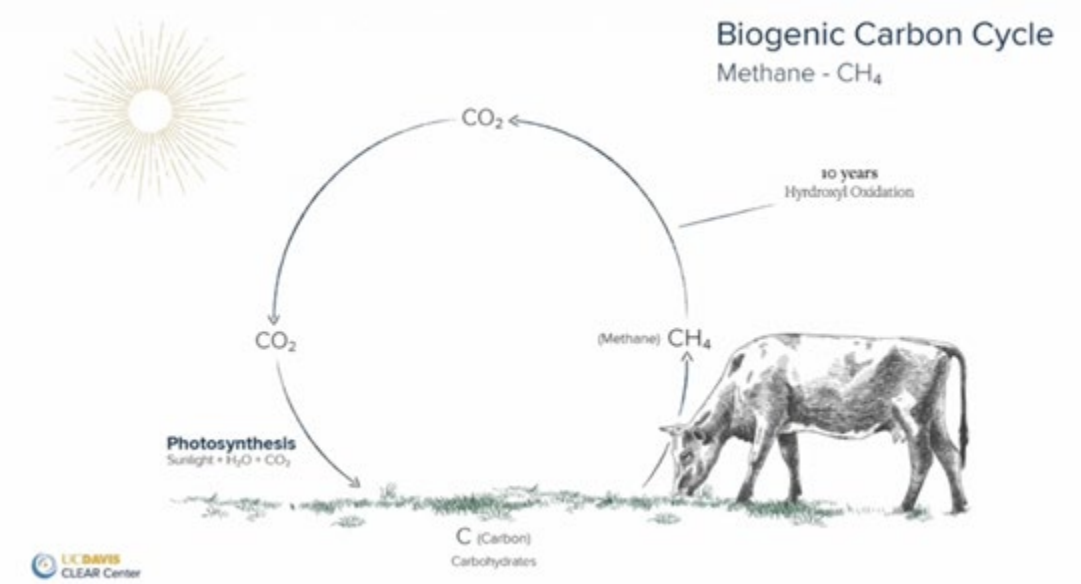


Figure 10 illustrates the short-lived atmosphere-grass-livestock-soil-atmosphere carbon cycle, of which pasture-based ruminant methane emissions are a part. With well managed pastures actually serving as net methane sinks, this cycle does not contribute to global warming (Rotz 2018, Wang et al 2014).

Scientific understanding continually develops. Knowing this, the County seeks to follow ICLEI protocols to allow for coordination with other jurisdictions while also integrating emerging science and how that might change our understanding of the contribution of this and other sectors to our overall emissions inventory. However, our understanding of GHG emission quantification shifts in the coming years, the measures in this chapter outline a path toward a climate beneficial agriculture for Marin County, not only reducing emissions but also improving ecosystem services, resilience, and agricultural economies in Marin. This chapter demonstrates opportunities to mitigate the release of emissions and shows how working lands can actively sequester GHG and support ecosystem health and a climate-smart future.

Working Lands and Carbon Sequestration

When the 2015 CAP was adopted, only three Carbon Farm Plans had been completed, demonstrating the exciting potential for agriculture to be a net carbon sink. In the development of this CAP, the County engaged a team of agricultural stakeholders who have led the research and development as well as implementation support for the leading-edge carbon farm planning and implementation work done in Marin County to date. This team included the Marin Resource Conservation District, UCCE Marin, Marin Agricultural Land Trust, and the Carbon Cycle Institute, who worked with the County to provide a more robust understanding of both GHG dynamics and the potential of carbon sequestration on working lands.

On-farm climate-beneficial practices, also called carbon farming practices, bring many co-benefits beyond sequestering carbon and reducing greenhouse gas emissions. These practices benefit the natural environment and the agricultural operation. For example, increasing carbon in the soil reduces erosion, promotes plant growth, and helps the soil hold more water. This helps plants grow longer into the dry summer months, produce more forage for livestock and sequester even more CO2. Restoring creek vegetation increases wildlife habitat, stabilizes creek banks

and improves water quality. Carbon farm plans qualify as conservation plans for the NRCS and other state and federal agencies, emphasizing the multitude of benefits of carbon farm practice implementation. Working lands present a unique opportunity for delivering a multitude of ecological and economic benefits in addition to climate change mitigation and resilience.

What is Carbon Farming?

Carbon farming involves implementing practices that are known to improve the rate at which CO2 is removed from the atmosphere and converted to plant material and soil organic matter. Carbon farming is successful when carbon gains resulting from enhanced land management or conservation practices exceed carbon losses.

Source: Marin Carbon Project

Actions to Date

Carbon Farm Plans outline practices that farmers and ranchers can implement on their working lands to enhance the sequestration of carbon dioxide as soil organic carbon and woody biomass. These practices are wide ranging and include, but are not limited to, the following:

- Conservation Cover
- Residue and Tillage Management (no-till)
- Critical Area Planting
- Filter Strip
- Compost Application
- Nutrient Management
- Forage Biomass Planting
- Prescribed Grazing
- Range Planting
- Riparian Forest Buffer
- Riparian Restoration
- Tree & Shrub Establishment
- Silvopasture Establishment
- Windbreak/Shelterbelt Establishment

To date, 19 carbon farm plans have been completed, encompassing 8,307 acres of farmland in Marin County. Over 20 additional producers have expressed interest in having a carbon plan completed for their farm. Of the 19 plans that have been completed, five are for dairies and 14 are for grazing operations. An average of eight of the above practices are prescribed in each plan which, if implemented, would sequester 11,585 $MTCO_2e$ annually. Over twenty years, this is 258,237 $MTCO_2e$ sequestered.

It's important to note that many of these practices are already being implemented on farms and ranches across Marin County, both with and without a carbon farm plan. A breakdown of known carbon farming practices implemented to date is shown in Table 14. Many more climate beneficial efforts are being made by producers independent of any assistance provided by resource agencies and are not captured in Table 14. As stewards of the land, many farmers and ranchers have expressed an understanding of the value of these actions and have put many of them into practice. Other practices, such as planting windbreaks, require considerable technical support, purchased plant material, installation of temporary irrigation systems and protective fencing for plant establishment. Understanding the broad support for these measures among producers, as well as the cost and time burdens faced by many producers, is critical for the County to consider when assessing how best to support implementation of carbon sequestration approaches on Marin County working lands.

TABLE 14: CARBON FARMING PRACTICES: IMPLEMENTATION ON MARIN AG :AMD BETWEEN 2007-2020

Carbon Farm Practice	Acres Implemented	Total annual $MTCO_2e$ sequestration benefit through 2020
Compost Application	939.20	4,956.2
Conservation Cover	0.4	0.6
Critical Area Planting	1.3	9.1
Filter Strip	0.2	0.0
Forage Biomass Planting	839.5	1,042.0
Hedgerow Planting	3.0	75.0
Nutrient Management	31.0	2.5
Prescribed Grazing	6,316.4	119.0
Range Planting	543.3	2,437.0
Residue and Tillage Management (no-till)	267.00	10.7
Riparian Forest Buffer	16.5	143.8
Riparian Restoration	7.4	81.4
Silvopasture Establishment	5.0	17.0
Tree & Shrub Establishment	2.4	84.2
Windbreak/Shelterbelt Establishment	6.4	300.7
Total	**8,979**	**9,279**

Understanding The Potential for Scaling Carbon Sequestration on Marin's Working Lands

When considering both practices that reduce operational emissions from manure management and enteric fermentation, as well as opportunities to sequester CO2 through carbon farm practice implementation, this work identifies the potential for reducing/sequestering 265,162 $MTCO_2e$ on Marin agricultural lands annually. These GHG benefits were estimated using the best available local data and methods tailored to assess the potential to scale specific practices across Marin's agricultural lands. These findings were used to estimate the potential GHG benefit of the measures outlined in the following section, *Agriculture and Working Lands Actions.* The approaches used include:

- **Mapping**, to identify land in the County that could feasibly have specific carbon farming practices applied. This approach was used to assess carbon sequestration potentials for:
    - Riparian restoration;
    - Compost application on grazed rangelands, and;
    - Compost application on croplands
- **Carbon Farm Plans** were used to extrapolate data from the 19 existing plans to other appropriate land in Marin. This was used to assess carbon sequestration benefit for were used to extrapolate data from the 19 existing plans to other appropriate agricultural land in Marin. This approach was used to assess carbon sequestration potential for:
    - Hedgerow planting;
    - Prescribed grazing;
    - Range planting;
    - Tree & shrub establishment.;
    - Windbreaks/shelterbelts, and;
    - Critical area planting

- **Modelling** was used to estimate GHG benefits from manure management practices, relying on empirical models developed in California. This approach was used to assess GHG mitigation and sequestration benefits for manure management practices.

Select findings from the above process are included below, demonstrating the range of approaches used to most accurately estimate agricultural carbon sequestration potential and allowing the County to incorporate these estimates into a comprehensive portfolio of climate action measures in this plan. Beyond the GHG emission reduction benefits measured for the purposes of the CAP, full implementation of these measures would serve to increase habitat, improve soil health and water retention, and reduce imported feed and other operating costs for producers. The continuation of active farm and ranch operations on working lands in the unincorporated County is critical to ensure the availability of working lands for carbon-sequestration activities, to preserve the biodiversity and a complex vegetation mosaic of Marin's rural landscape and to insure access to local food and fiber to meet the needs of residents across Marin and the region far into the future.

MAPPING

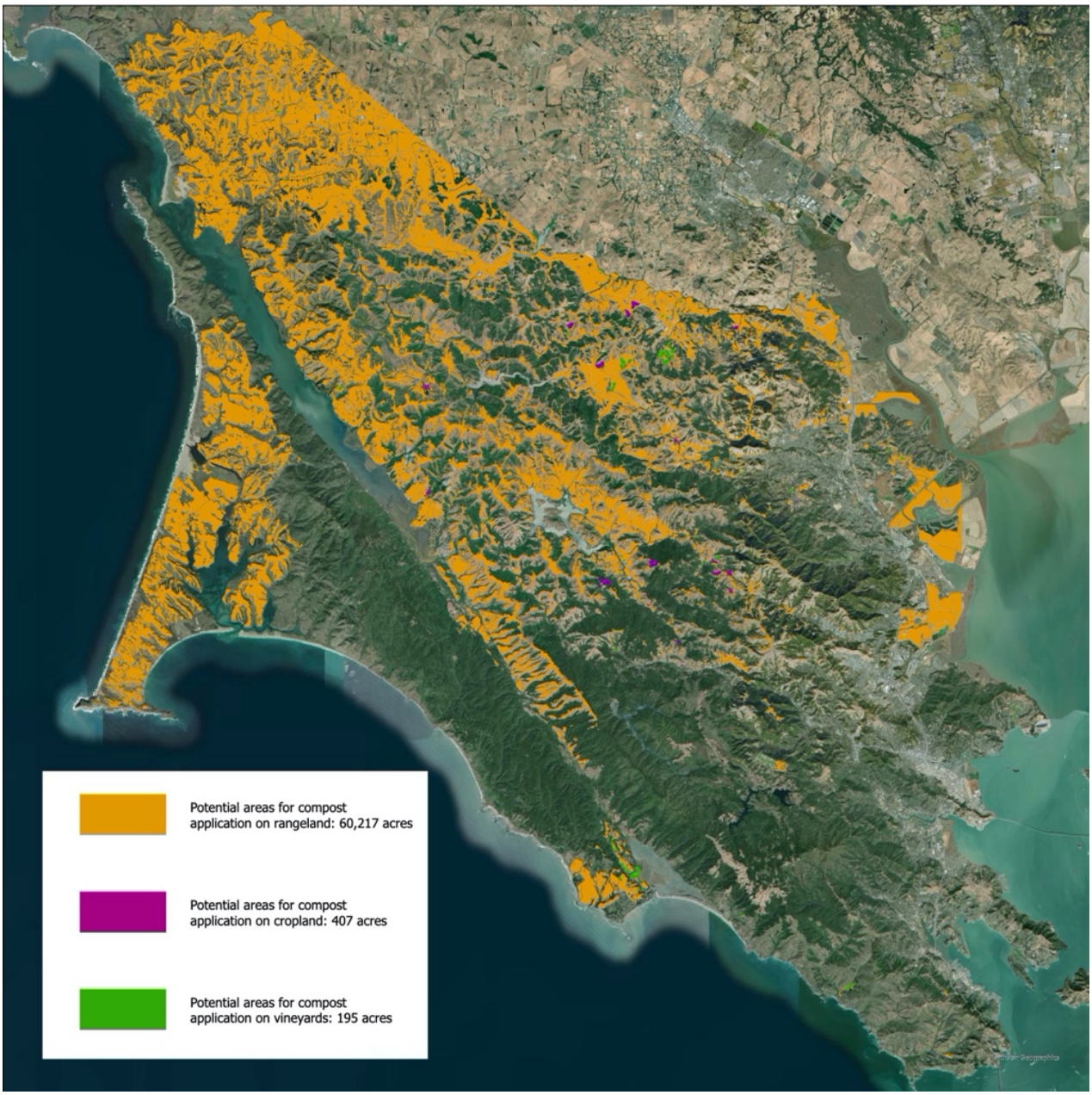
A mapping approach was used to estimate potential for compost applications and riparian practice implementation. Compost production and use is an important carbon farming practice due to the multiple associated GHG benefits. Using the latest Geographic Information Systems (GIS) resources, working lands appropriate for application of compost were identified by first mapping all agricultural land in Marin, and then removing the following lands from consideration:

- Land not being actively farmed or ranched;
- Land with slopes greater than 20%, which are difficult to apply compost to for technical reasons;
- Areas within 30 feet of streams and ponds, to avoid potential water quality impacts;
- Serpentine areas, which may support native plant communities unlikely to benefit from compost applications.

Figure 11 shows the outcome of this analysis. Overall, 60,217 acres of Marin's grazed rangelands were identified as feasible for the application of compost, as well as 407 acres of cropland and 195 acres of vineyards. When multiplied by a per acre annual GHG sequestration factor based on research carried out in Marin, potential annual sequestration can be calculated for the unincorporated county (outlined in Actions section, below). The intention of this mapping exercise is to demonstrate total physical potential for carbon sequestration within the County. While the analysis, includes ranch land currently grazed by livestock within the Point Reyes National Seashore, and language within the 2020 Seashore Ranch Management Plan limits the implementation of certain carbon farming practices, including compost applications, it is important to emphasize that the recommendations in this chapter are not prescriptive and require comprehensive, site specific planning, design and review prior to implementation.

The mapping approach used to estimate potential for riparian restoration on Marin ag lands is described by Matzek et al. (2020). Remote sensing techniques were used to determine the vegetation types along every stream corridor in Marin. Restorable riparian areas were considered to be any riparian areas with grassland cover rather than forest or shrub cover. The potential for carbon sequestration in these restorable riparian areas was estimated by directly measuring carbon storage of restored riparian areas across projects of different ages. This research estimates 5,700 acres of riparian area in Marin have the potential to be restored.

FIGURE 11: MAP OF POTENTIAL COMPOST APPLICATIONS AREAS



NOTE: On Figure 11, mapped areas are not prescriptive; any prospective compost application requires comprehensive, site-specific planning, and design and review prior to implementation.

CARBON FARM PLAN APPROACH

A different approach was used for other carbon farming practices, such as windbreaks, for which mapping potential implementation areas would not be realistic. Instead, to assess the potential for scaling these practices, the 19 existing carbon farm plans were used as a representative sample of Marin agricultural land. For each measure assessed using this method, the recommended extent of that practice per area of agricultural land was averaged

across all 19 carbon farm plans. This average recommended practice extent was then used to extrapolate across all similar agricultural lands in the County that do not yet have Carbon Farm Plans.

For example, across the 19 existing plans, an average of nine feet of windbreak per acre of agricultural land was recommended. Across the 130,480 acres of similar Marin County working lands without carbon farm plans, this equates to windbreak plantings on 426 acres. At an annual sequestration rate of 4.32 $MTCO_2e$ per acre (COMET-Planner), this practice, if expanded across all feasible lands in Marin, could sequester 1,887 $MTCO_2e$ annually.

Modeling Marin Dairy GHG Reduction/Sequestration Potential

This analysis focused on three broad strategies for reducing and/or mitigating emissions from Marin County dairy manure management, and the potential to capture additional atmospheric CO_2 on Marin dairies for climate, production and natural resource benefits. These three broad strategies are:

1. Anaerobic Digesters. Conversion of existing flush systems with anaerobic storage lagoons and seasonal land application of manure liquids, to anaerobic digestion with energy capture and seasonal land application of digestate;
2. Dry Scrape Conversion. Conversion of existing flush systems with anaerobic storage lagoons and seasonal land application of manure liquids, to dry scrape systems with co-composting of solids with high carbon additives and seasonal land application of compost;
3. Compost Bedding Pack Barns. Conversion of existing flush systems, with anaerobic storage lagoons and seasonal land application of manure liquids, to compost bedding pack barns with seasonal land application of compost.

While these three options do not represent the entire suite of possible manure management GHG mitigation options for Marin dairies, they do represent alternatives already in use by some Marin dairies and suggest the range of potential GHG reduction, mitigation and sequestration values available for Marin dairy manure management.

The greenhouse gas mitigation and sequestration impact of each of these three strategies was modeled using the latest empirical models developed for the state of California. These models account for the reductions in CH_4 and N_2O emissions from these management strategies, the increased carbon sequestration resulting from co-composting of manure solids with other high carbon materials, and the emissions avoided by generating electricity from anaerobic digestors.

What You Can Do

- If you are a farmer or rancher, consider developing and implementing a carbon farm plan.
- If you are a resident, grow your own vegetables and fruits, add compost to your garden soil and support local farms and ranches.

Agriculture and Working Lands Actions

All of the above practices were employed in developing the most complete picture to date of the potential for working lands to substantially sequester carbon dioxide in soils and biomass in Marin County. This potential, if fully

achieved, could not only outweigh emissions from agricultural operations, but also support Marin County in achieving its carbon drawdown goals. For the purposes of this CAP, it is not assumed that all of this potential would be achieved by 2030. Understanding the numerous barriers that farmers and ranchers face in seeking to develop and implement carbon farm plans, the County and partners have identified voluntary targets for achievement of the identified potential by 2030.

The measures listed here are quantified actions that can be taken to both mitigate agricultural emissions and amplify carbon sequestration on natural and working lands. For the purposes of this climate action plan, these are looked at through the lens of GHG emission reduction. This analysis does not highlight the numerous other benefits of many of these practices, which can include: increased soil health and soil water retention; reduced feed costs for farmers; improved water quality; enhanced biodiversity; increased climate resilience and an ongoing supply of local food and fiber to support our community.

This work is supported by agricultural partners and numerous producers in unincorporated Marin County who are eager to apply Carbon Farming practices. However, in many instances agricultural producers face pressures that threaten continuing operations. These climate-beneficial actions depend on working lands, including Marin's grazed grasslands, to be successful. As with all other actions outlined in this CAP, the success of GHG mitigation and sequestration measures can only be achieved with meaningful financial, technical and programmatic support.

TABLE 15: AGRICULTURE AND WORKING LANDS STRATEGIES

ID	Strategy	Annual GHG Reduction by 2030 ($MTCO_2e$)
AG-C1	Carbon Farming ***(Drawdown: Marin Endorsed Solution)***	55,752
AG-C2	Manure Management	26,191
AG-C3	Urban Forest and Food Production and Natural Lands Management	106
AG-C4	Agricultural Land Preservation	-
AG-C5	Blue Carbon	-
AG-C6	Energy Efficiency	-
AG-C7	Low Carbon Off-Road Vehicles and Equipment	-
AG-C8	Agricultural Institute of Marin's Center for Food and Agriculture ***(Drawdown: Marin Endorsed Solution)***	-
TOTAL		82,049

AG-C1: Carbon Farming

(Drawdown: Marin Endorsed Solution)

Expand Carbon Farm Planning and implementation by engaging 180 Marin farms and ranches across 90,000 acres by 2045. Based on the proven success of the Marin Carbon Project's foundational work on agricultural lands in Marin, this initiative would expand Carbon Farm Planning and implementation to reach a large scale of acreage and operations in Marin County. To remain on course for this target, 60 farms and ranches across 30,000 acres will be engaged by 2030. For the purposes of this measure, the goal is to achieve 30% of estimated sequestration potential by 2030, equivalent to reducing 55,752 $MTCO_2e$ annually.

The partnerships, models, and necessary experience to achieve this objective are in place already. The initiative must expand its technical support team and increase implementation funding to launch an expansion of the existing carbon farming work in Marin County. The County will support this measure by working with agricultural partners and producers in the County to ensure policy support, technical assistance, and funding align to achieve maximum

potential sequestration and benefit to the environment and producers. The County will meaningfully engage in the following efforts to support Carbon Farming:

- Establish a terrestrial/agricultural carbon finance committee to identify finance mechanisms and funding sources to support the ongoing development and implementation of Carbon Farm Plans in Marin County. This could include, but not limited to, assessment of participation in the voluntary carbon markets (although the current market trades well below the cost to implement many of these measures); the development of a local carbon or ecosystem marketplace, including partnerships with local businesses focused on carbon neutrality; revolving loan funds; matching funds that can be used in conjunction with outside funding, and/or state funding. It is essential to identify reliable funding streams for the planning and implementation of high-impact practices to achieve actual carbon sequestration benefits.
- Support producers by providing them with technical expertise in the development of plans, permits, designs. Expertise such as agroecologists, agronomists, agricultural engineers, conservation planners, biologists and soil scientists will be necessary to carry out this work. Though current demand for plans and producer engagement is high, time and expertise about carbon farm plan development is often limited. Partners such as the Marin RCD, UCCE, MALT and CCI are essential resources for farmers and ranchers for identifying and applying for funding, complying with regulatory and grant requirements, and developing a plan to sequester carbon on their lands. This expansion of technical assistance is a critical first step in realizing the carbon sequestration potential of agricultural lands in Marin.
- Build the capacity of the local agricultural community and its ability to be self-directed in practice implementation through increased farmer-to-farmer networking and resource sharing. This could include participant-lead educational meetings, group purchasing and exchanges of key equipment, and information networking and notification for materials access.
- Provide construction contractors and monitoring assistance to support the implementation of projects. While some carbon sequestration approaches are best practices and commonly implemented on working landscapes in Marin (with or without carbon farm plans), others are both technical and expensive to implement. Monitoring assistance if often needed to substantiate benefits.
- Support partners in the development of a project tracking database, such as RCD Project Tracker currently being built out, to record and recognize carbon benefits of implemented practices by ranchers and allied organizations.
- Identify, and soften or eliminate permitting barriers, such as triggers that classify restoration as development, at the County level to incentivize implementation of carbon farm practices. Understanding the importance of carbon farm plan implementation to achieving the County's climate goals, work internally within County government to ensure permitting carbon farm practices is streamlined while protecting the health and safety of the public and environment.

TABLE 16: CARBON SEQUESTRATION APPROACHES AND ESTIMATED POTENTIAL

Carbon Sequestration Approach	Total Potential Acres	Sequestration Factor (MTCO2e/acre/year)	Sequestration Potential (MTCO2e/year)	Sequestration Lifespan*
Compost on croplands	407	1.18	482	6
Compost on rangelands	60,217	1.49	89,723	20
Compost on vineyards	195	4.4	860	1
Critical area planting	353	1.9	671	10
Hedgerow planting	267	1.49	399	34
Prescribed grazing	101,496	0.005	507	10
Range planting	28,271	0.502	14,192	10
Riparian restoration	5,700	9.16	52,212	20
Silvopasture	17,254	1.48	25,486	80
Windbreak/shelterbelt	852	1.48	1,263	80
Cumulative all approaches, Annualized			**185,795 $MTCO_2e$**	

* "Sequestration lifespan" refers to the length of time a practice is expected to continue to actively sequester carbon following implementation.

AG-C2: Manure Management

The County will support agricultural partners and producers in the unincorporated County to implement changes to manure management that will decrease emissions. This support may include identifying or creating funding opportunities for implementation of manure management approaches (such as California's Alternative Manure Management Program), supporting partner agencies in providing technical assistance, and identifying opportunities for championing existing projects. The following manure management approaches are quantified to outline the potential for emission reductions. For the purposes of this measure, the goal is to achieve 33% of estimated emission reduction potential by 2030, equivalent to reducing 26,191 $MTCO_2e$.

It is important to note that the savings outlined here are not strictly from the mitigation of emissions from manure management. Each of these practices allow for reduced methane emissions, but also provides additional savings through carbon sequestration with reutilization of organic materials for soil carbon enhancements. This highlights the synergies that exist within this sector to achieve multiple benefits through enhanced management practices.

TABLE 17: MANURE MANAGEMENT APPROACHES AND ESTIMATED POTENTIAL

Manure Management Approach	Number of Dairy Cows Est. to be Impacted by Measure	MTCO2e reduced per Cow, annual	Potential Annual Reduction (Mitigation + Sequestration) (MTCO2e)	Measure Lifespan
Methane Digesters	2,985	5.48	16,365	20
Dry Scrape Conversion	2,985	7.97	23,801	20

Manure Management Approach	Number of Dairy Cows Est. to be Impacted by Measure	MTCO2e reduced per Cow, annual	Potential Annual Reduction (Mitigation + Sequestration) (MTCO2e)	Measure Lifespan
Compost Bedding Pack Barn	2,985	5.98	17,858	30
On-Farm Woodchip Production for Co-Composting	2,239	9.53	21,343	40
Cumulative all approaches, Annualized			**79,367 $MTCO_2e$**	

AG-C3: Urban Forest and Food Production and Natural Lands Management

In addition to harnessing the power of natural systems to sequester GHG emissions in working lands, there are also numerous opportunities to achieve savings through responsible tree planting and management on natural lands in Marin. Doing so improves air quality and natural cooling through increasing tree cover in the County. The following actions are supported in this measure:

1. Encourage active management of trees and invasive species in the open space to encourage ecosystem health and reduction of fuel load.
2. Improve ecosystem health by planting additional trees on County-owned land, including public parks, open space, medians, and rights of way.
3. Review parking lot landscape standards to encourage appropriate tree cover and associated sequestration potential.
4. Require that site planning, construction, and maintenance of new development preserve existing healthy trees and native vegetation on site to the maximum extent feasible. Replace trees and vegetation not able to be saved, preferably with appropriate native species.
5. Encourage community members to plant trees on private land, where appropriate, (taking into consideration fuel reduction goals and defensible space requirements). Consider creating a tree giveaway event or providing lower-cost trees to the public through a bulk purchasing program.
6. Encourage the creation of community gardens on public and private lands by community groups.
7. Provide information to the public, including landscape companies, gardeners, and nurseries, on carbon sequestration rates, drought tolerance, and fire resistance of different tree species.

AG-C4: Agricultural Land Preservation

The County understands the critical importance of both working lands and of farmers and ranchers in Marin. Agricultural lands are central to unincorporated Marin County's culture and character and, as illustrated above, are a key part of the County's climate future. Without working lands and agricultural operators in Marin, the opportunities for carbon sequestration identified above would not be possible. With rising property values, an aging population of farmers (both locally and nationwide), and ongoing labor shortages, the preservation of agricultural working lands and the viability of ranches and farms in Marin is both critical and not guaranteed.

The County will continue to collaborate through planning, regulations and other programs to identify ongoing opportunities to preserve agricultural lands and active agricultural operations in ways that support producers, reduce and sequester greenhouse gases, and enhance ecosystems in Marin. Specifically, the following actions are supported in this measure:

- Work collaboratively with local partners to identify farm and ranch land of strategic importance for preservation.
- Support agricultural land succession and access for new and next generation farmers and ranchers.
- Consider new land preservation and stewardship tools through the Marin County Farmland Preservation Program to promote long-term land stewardship and carbon farming.

AG-C5: Blue Carbon

Through this measure, Marin County will work with partners to explore opportunities to expand terrestrial carbon sequestration efforts to aquatic environments and identify opportunities to enhance aquatic sequestration, especially as the county develops sea level rise mitigation projects such as coastal wetland restoration.

The work in this chapter illustrates the potential of natural and working lands in Marin County to sequester carbon, creating a true opportunity for carbon drawdown. Existing research shows that similar potential may be found in aquatic environments, such as tidal wetlands, gullies, and bays. Dedicated science and assessment to understand this opportunity is necessary to help shape management decisions moving forward for ecosystem health, climate adaptation, and carbon sequestration potential.

Aquaculture (including the cultivation of oysters, mussels, and clams) represent 7% of Marin County's total agricultural production value (2019 Marin County Crop Report). This equates to a dollar value of $6,925,000 in 2019, up 34% from the 2018-dollar value of aquaculture of $5,165,000. Existing studies have been done in Tomales Bay, where Salt Point Seaweed worked with Hog Island oysters on a seaweed cultivation pilot that demonstrated seaweed successfully removed carbon and nitrogen from the surrounding water. Funding is needed to further explore the potential overlap of aquaculture and aquatic carbon sequestration.

AG-C6: Energy Efficiency

Aligned with energy efficiency measures in Section EE of this CAP, energy efficiency outreach and support will be expanded to agricultural producers in the County. This can include technical assistance for understanding energy usage data, connection to funding and financing opportunities, and other energy efficiency programs as they become available through 2030. This work is especially valuable in leveraging energy produced with dairy digesters to reduce energy related emissions and can support effective energy storage projects to allow efficient use of essential equipment in power outages.

AG-C7: Low Carbon Off-Road Vehicles and Equipment

Identify funding opportunities to encourage agricultural producers to adopt low-carbon transportation alternatives at time of replacement, such as electric or fuel-cell vehicles. Agricultural emissions from off-road equipment, such as heavy-duty farm vehicles, is counted in the off-road emissions of this document. Agriculture is only estimated to account for 7% of the unincorporated County's off-road emissions, the majority of which come from construction and landscaping equipment.

While electric vehicle adoption for passenger vehicles has increased in public awareness and popularity, barriers still exist for low or zero-emission heavy duty equipment. This is especially true for more specialized equipment, such as industrial compost turners. The County will provide technical assistance to ranchers interested in upgrading assistance through connection and support for applications to funding opportunities, such as the Carl Moyer program administered by the Bay Area Air Quality Management District. The County will also support connection of existing renewable diesel resources to interested producers as a bridge while zero-emissions alternatives are developed.

AG-C8: Agricultural Institute of Marin's Center for Food and Agriculture

(Drawdown: Marin Endorsed Solution)

The Center for Food and Agriculture and the Zero Waste Farmers Market will be the connection point between those who need quality, nutrient-dense foods and those who make their livelihood providing it in a way that mitigates the climate crisis, and regenerates healthy soils, healthy pastures, and healthy seas.

DDM will help promote Marin's Center for Food and Agriculture, raise awareness of its benefits, engage communities that typically do not frequent farmers' markets, identify outside funding to support implementation, share project successes and lessons learned, and provide technical assistance when needed, e.g. input on solar panel selection.

CHAPTER 5: IMPLEMENTATION AND MONITORING

Plans are only effective if they're implemented and results are carefully evaluated. The County will prepare an annual assessment of the progress it is making on implementing the actions contained in this Climate Action Plan and continue to quantify community and GHG emissions to determine if we are on track to meet our reduction targets.

The County will take the following actions to implement and monitor the Climate Action Plan.

TABLE 18: IMPLEMENTATION AND MONITORING STRATEGIES

ID	Strategy
IM-C1	Annual Monitoring
IM-C2	Update GHG Emissions Inventories
IM-C3	Funding Sources
IM-C4	Update the Climate Action Plan
IM-C5	Project Compliance Checklist
IM-C6	Mitigation Measures for CEQA Analysis

IM-1: Annual Monitoring
Monitor and report on the County's progress annually. Create an annual priorities list for implementation.

IM-2: Update GHG Emissions Inventory
Update the GHG emissions inventory for community emissions annually.

IM-3: Funding Sources
Identify funding sources for recommended actions and pursue local, regional, state, and federal grants as appropriate. Investigate creation of a local carbon fund or other permanent source of revenue to implement the Climate Action Plan. Investigate reinstatement of the Sustainability Review Fee.

IM-4: Update the Climate Action Plan
Update the Climate Action Plan regularly to incorporate new long-term reduction targets and strategies to meet those targets.

IM-C5: Project Compliance Checklist
Develop a project compliance checklist to use when reviewing development proposals requiring environmental review to ensure compliance with Climate Action Plan measures.

IM-C6: Mitigation Measures for CEQA Analysis
Work with the Bay Area Air Quality Management District to identify local Marin County projects that reduce and/or sequester GHG emissions, quantify those reductions, and list them as potential CEQA mitigation measures for project applicants required to reduce GHG emissions tied to specific development projects.

List of Abbreviations

AB	Assembly Bill
ABAG	Association of Bay Area Governments
BAAQMD	Bay Area Air Quality Management District
BAU	business-as-usual
BCDC	San Francisco Bay Conservation and Development Commission
CALGreen	California Green Building Standards
CAP	Climate Action Plan
CARB	California Air Resources Board
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
EIR	environmental impact report
EO	Executive Order
EV	electric vehicle
GHG	greenhouse gas
kW	kilowatt
kWh	kilowatt hour
IPCC	International Panel on Climate Change
LED	Light-emitting diode
MCE	MCE Clean Energy
MMWD	Marin Municipal Water District
$MMTCO_2e$	Million metric tons of carbon dioxide equivalent
MTC	Metropolitan Transportation Commission
$MTCO_2e$	metric tons of carbon dioxide equivalent
NMWD	North Marin Water District
PG&E	Pacific Gas and Electric
RCP	representative concentration pathway
RPS	Renewables Portfolio Standard
SB	Senate Bill
SMART	Sonoma-Marin Area Rail Transit
TDM	transportation demand management
VMT	vehicle miles traveled
ZEV	zero emission vehicle

WORKS AND SOURCES CITED

Association of Bay Area Governments and Metropolitan Transportation Commission. (April 2013.) *Draft Plan Bay Area Draft Environmental Impact Report*.

Association of Bay Area Governments and Metropolitan Transportation Commission. (2018.) *Plan Bay Area Projections 2040*. Retrieved from http://projections.planbayarea.org/.

Bedsworth, Louise, Dan Cayan, Guido Franco, Leah Fisher and Sonya Ziaja. (California Governor's Office of Planning and Research, Scripps Institution of Oceanography, California Energy Commission and California Public Utilities Commission). Statewide Summary Report. California's Fourth Climate Change Assessment. (2018). Publication number: SUMCCCA4-2018-013. https://www.energy.ca.gov/sites/default/files/2019-11/Statewide_Reports-SUM-CCCA4-2018-013_Statewide_Summary_Report_ADA.pdf.

C40 Cities. *Consumption-Based GHG Emissions of the C40 Cities*. Retrieved from https://www.c40.org/researches/consumption-based-emissions

California Air Resources Board. (2017). *California's 2017 Climate Change Scoping Plan.* Retrieved from https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf.

California Department of Finance. Report E-5 Population and Housing Estimates for Cities, Counties and the State, January 1, 2011-2020, with 2010 Benchmark.

California Department of Finance. (2019). Report P-1 Total Estimated and Projected Population for California and Counties: July 1, 2010 to July 1, 2060 in 1-year increments. http://www.dof.ca.gov/Forecasting/Demographics/Projections/

California Department of Forestry and Fire Protection. "Stats and Events." https://www.fire.ca.gov/stats-events/.

CARI 2016. California Aquatic Resources Inventory v0.2. San Francisco Estuary Institute. https://www.sfei.org/cari

CDFA COMET-Planner 2020. Carbon and greenhouse gas evaluation for NRCS conservation practice planning. USDA NRCS, Colorado State University, California Air Resources Board, and California Department of Food and Agriculture. http://comet-planner-cdfahsp.com/

Census Transportation Planning Products. http://data5.ctpp.transportation.org/ctpp1216/Browse/browsetables.aspx

COMET-Farm 2020. Whole farm and ranch carbon and greenhouse gas accounting system. USDA NRCS and Colorado State University. https://comet-farm.com/

Cool Climate Network. *Consumption-Based Greenhouse Gas Inventories.* Retrieved from https://coolclimate.org/inventory.

County of Marin. (Draft July 2020). *Drawdown: Marin Strategic Plan.* https://www.marincounty.org/-/media/files/departments/cd/planning/sustainability/climate-and-adaptation/drawdown-marin/strategic-plan/draft-drawdown-marin-strategic-plan.pdf?la=en

County of Marin. (2015). *Marin County Climate Action Plan.*

Dorich, C., Easter, M., Marx, E., Paustian, K. 2014. Potential woody and soil organic carbon sequestration and associated soil nitrous oxide emissions in three Marin County, California carbon farms. Prepared for The Marin Carbon Project.

FMMP 2018. Farmland Mapping and Monitoring Program. California Department of Conservation. https://www.conservation.ca.gov/dlrp/fmmp

ICLEI-Local Governments for Sustainability USA. (July 2019). *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. Version 1.2.*

Intergovernmental Panel on Climate Change. (2014). Fifth Assessment Report.

Jones, Christopher and Daniel Kammen. (December 15, 2015). *A Consumption-Based Greenhouse Gas Inventory of San Francisco Bay Area Neighborhoods, Cities and Counties: Prioritizing Climate Action for Different Locations*

Marin County 2019. 2019 Agricultural Crop and Livestock Report. Count of Marin. https://www.marincounty.org/-/media/files/departments/ag/crop-reports/2019-marin-crop-livestock-report.pdf?la=en

Marin Maps DEM 2020. Digital Elevation Model. County of Marin. http://www.marinmap.org/dnn/DataServices/GISDataDownload.aspx

Marin Maps Zoning 2020. Zoning, Unincorporated. County of Marin. http://www.marinmap.org/dnn/DataServices/GISDataDownload.aspx

Matzek, V., Lewis, D., O-Geen, A., Lennox, M., Hogan, S.D., Feirer, S.T., Eviner, V., and Tate, K.T. 2020. Increases in soil and woody biomass carbon stocks as a result of rangeland riparian restoration. Carbon Balance and Management: https://doi.org/10.1186/s13021-020-00150-7

National Aeronautics and Space Administration. (January 15, 2020). "NASA, NOAA Analyses Reveal 2019 Second Warmest Year on Record." Retrieved from https://www.giss.nasa.gov/research/news/20200115/.

OneTam 2019. Marin countywide fine scale vegetation map and landscape database project: Draft Vegetation Lifeform Map Released 12/23/2019

PolicyLink. "The Equity Manifesto." Retrieved from https://www.policylink.org/resources-tools/equity-manifesto#:~:text=Equity%20Is...,%C2%A9%202020%20PolicyLink.U.S. Census Bureau. https://data.census.gov/cedsci/

Ryals, R., Hartment, M.D., Parton, W.J., DeLonge, M.S., and Silver, W.L. 2015. Long-term climate change mitigation potential with organic matter management on grasslands. Ecological Applications 25: 531-545

U.S. Census Bureau. https://data.census.gov/cedsci/

U.S Environmental Protection Agency. (2020). Inventory of U.S. Greenhouse Gas Emissions and Sinks. EPA 430-R-20-002.

US Forest Service 2019. Existing Vegetation: Region 5 - North Coast Mid. United States Forest Service. https://enterprisecontentnew-usfs.hub.arcgis.com/datasets/af9d8f3df7144a7480ff8b3946d293cb_4?geometry=-146.425%2C36.905%2C-99.558%2C42.803&page=10

USGS 2005. California Geological Survey. United States Geological Survey. http://pubs.usgs.gov/of/2005/1305

White, K.E., Brennan, E.B., Cavigelli, M.A., and Smith, R.F. 2020. Winter cover crops increase readily decomposable soil carbon, but compost drives total soil carbon during eight years of intensive, organic vegetable production in California. PLOS One: https://doi.org/10.1371/journal.pone.0228677

APPENDIX A: DRAWDOWN MARIN SOLUTIONS

The County of Marin, in its role as the backbone of Drawdown: Marin, worked with over 150 people over 2 years through 6 Stakeholder Collaboratives to develop local solutions to climate change that incorporate equitable principles and increase community resilience. Based on this process and input, the following is a list of recommended actions.

- Now (2021- 2023, 0-2 years) (includes Endorsed Solutions)
- Then (2024-2030, 3-6 years), and
- Next (2031 – 2045, 7-15 years)

NOW (2021-2023) – ENDORSED SOLUTIONS

MARIN CARBON FARMING INITIATIVE

This initiative would expand Carbon Farm Planning and implementation to reach a large scale of acreage and operations in Marin County; by 2030, it would engage, 60 Marin farms and ranches across 30,000 acres, sequestering 185,839 $MTCO_2e$, and by 2045 it would engage 180 Marin farms and ranches across 90,000 acres, sequestering over 525,000 $MTCO_2e$.

ZERO EMISSIONS VEHICLES – DRIVE CLEAN BAY AREA

Fuel-switching to zero-emission passenger vehicles to address 40%+ of Marin Countywide GHG emissions. This solution will accelerate widespread adoption of zero-emission vehicles by Marin's residents and employees through a new collaborative campaign, Drive Clean Bay Area.

AGRICULTURAL INSTITUTE OF MARIN'S (AIM) CENTER FOR FOOD AND AGRICULTURE

The Center for Food and Agriculture and the Zero Waste Farmers Market will be the connection point between those who need quality, nutrient-dense foods and those who make their livelihood providing it in a way that regenerates healthy soils, healthy pastures, and healthy seas.

BIOMASS STUDY/RECOVERY PATHWAYS

Assess the biomass recovery flows in Marin County and analyze different sequestration and GHG emissions reduction potential of alternative recovery pathways. The study will inventory existing biomass flows and increased flows due to SB 1383 (2016) and Measure C (2020). Funding is needed to conduct the study.

MICROGRIDS – FAIRFAX PAVILION PILOT PROJECT

The Town of Fairfax and its partners will build a Community Resilience Center at the Fairfax Pavilion. This project will leverage existing solar photovoltaic (PV) systems at the Fire and Police Stations and the Pavilion and will add additional solar, batteries, and a new inverter. The project will leverage Self-Generation Incentive Program (SGIP) funding, the MCE Resilience Fund, and other funding sources to build the project. When complete, it will provide a community gathering space, childcare center during public safety power shut-off (PSPS), showcase the latest battery storage technology, and educate and inspire other cities and town to pursue similar projects.

COMMUNITY RESILIENCE HUBS

The City of San Rafael and County of Marin propose two Community Resilience Hubs at the Albert J. Boro Community Center/Pickleweed Park and the County Health and Wellness Campus. Working with Canal District-based community organizations and non-profits and the County's Health and Human Services Department, the City and County will build Hubs that serve the community and coordinate communication, distribute resources, reduce GHG emissions, and helps prepare the community for emergencies. The Hubs will include community gardens, health clinics, communications center, green power, and recreational/educational opportunities.

RESILIENT NEIGHBORHOODS - CLIMATE PROTECTION AND RESILIENCE (CPR) FOR THE PLANET INITIATIVE

The CPR for the Planet initiative will adapt Resilient Neighborhood's (RN) proven comprehensive behavior-change program to engage residents throughout Marin in reducing GHG emissions and becoming resilient to climate-linked emergencies. CPR for the Planet will provide a replicable model to engage 1,000 residents to reduce 2,642 MTCO2e annually by 2023 and 3,713 residents to reduce 9,427 MTCO2e annually by 2030. CPR for the Planet will test five pilot training programs, designed with community input, to equitably reach audiences including: Spanish speakers, low-income, older adults, parents, households with high carbon footprints, and others, through online and offline programs that include consumption, diet, reducing climate anxiety, and engage everyone in achieving climate responsible lifestyles.

NOW (2021-2023) – ADDITIONAL SOLUTIONS

The solutions in the previous section are currently being implemented and need to be accelerated between now and 2023. Additional solutions are categorized as follows:

- Existing, lead implementer identified and already implementing
- New solutions (may or may not be ready for implementation)
- Additional potential actions (not ready for implementation)

Existing, lead implementer identified and already implementing

ADVANCED COMMUNITY ENERGY (ACE) PILOT

Proposed statewide legislative initiative and program to develop local energy resources across all California cities and counties, addressing today's energy grid needs. State would provide funding, technical assistance, and other support so communities can implement ACE systems, e.g. microgrids, solar plus battery back-up.

ALL-ELECTRIC SHARED MOBILITY HUB (NEW SOLUTION, BUT IMPLEMENTATION STARTED)

Expand electric mobility services and charging equipment at the Larkspur Ferry Terminal (Terminal), allowing for electric bikes, electric carsharing, additional electric vehicle (EV) charging, and electric shuttles to serve commuters going to and from the Terminal. These electric mobility services would be integrated with infrastructure improvements to prioritize and improve transit, biking, and walking to this hub.

BLUE CARBON HOG ISLAND OYSTER COMPANY PILOTS

In 2019, a pilot project between Hog Island Oyster Company and Salt Point Seaweed was completed. The pilot project aimed to grow edible seaweed in Tomales Bay and measure the carbon sequestration and water quality benefits

that resulted. To conduct additional studies, additional funding is needed. In some instances, results may indicate that regulatory or legislative changes are needed to advance aquaculture.

LOAD SHIFT PILOT PROGRAM

Use deployed devices to shift energy use during the day and provide grid services, e.g. reduce energy in the evenings when electricity comes from dirtier sources like natural gas. Shifting energy use to the daytime means that use is likely solar or wind generated. Additionally, reducing energy use in the evenings can reduce customers costs since time of use rates are higher in the evenings. Devices can be controlled by third-parties, e.g. OhmConnect, that send signals to high energy-using devices such as refrigerators.

BUILDING ELECTRIFICATION PROGRAM

The County of Marin received a Bay Area Air Quality Management District (BAAQMD) grant ($296,997) and contributed $150,000 of matching funds to implement a "building decarbonization pilot project" also known as Electrify Marin. In January 2019, this program started offering rebates to single family property owners for the replacement of natural gas appliances with efficient all-electric units. The County may continue to issue rebates using County funds post-2020.

COMMUNITY-BASED INTEGRATED MOBILITY SERVICES

A prototype mobility system that will be designed from the bottom up with wide community involvement from the beginning, conducting a thorough needs assessment to determine the barriers to participation and the transit services that have the highest chance of success. It would include a mobility app with both private and public transportation options and would feature disbursement for all services with one easy payment. The program would be packaged as a "membership" program with 100% community participation to foster a culture based on sustainable travel.

AGRICULTURAL COMMUNITY EVENTS FARMERS MARKETS (ACEFM) CURBSIDE PICK-UP PROGRAM

ACEFM developed an online ordering and curbside pick-up program in response to COVID-19. This program ensures high-risk producers, farmers, vendors, and customers can still sell and purchase items. ACEFM wants to expand this program by offering delivery options, pick-up locations or "food hubs" in low and moderate income communities where there is no access to farmers markets, and to track and report program metrics, e.g. reduced food waste, new jobs, and reduced vehicle miles traveled.

New Solutions (may or may not be ready for implementation)

ORGANIC WASTE DIVERSION & PUBLIC COMPOST USE

Prevent organic waste from being landfilled (one pillar in the resilient food system) by implementing three measures: 1) increased organics processing capacity by supporting compost facility expansion permitting, 2) investment in food scrap diversion technology, and 3) scale up existing initiatives to increase compost use through community gardens and backyard composting.

FOOD RESILIENT MARIN

Expand upon existing collaborative work to launch a county wide initiative that leverages the COVID induced food system awareness to showcase the elements of a resilient food system and ways that consumers can engage directly

in solutions. There are three components to the initiative: reporting on food resiliency statistics as part of the recovery effort, mapping where community members can "join the resilient cycle", and more effectively linking resources and marketing/outreach efforts across the Marin food network, working with local jurisdictions to coordinate a food recovery network as required by SB 1383.

YOUTH ENGAGEMENT – HEALTHY FOOD VIDEOS VIA TIKTOK

Create a fun series of TikTok videos on how students can reduce plate waste. Sanzuma and San Rafael City School (SRCS) will share the videos with all Marin County students through a variety of outlets such as: Instagram, Facebook, text messages to parents, classrooms, and on school TVs while students are in line for lunch.

WATER-ENERGY NEXUS – MICRO-HYDRO TURBINES, MARIN MUNICIPAL WATER DISTRICT (MMWD)

Harness sustainable energy throughout Marin County's water distribution cycle by installing micro-hydroelectric turbines within MMWD's existing water pipeline infrastructure. These turbines generate energy from the natural flow of water and excess pressure in pipelines. This on-site renewable energy generation will reduce the amount of grid power MMWD needs to purchase, therefore reducing GHG emissions. It will also create a more resilient water supply, e.g. MMWD could still generate energy during public safety power shut-off (PSPS) events.

RESILIENCE COORDINATING COUNCIL (RCC)

A Resilience Coordinating Council (RCC) can counter the adverse psychological & psycho-social-spiritual reactions to climate-enhanced traumas and toxic stresses by bringing together a wide range of uncommon partners to co-create and implement innovative local networks that foster and sustain mental wellness and resilience before, during, and after climate disasters. Using a "train the trainer" model to train frontline workers, agency staff, educators, climate activists, and community leaders in mental wellness and resilience tools, these individuals they care for themselves and help others affected by climate related toxic stresses and trauma. Additional research into potential partners and Council structure needs to be completed.

"KNOW YOUR BLUE LINE" SEA LEVEL RISE PUBLIC ART PROJECT

Sea level rise is already happening and will get worse as time passes. Critical infrastructure is at risk and rising waters have and will have serious impacts on Marin County's most vulnerable populations. Increasing awareness about sea level rise is crucial to moving forward with a variety of strategies to deal with this disaster. The "Know Your Blue Line" public art project will demonstrate to the public where expected sea levels will rise and by what time horizon. The blue line will be accompanied by additional public service announcements in advance of high tide and flooding events and planning/training (expand upon Community Emergency Response Team (CERT) program) for floods in at-risk communities.

Additional potential actions (not ready for implementation)

COUNTYWIDE DECISION-MAKING PLATFORM

The Drawdown: Marin Buildings + Infrastructure Collaborative proposed a "decision-making platform" solution so the County (and other jurisdictions) could evaluate and prioritize climate change projects across the County. The Drawdown: Marin Coordinator investigated options for this platform including:

- EarthShift Global's Sustainable Return on Investment (S-ROI) tool

- Global Footprint Network's Net Present Value Plus (NPV+) framework
- DecisionLens Project Prioritization software/tool

The ESC decided to pursue DecisionLens, but only when cities, towns, and County Staff were able to designate staff time to complete a no-cost Proof of Value pilot. This pilot would involve forming a stakeholder group, developing evaluation criteria (social, environmental, and financial), selecting 3-5 projects to analyze, and assessing results.

TRANSPORTATION ORDINANCES AND POLICIES

A mix of Government and private sector policies are needed to lower transportation emissions. For example, electric vehicle (EV) and bus-only purchase/lease policy, required EV charging for businesses of a certain size, required prewiring for EV charging stations at renovated or new multi-family dwellings, banning the issuance of business licenses for new gas stations, and allowing 5G communications technology to support the interconnection and use of EV charging stations, smart phones, and other smart devices.

MARIN CLIMATE MOBILIZATION DECADE

Generate public funds through one or more public funding mechanisms. Potential mechanisms include property tax assessments, a sales tax, and/or issuing bonds. These additional revenues would allow for the implementation of a comprehensive Marin Climate Mobilization ensuring that Drawdown: Marin objectives are funded for the coming decade, when they are most critically needed.

GO100

Increase residential (then commercial) solar and solar plus storage installations countywide; increase Deep Green enrollment and MCE opt-in by providing technical assistance to customers, increasing outreach and engagement efforts, and offering additional incentives. MCE Clean Energy is leading efforts to increase residential solar plus storage. There are mixed opinions about the need to install more local solar generation without battery since we have more solar than we use during the day and this energy is not available in the evenings.

THEN (2024-2030)

Existing, needs to be scaled

TRANSIT ORIENTED MIXED-USE DEVELOPMENT

Transit-oriented, mixed use development is "the creation of compact, walkable, pedestrian-oriented, mixed-use communities centered around high-quality train systems."[15] Over 50% of countywide emissions are attributed to the transportation sector and this development approach would decrease dependence on cars for mobility. Existing zoning may need revisions to allow for increased density and mixed-uses near transit, e.g. SMART train stations.

REZONING OF SINGLE-FAMILY HOMES

Marin is experiencing both a housing crisis and a climate crisis. Seventy-two percent of existing housing in Marin County is zoned single-family. Permitting more density in existing neighborhoods, via "cottage overlays" will allow more people to live near transit and job sites, reducing transportation-related GHG emissions. It will also allow Marin

[15] Homepage, http://www.tod.org/ (last visited Apr. 10, 2020).

to house its workers and residents without encroaching on our protected open space. Without rezoning, there is limited opportunity for new housing development in Marin. Additionally, Marin's aging population is often isolated, in large homes with no support structure. This type of ordinance would have multiple benefits including increasing housing stock, connecting older individuals with others, and increasing financial health of older adults.

AFFORDABLE HOUSING ON STATE-OWNED PROPERTY

Governor Newsom signed Executive Order (EO) N-06-19 Affordable Housing Development to address the shortage of housing for Californians. Specifically this EO addresses communities that do not build their "fair share of housing" and identifies an opportunity to build additional housing on state-owned land, which is often times located in and near urban areas.[16] Using the interactive maps developed by the State, local jurisdictions should understand what state-owned parcels are ideal for new housing development. The State Department of General Services will then issue RFPs to develop priority parcels across the State. Existing, lead implementer identified and already implementing

BLUE CARBON WETLANDS RESTORATION

The Marin County Public Works Department is already working to restore tidal wetlands at McInnis Marsh and the Novato Baylands. Both projects are under way - McInnis Marsh is finalizing design and environmental review and Deer Island (one of several potential Baylands projects) is in design phase. Construction funding is needed for both, and both will require significant capital. County Staff assumes both projects will seek Measure AA[17] ($25 million available annually) and other wetlands restoration-type grant funding.

New Solutions

None.

Additional potential actions (not ready for implementation)

None.

NEXT (2031-2045)

All of the solutions listed in the previous section should continue to be implemented year-over-year or until program or project specific goals are met. There are no solutions that Drawdown: Marin should wait to implement until 2031. It is feasible that new ideas will emerge in the coming months and years. Those ideas should be considered and phased in as appropriate to the Drawdown: Marin plan to meet our 2030 and 2045 goals.

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[16] See Executive Order N-06-19 Affordable Housing Development available at https://www.dgs.ca.gov/RESD/Projects/Page-Content/Projects-List-Folder/Executive-Order-N-06-19-Affordable-Housing-Development (last visited Apr. 10, 2020).

[17] Measure AA, or the San Francisco Bay Clean Water, Pollution Prevention and Habitat Restoration Measure, was a revenue generating measure placed on the June 2016 ballots of the nine-county San Francisco Bay Area by the Restoration Authority. The measure proposed a 20-year, $12 parcel tax to raise approximately $25 million annually, or $500 million over twenty years, to fund restoration projects in the Bay. http://sfbayrestore.org/overview (last visited June 22, 2020).

APPENDIX B: GHG REDUCTION CALCULATIONS

GHG EMISSIONS REDUCTION SUMMARY

LOCAL ACTIONS

Code	Strategy	GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)
LCT-C1	Zero Emission Vehicles	-32,132
LCT-C2	Bicycling and Micromobility	-135
LCT-C3	Walking	-35
LCT-C4	Safe Routes to School	-347
LCT-C5	Public Transit	-1,057
LCT-C6	SMART	-950
LCT-C7	Employee Trip Reduction	-72
LCT-C8	Traffic System Management and Vehicle Idling	-73
LCT-C10	Zero Emission Landscape Equipment	-385
LCT-M1	Zero and Low Emission County Vehicles	-1,139
LCT-M3	County Employee Commute	-1,020
LCT-M4	Municipal Zero Emission Landscape Equipment and SORE	-23
EE-C1	Energy Efficiency Programs	-15,323
EE-C2	Energy Audits	-160
EE-C3	Cool Pavement and Roofs	-383
EE-C4	Green Building Reach Code	-830
EE-M1	Public Lighting	-
EE-M2	Energy Efficiency Audit and Retrofits in County Buildings	-20
EE-M3	Energy Conservation in County Buildings	-10
RE-C1	Renewable Energy Generation	-5,370
RE-C2	GHG-Free Electricity	-7,078
RE-C3	Building and Appliance Electrification	-7,424
RE-M1	Solar Energy Systems for Municipal Buildings	-
RE-M2	Municipal Deep Green Electricity	-
RE-M3	All-Electric Municipal Buildings	-22
WR-C1	Commercial Organic Waste	-1,730
WR-C2	Residential Organic Waste	-2,806
WR-C3	C&D and Self-Haul Waste	-261
WR-C4	Mandatory Waste Diversion	-4,567
WR-C5	Waste Processing Infrastructure and Franchise Agreements	-3,231
WC-C1	Community Water Use	-15
AG-C1	Carbon Farming	-55,752
AG-C2	Manure Management	-26,191

Code	Strategy	GHG Emissions Reductions in 2030 ($MTCO_2e$/yr)
AG-C3	Urban Forest and Food Production and Natural Lands Management	-106
	TOTAL - LOCAL ACTIONS	-168,649

State Actions

Code	Strategy	GHG Emissions Reductions in 2030 ($MTCO_2e$/yr)
RPS		-1,476
TITLE 24		-936
	Light and Heavy Duty Fleet Regulations	-20,473
	TOTAL - STATE ACTIONS	-22,884

Projected Emissions

Strategy	GHG Emissions Reductions in 2030 ($MTCO_2e$/yr)
Projected BAU Community GHG Emissions	386,316
Emissions Reduction from Local and State Actions	-191,533
Projected Community Emissions with Local and State Actions Implemented	194,783

Targets and Results

State Target

Strategy	GHG Emissions Reductions in 2030 ($MTCO_2e$/yr)
Estimated 1990 Community GHG Emissions (15% below 2005 level)	419,632
GHG Target to Meet State Goals (40% below 1990 level)	251,779
CAP Result without Sequestration	250,641
% Below 1990 Levels without sequestration	40.3%

DRAWDOWN TARGET

Strategy	**GHG Emissions Reductions in 2030** ($MTCO_2e/yr$)
2005 Community GHG Emissions	493,685
GHG Target to Meet Drawdown Target (60% below 2005 level)	197,474
CAP Result	194,783
CAP Result % Reduction from 2005 Emissions	60.5%

ZERO EMISSION VEHICLES, LCT-C1

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-32,132**
Targets	45% of passenger vehicles in Marin are ZEVs in 2030 (approximately 90,000 ZEVs). 26% annual growth rate of registered ZEVs in Marin.
Methodology and Assumptions	Marin has approximately 1.5% of all ZEVs in California (DMV, 1-1-19) and 197,609 automobiles registered in the County (DMV, 2019). CARB's proposed strategy is to put 4.2 million ZEVs on the road by 2030, which is approximately 14% of light duty vehicles in California in 2030. In January 2018, Governor Brown issued Executive Order B-48-18 which set a new goal of having a total of 5 million ZEVs in California in 2030. In September 2020, Governor Gavin Newsom issued Executive Order N-79-20 which sets a goal for 100 percent of in-state sales of new passenger cars and light trucks to be zero-emission by 2035. In January 2019, DMV reports there were 4,309 battery EVs, 2,747 plug-in hybrid EVs, and 60 fuel cell vehicles, for a total of 7,116 ZEVs in Marin County. We assume a similar penetration rate in the unincorporated areas. We also conservatively assume the same percentage of EVs in 2030: 61% battery EVs and 39% plug-in hybrids. 74% of the distance PHEVs drive is electric (Smart et al, 2014). EV kWh/mile is 0.32 (US Dept of Energy). Assuming the same share of ZEV ownership in 2030 as in 2019 (1.5%) means there would be approximately 75,000 ZEVs registered in Marin by 2030, or approximately 37% of existing automobile registrations. We are targeting approximately 90,000 ZEVs in Marin in 2030, or 45% of ZEVs registered in Marin. This would require an average annual growth rate of 26%. The number of ZEVs grew 33% in Marin between 2018 and 2019. This data suggests that an annual growth rate of 26% is feasible, especially as the number of models expands and battery technology and charging improves. Passenger VMT is adjusted to reflect the fact that approximately 35% of countywide commute VMT originates from workers who live outside Marin County (TAM). Measure does not apply to VMT generated by workers and visitors who do not live in Marin. According to the Department of Energy, towns (population 2,500 to 50,000) need 54 public EV plugs per 1,000 PEVs, which would equal about 4,800 public EV plugs countywide for 89,600 PEVs. The analysis assumes 88% of EV charging is done at home.

Sources	California Air Resources Board, 2017 Scoping Plan. Smart, J., Bradley, T., and Salisbury, S., "Actual Versus Estimated Utility Factor of a Large Set of Privately Owned Chevrolet Volts," SAE Int. J. Alt. Power. 3(1):2014, doi:10.4271/2014-01-1803. U.S, Department of Energy, Alternative Fuels Data Center, https://www.afdc.energy.gov/vehicles/electric_emissions_sources.html. Sales weighted average of 2016 model year vehicles with sales in 2015: 2015 sales from "U.S. Plug-in Electric Vehicle Sales by Model" (https://www.afdc.energy.gov/data/vehicles.html); MPGs from 2016 Fuel Economy Guide (https://www.fueleconomy.gov/feg/) US Department of Energy, "National Plug-In Electric Vehicle Infrastructure Analysis," September 2017. https://www.nrel.gov/docs/fy17osti/69031.pdf Bay Area Air Quality Management District, Vehicle Miles Dataportal, http://capvmt.us-west-2.elasticbeanstalk.com/, accessed 3/21/19. California Department of Transportation, "California County-Level Economic Forecast 2018-2050," September 2018. California Department of Motor Vehicles, Estimated Vehicles Registered by County for the Period January 1 through December 31, 2018" and "Fuel Type by County as of 1/1/2019." Personal communication with Derek McGill, Planning Manager, Transportation Authority of Marin, dmcgill@tam.ca.gov, August 22, 2018.

Calculation

Metric	2030
Number of registered Marin ZEVs in January 2019	7,116
Projected number of registered passenger vehicles in Marin	199,141
Percent of Marin ZEVs in target year	45%
Number of Marin ZEVs in target year	89,613
Increase in ZEVs	82,497
Additional ZEVs as a percent of Marin vehicles	41.4%
Unincorporated area passenger VMT	303,994,722 miles
VMT from non-Marin workers and visitors	54,280,973 miles
Unincorporated area passenger VMT from Marin-based vehicles	249,713,749 miles
VMT from additional ZEVs	103,448,047 miles
VMT driven with electricity	92,958,415 miles
Emissions without EV program	35,786 $MTCO_2e$
Tailpipe emissions reduction with EV program	32,901 $MTCO_2e$
Electricity used by ZEVs	31,174,534 kWh
Electricity emissions from ZEVs	769 $MTCO_2e$
Emissions reduction	32,132 $MTCO_2e$

Bicycling and Micromobility, LCT-C2

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-135**
Targets	21.9 miles of Class I multi-use paths and 106.1 miles of Class II bike lanes constructed by 2030.
Methodology and Assumptions	Studies cited by CAPCOA show each additional mile of bike lanes per square mile increases the share of workers commuting by bicycle by 1% (CAPCOA SDT-5). We have applied this to the following population segments: • Live in/work in area • Live in/work out of area • Live in area/non-worker • Live out of area/work in area The Marin County Unincorporated Area Bicycle and Pedestrian Master Plan Table 5-6 identifies 21.9 miles of proposed Class I bike facilities and 106.1 miles of proposed Class II facilities.
Sources	Marin County Unincorporated Area Bicycle and Pedestrian Master Plan (2018). Bay Area Air Quality Management District Vehicle Miles Traveled Dataportal, http://capvmt.us-west-2.elasticbeanstalk.com/data. California Air Pollution Control Officers Association, "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures," August, 2010.

Calculation

Metric	2030
VMT generated by targeted population segments	253,066,505 VMT
Additional Class I and II facilities	128.0 miles
New bike facilities/sq. mile	0.2
Reduction in local VMT	391,214 VMT
Emissions reductions	135.3 $MTCO_2e$

WALKING, LCT-C3

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	-35
Targets	1% reduction in VMT for vehicle trips that start and end in unincorporated communities by 2030.
Methodology and Assumptions	Studies cited by CAPCOA show pedestrian network improvements can reduce VMT 1-2% (CAPCOA SDT-1). We apply this to passenger vehicle trips that start and end in the unincorporated communities. Given the rural nature of some of the unincorporated communities and the fact that many unincorporated areas adjacent to cities and towns are on the outskirts of their downtowns and employment and shopping centers, we assume the low-end 1% reduction in VMT for 2030.
Sources	California Air Pollution Control Officers Association, "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures," August, 2010. Bay Area Air Quality Management District Vehicle Miles Traveled Data Portal, http://capvmt.us-west-2.elasticbeanstalk.com/data

CALCULATION

Metric	2030
Passenger vehicle trips starting and ending in unincorporated communities	10,220,081 VMT
% decrease in VMT due to pedestrian improvements	1.0%
Annual decrease in VMT	102,201 VMT
GHG emissions reductions	35 $MTCO_2e$

SAFE ROUTES TO SCHOOL, LCT-C4

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-347**
Targets	Reduce school trips in a family vehicle by 29%, from an average of 50% to 36%.
Methodology and Assumptions	According to the Marin County Unincorporated Area Bicycle and Pedestrian Master Plan, most school districts serving the unincorporated areas of the county currently participate in the Safe Routes (SR2S) program. SR2S projects and programs may be developed for other communities. Virtually all schools in Marin, especially those not currently participating in the program, could use additional funds for bicycle racks, long-term bicycle parking, and crossing guards. The Marin County Unincorporated Bicycle and Pedestrian Master Plan identifies several recommendations (#15 through 19) to expand the program to all schools, utilize the safe pathways program, sustain and increase participation and enthusiasm, remove barriers to alternative modes, and increase transit access. To demonstrate the benefits of providing Safe Routes to Schools, the Marin County Bicycle Coalition recruited nine pilot schools in four different geographic locations. Initial surveys reported that 62% of the students were arriving by car, with only 14% walking, 7% biking to school, 11% carpool, and 6% arriving by bus. Every school in the pilot program held periodic Walk and Bike to School Days and participated in the Frequent Rider Miles contest, which rewarded children who came to school walking, biking, by carpool or bus. At the end of the pilot program, the participating schools experienced a 57% increase in the number of children walking and biking and a 29% decrease in the number of children arriving alone in a car. Plan Bay Area 2040 projects 10,135 school-age children in the unincorporated area in 2030. We assume an elementary school (K-5) age population of 2,854 with an average trip length of 1.7 mile, a middle school (6-8) population of 3,983 with an average trip length of 1.7 miles, a high school (9-12) population of 3,298 with an average trip length of 2.3 miles, 180 school days, and an average share of school trips completed in a family vehicle of 50% according to Safe Routes to School surveys taken at participating schools serving Marin in Fall 2016.
Sources	Marin County Unincorporated Area Bicycle and Pedestrian Master Plan (2018). US Census Bureau, American Community Survey 5-Year Estimates 2014-2018, Table S0101. Plan Bay Area 2040 Projections, http://projections.planbayarea.org/. Marin County Safe Routes to School Program Evaluation, September 2016. Average school trip lengths provided by Transportation Authority of Marin. Safe Routes to School Marin County, http://www.saferoutestoschools.org/history.html#success

Calculation

Metric	2030
Elementary school population	2,854
Middle school population	3,983
High school population	3,298
School population miles travelled	6,914,953 miles
Percent of miles driven in a family vehicle	50%
Potential percent decrease in students driving to school	29%
VMT avoided	1,002,668 VMT
Emissions reductions	347 $MTCO_2e$

PUBLIC TRANSIT, LCT-C5

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-1,057**
Targets	33% of Marin Transit and Golden Gate Transit buses will use be electric and 66% will use renewable diesel by 2030.
Methodology and Assumptions	Marin Transit reports 3,674,440 revenue miles in FY 18/19 and 31.7% of those miles within unincorporated areas. Golden Gate Transit reports 3,467,056 revenue miles in FY 18/19 and 17.5% of those miles in unincorporated areas. Marin Transit's Draft Fixed Route Vehicle Replacement Plan indicates 3% of its fleet will be comprised of zero emission buses in 2020 and 33% of its fleet will be zero emission by 2030. In 2019, 72% of its buses were using renewable diesel and 3% of the fixed route buses were zero emission. Marin Transit and Golden Gate Transit have been using renewable diesel since 2016. We assume 33% will be driven by electric buses utilizing MCE electricity by 2030. CARB adopted the Innovative Clean Transit (ICT) Rule in December 2018. This rule outlines a transition of California transit agencies to a zero emission fleet by 2040. 100% of transit agencies' bus purchases must be zero emission beginning in 2029. Marin Transit's Draft Fixed Route Vehicle Replacement Plan (2019) identifies purchases that will achieve the ICT zero emission fleet mandate in 2040. As of October 2019, Golden Gate Transit had not yet developed a transition plan.
Sources	Marin Transit Board of Directors Staff Report, April 1, 2019 Personal communication with Keith Nunn, Director of Maintenance, Golden Gate Transit, Oct. 22, 2019. Personal communication with Anna Penoyar, Senior Capital Analyst, Marin Transit, Oct. 22, 2019.

CALCULATION

Metric	2030
Transit miles, BAU	1,767,976 miles
Emissions, BAU	2,212 $MTCO_2e$
Renewable diesel VMT	67%
Electric bus VMT	33%
Tailpipe emissions	1,155 $MTCO_2e$
GHG emissions reductions	1,057 $MTCO_2e$

SMART TRAIN, LCT-C6

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-950**
Targets	SMART Train uses 100% renewable diesel by 2030. SMART ridership increases to an average of 388 boardings and 388 alightings per day at the Marin County Civic Center train station by 2030.
Methodology and Assumptions	Renewable diesel, or RD99, is a transportation fuel made from nonpetroleum renewable resources like natural fats, vegetable oils, and greases and works like regular diesel. Switching to renewable diesel can reduce greenhouse gas emissions by 60% or more. RD99 is readily available on the west coast and most petroleum suppliers can source it. SMART train diesel consumption is based on number and frequency of diesel multiple units (DMUs) that travel within the unincorporated area. SMART reports 2,040 passenger trips per weekday and 800 passenger trips per weekend day for January-September 2019, or an average of 1,686 passenger trips per day. SMART also reports an average car capacity of 30 people. Each train car has capacity for approximately 150 riders, which calculates to a ridership rate of approximately 20%. SMART NTD data indicates that approximately 16% of passenger rail trips start or end at the Marin County Civic Center station. Therefore, there are approximately 98,462 passenger trips (1,686 passenger trips per day x 365 days x 16%) starting or ending at the Marin County Civic Center annually. SMART reports that the average passenger trip is 24 miles. Similar to the way we allocate VMT for trips that either start or end in the unincorporated areas, we allocate one half of the avoided trip length to the unincorporated area, or 1,181,549 vehicle miles (98,462 passenger trips per year x 24 miles x 50%). The 2005 Travel Demand Forecasting Report forecasted 388 boardings and 388 alightings per day at the Marin County Civic Center station in 2025. Assuming the same 24-mile average trip length, there would be 3,398,880 avoided vehicle miles allocated to the unincorporated area (388 boardings per day+ 388 alightings per day x 365 days x 24 miles x 50%). The difference between the current vehicle miles avoided and the projected vehicle miles avoided is 2,217,331 miles (3,398,880 miles - 1,181,549 miles). This means ridership would need to increase 287% to meet the ridership rates originally forecasted in 2005. In order to provide capacity for the additional demand, we assume an extra car will be placed in service for 12 weekday trips per day, similar to service levels in 2019.
Sources	SMART DMU MPG from Ken Hendricks, SMART Procurement Coordinator, khendricks@sonomamarintrain.org

	Renewable diesel emission factor derived from NEXGEN Fuel http://www.nexgenfuel.com/fleets-commercial-use/ SMART NTD Counts, January-September 2019, Final Report (Revised 12-20-19) http://sonomamarintrain.org/sites/default/files/Ridership%20Reports/January_8_2020_%20Staff%20Report_Ridership.pdf SMART Green Commute Fact Sheet, http://sonomamarintrain.org/sites/default/files/Document%20Library/Green-Commute-Fact-Sheet-with-video.pdf Travel Demand Forecasting Report prepared for Sonoma-Marin Area Rail Transit District, Parsons Brinckerhoff, Appendix I, September 2005 https://srcity.org/DocumentCenter/View/3668/Sonoma-Marin-Rail-Transit-Appendix-I---Travel-Forecasting-Report--PDF

CALCULATION

Metric	2030
SMART train diesel consumption, 2018	34,119 gallons
SMART train emissions from diesel, 2018	348 $MTCO_2e$
SMART train emissions from renewable diesel	143 $MTCO_2e$
GHG emissions reduction from switch to renewable diesel	206 $MTCO_2e$
Estimated avoided vehicle miles from passenger trips starting or ending at the Marin County Civic Station in 2019	1,181,549 miles
Projected avoided vehicle miles from passenger trips starting or ending at the Marin County Civic Station in 2030	3,398,880 miles
Additional avoided vehicle miles by 2030	2,217,331 miles
Emissions from renewable diesel for additional cars	23 $MTCO_2e$
GHG emissions reduction from increase in ridership	744 $MTCO_2e$
Total GHG emissions reduction	950 $MTCO_2e$

EMPLOYEE TRIP REDUCTION, LCT-C7

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-72**
Targets	100% of covered employers provide an employee trip reduction program.
Methodology and Assumptions	CAPCOA TRT-1 indicates VMT reduction of 5.4% for suburban center location. Employer programs include: carpooling, ride matching, preferential carpool parking, flexible work schedules for carpools, a half-time transportation coordinator, vanpool assistance, bicycle parking, showers, and locker facilities. This measure assumes voluntary employee participation. BAAQMD Transportation Fund for Clean Air guidance indicates a reduction of 0.2% of commute VMT for Guaranteed Ride Home Programs. Bay Area Metro identifies 181 unregistered businesses in the Commuter Benefits Program with approximately 7,431 unregistered employees in Marin County. We estimate 16% of these employees work in the unincorporated area, based on the unincorporated area's share of countywide jobs. We attribute worker 13.1 miles per day per commuter based on San Rafael data, and 240 work days per year.
Sources	California Air Pollution Control Officers Association, "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures," August, 2010. BAAQMD Transportation Fund for Clean Air Guidance FYE 2018. Bay Area Air Quality Management District Vehicle Miles Traveled Data Portal, http://capvmt.us-west-2.elasticbeanstalk.com/data Personal communication with Corey Dodge, Bay Area Metro.

Calculation

Metric	2030
Estimated number of unregistered employees working in companies with 50 or more employees in Marin County	7,431
Percent of employees located in unincorporated area	16%
Number of employees targeted for program	1,182
Average daily VMT for worker	13.1
Estimated annual VMT	3,716,391
VMT reduction	5.6%
Annual decrease in VMT	208,118
GHG emissions reductions	72

Traffic System Management and Vehicle Idling, LCT-C8

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-73**
Methodology and Assumptions	The County and the City of Larkspur completed a signal synchronization project on Sir Francis Drake Boulevard from Larkspur Landing to Elm Avenue in Kentfield in 2019 that is estimated to reduce fuel consumption by 114,986 gallons in the first year. Larkspur and the County are installing infrastructure to make the system adaptive. We assume continued adjustments in synchronization will retain original fuel savings through 2030. TAM's Origin-Destination Data Collection Report documents that 7% of vehicle trips on Sir Francis Drake Boulevard east and west of Hwy 101 start and/or end in the unincorporated area. We apply this percentage to the total fuel consumption savings identified in the PASS project.
Sources	DKS, "Final - Deliverable 4B Final Project Report: Metropolitan Transportation Commission Program for Arterial System Synchronization (PASS) FY 18/19," prepared for Marin County, City of Larkspur, and Caltrans Fehr & Peers for Transportation of Marin, "TAM Origin-Destination Data Collection Draft Report," March 14, 2017

Calculation

Metric	2030
Gasoline fuel savings	114,986 gallons
% of trips starting and/or ending in unincorporated areas	7%
Total emissions reductions	73 $MTCO_2e$

Zero Emission Landscape Equipment, LCT-C10

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-385**
Targets	50% reduction in fuel used in portable landscape equipment by 2030 due to switching to electric equipment.
Methodology and Assumptions	CARB is currently considering regulating small off-road engines (SORE) that will reduce smog-pollutant emissions from mobile sources by 80% in 2031 through a combination of regulatory and incentive approaches. SORE are spark-ignition engines rated at or below 19 kilowatts. Engines in this category are primarily used for lawn, garden, and other outdoor power equipment. CARB's goal is to require all new sales to be zero emissions equipment by 2028. For this action, portable landscape equipment includes lawn mowers, leaf blowers/vacuums, trimmers/edgers/brush cutters. This equipment consumed 332,153 gallons of gasoline in 2018 (OFFROAD2007). Similar to the off-road emissions inventory, we assume 25.3% of emissions are attributable to the unincorporated areas based on their share of countywide households in 2018. We assume a 50% reduction in 2030 due to the County's action to ban gasoline portable landscape equipment by 2030.
Sources	OFFROAD2007

Calculation

Metric	2030
Portable landscape equipment gasoline consumption, BAU	86,320 gallons
Emissions from potable landscape equipment, BAU	769 $MTCO_2e$
Reduction target	50%
Emissions reductions	385 $MTCO_2e$

Zero and Low Emission County Vehicles, LCT-M1

GHG Emissions Reductions in 2030 ($MTCO_2e$/yr)	**-1,139**
Targets	50% improvement in fuel efficiency of County vehicles that use gasoline by 2030.
Methodology and Assumptions	As vehicles are replaced, there will be opportunities to purchase/lease electric vehicles or improve vehicle fuel efficiency with similar models. We assumed the County will continue to purchase 100% renewable electricity, and therefore there are no emissions attributed to EV use.
Sources	County of Marin

Calculation

Metric	2030
Gasoline consumption, 2018	255,707 gallons
County vehicle fleet tailpipe emissions	2,279 $MTCO_2e$
Fuel efficiency improvement for fleet	50%
Emissions reductions	1,139 $MTCO_2e$

County Employee Commute, LCT-M3

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-1,020**
Target	Annual average increase of 50 employees participating in the Ride Green program. In addition to the Ride Green program, we target an additional 10% of employee commute miles to be reduced by remote working.
Methodology and Assumptions	The County has been running a RideGreen program for its employees since 2016. Participation rates were analyzed between 2016 and 2019 (2020 data is excluded due to the COVID-19 pandemic). Participation increased by 49 participants between the May 2018-October 2018 period and the May 2019- October 2019 period. We assume participation will increase by 50 employees each year after 2021. In addition to the RideGreen program, we target an additional 10% of employee commute miles to be reduced by remote working. According to the County's 2018 commute survey, the average one-way commute distance is 22.1 miles. We assume an average of 240 work days for a County employee. Similar to how we count transportation emissions for trips that start or end in the jurisdiction, we credit one half of the VMT reduction to the emissions reduction.
Sources	County of Marin Bay Area Air Quality Management District Vehicle Miles Traveled Data Portal, http://capvmt.us-west-2.elasticbeanstalk.com/data

Calculation

Metric	2030
Average annual employee commute VMT	5,304 VMT
Annual increase in employee participation after 2021	50 people
VMT reduced by RideGreen program	4,773,600 VMT
VMT reduced by telecommuting	1,124,448 VMT
Emissions reduction	1,020 $MTCO_2e$

Municipal Zero Emission Landscape Equipment and Small Off-Road Engines, LCT-M4

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-23**
Target	50% of landscape equipment and small off-road engines, or 75 units, are replaced with zero emissions equipment by 2030.
Methodology and Assumptions	CARB is currently considering regulating small off-road engines (SORE) that will reduce smog-pollutant emissions from mobile sources by 80% in 2031 through a combination of regulatory and incentive approaches. SORE are spark-ignition engines rated at or below 25 horsepower or 19 kilowatts. Engines in this category are primarily used for lawn, garden, and other outdoor power equipment including generators, power washers, and utility carts. Construction and agricultural equipment are regulated by the federal government and not subject to CARB regulation. CARB's goal is to require all new sales of regulated equipment to be zero emissions equipment by 2028. The County has approximately 150 pieces of equipment that would be subject to SORE zero emissions regulations, including blowers, mowers, hedge trimmers, brush cutters and clearing saws (under 40 cc), chain saws (under 45 cc), pressure washers, and generators. We target 50% to be replaced with zero emissions equipment by 2030. We further assume average annual gasoline consumption of 35 gallons per equipment.
Sources	CARB Small Engine Fact Sheet, https://ww3.arb.ca.gov/msprog/offroad/sore/sm_en_fs.pdf?_ga=2.15457782.1959742507.1598026042-1995196326.1515467224 CARB List to Determine Preempt Off-Road Applications, https://ww3.arb.ca.gov/msprog/offroad/preempt.htm County of Marin

Calculation

Metric	2030
Number of small off-road engines replaced with zero emissions equipment	75
Estimate annual gasoline used for small landscape equipment	2,625 gallons
Emissions reduced	23 $MTCO_2e$

ENERGY EFFICIENCY PROGRAMS, EE-C1

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-15,323**
Targets	Electricity consumption is reduced an average of 1% per year and natural gas consumption is reduced 1.3% per year between 2018 and 2030.
Methodology and Assumptions	We are forecasting an annual electricity savings of 1% and an annual natural gas savings of 1.3% based on the following: The National Action Plan for Energy Efficiency states among its key findings "consistently funded, well-designed programs are cutting annual savings for a given program year of 0.15 to 1 percent of energy sales." The American Council for an Energy-Efficiency Economy (ACEE) reports for states already operating substantial energy efficiency programs, energy efficiency goals of one percent, as a percentage of energy sales, is a reasonable level to target. MCE Clean Energy's Implementation Plan states "MCE's goal is to increase annual savings through energy efficiency programs to two percent (combined MCE and PG&E programs) of annualized electric sales…by the end of 2018." Electricity consumption declined an average of 0.9% per year in the unincorporated areas between 2005 and 2018. Natural gas consumption declined an average of 1.3% per year between 2005 and 2018.
Sources	Marin Clean Energy Revised Community Choice Aggregation Implementation Plan and Statement of Intent, July 18, 2014. National Action Plan for Energy Efficiency, July 2006, Section 6: Energy Efficiency Program Best Practices (pages 5-6). Energy Efficiency Resource Standards: Experience and Recommendations, Steve Nadel, March 2006 ACEEE Report E063 (pages 28-30).

Calculation

Metric	2030
Residential and commercial electricity use, 2018	321,462,824 kWh
Electricity use less other local actions	320,933,419 kWh
Annual decrease in electricity consumption	1%
Electricity savings	38,512,010 kWh
Residential and commercial natural gas use, 2018	16,640,231 therms
Natural gas use less other local actions	15,176,227 therms
Annual decrease in natural gas consumption	1.3%
Natural gas savings	2,367,491 therms
GHG emissions reductions	15,323 $MTCO_2e$

Energy Audits, EE-C2

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-160**
Targets	187 housing units implement energy efficiency projects between 2025 and 2030 due to ordinance requiring energy audits at time of sale.
Methodology and Assumptions	Assumes program will be implemented in 2025 and will require audits at time of sale but energy efficiency projects will be voluntary. Assumes 5% of audited housing units will implement energy efficiency upgrades based on findings from the City of Berkeley's Building Energy Saving Ordinance. Assume 31% Btu energy use reduction based on demonstrated Energy Upgrade California projects completed in Marin County between June 2010 and May 2012. 748 housing units sold annually, based on 2005-2018 average (Marin County Assessor).
Sources	Marin County Assessor, http://www.marincounty.org/depts/ar/divisions/assessor/sales City of Berkeley, "Building Energy Savings Ordinance (BESO) Findings through Nov. 2016," December 7, 2016, https://www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-_Energy_and_Sustainable_Development/Energy%20Commission%20Presentation%20Berkeley.pdf Marin County Energy Watch Partnership, Dana Armanino, Sustainability Planner, County of Marin, darmanino@marincounty.org

Calculation

Metric	2030
Average household electricity use, 2018	6,602 kWh
Average household natural gas use, 2018	445 therms
Number of housing units sold annually	748 units
Number of housing units provided energy audits	3,738 units
Percent of participating housing units	5%
Number of housing units implementing energy efficiency projects	187 units
Electricity reduction	31%
Natural gas reduction	31%
Annual electricity savings	382,476 kWh
Natural gas savings	25,808 therms
Electricity emissions reduction	23 $MTCO_2e$
Natural gas emissions reduction	137 $MTCO_2e$
Total GHG emissions reduction	160 $MTCO_2e$

Cool Pavement and Roofs, EE-C3

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-383**
Targets	50% of paved surfaces in the urbanized areas are converted to high-albedo surfaces by 2030.
Methodology and Assumptions	On average, for metropolitan areas studied, vegetation covers about 29-41% of the area, roofs 19-25%, and paved surfaces 29-39% (Akbari, 2008). For the County, we assume paved surfaces cover 29% of the urbanized areas of certain CDPs (Black Point-Green Point, Kentfield, Lucas Valley-Marinwood, Marin City, Santa Venetia, Sleepy Hollow, and Strawberry). Electricity consumption in the urbanized areas was estimated using the proportionate share of the household population in urbanized areas of the CDPs to the total household population of the unincorporated area. This method is conservative as it may be undercounting the share of commercial electricity in the urbanized areas. We assume 5% of the pavement in the urbanized areas will be replaced with high albedo content each year. Pavement has a potential for a 0.15 to 0.25 increase in albedo (Akbari, 2008); we have conservatively assumed a 0.15 change in albedo. 0.29 *0.15 * 0.50 = Net change of 0.870 for 2030. - a 10K decrease in temperature for a 0.25 increase in albedo (Akbari) - 10 Kelvin = 10 Celsius - Electricity demand in cities increases by 2–4% for each 1 degree Celsius increase. Assume 3% for the urbanized unincorporated areas.
Sources	Akbari, Hashem and Rose, Leanna Shea, "Urban Surfaces and Heat Island Mitigation Potentials," Journal of the Human-Environmental System, Vol. 11; No. 2: 85-101, 2008.

Calculation

Metric	2030
Percent of urbanized unincorporated area covered in pavement	29%
Percent of paved area with high albedo	50%
Albedo change	0.022
Temperature decrease	0.870 Celsius
Reduction in electricity use	5,404,130 kWh
Reduction in emissions	383 $MTCO_2e$

GREEN BUILDING REACH CODE (A), EE-C4

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-97**
Targets	Implement green building reach code that provides options for all-electric, limited mixed fuel, and fuel construction for new single family and multi-family buildings for the 2019 building code cycle.
Methodology	CAPCOA Measure BE-1 used for estimating building energy savings. We assume a 27% improvement in energy efficiency for residential buildings, similar to the mixed fuel compliance method which requires a total compliance margin of 10 EDR. We assume a 10% improvement in energy efficiency in non-residential buildings, similar to the mixed fuel compliance method.
Sources	California Air Pollution Control Officers Association, "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures," August, 2010.

CALCULATION

RESIDENTIAL

Metric	2030
Percent over Title 24 Energy Requirements	27%
New construction electricity use, BAU	145,503 kWh
New construction electricity use, after Title 24	0 kWh
Additional reduction in electricity use	0 kWh
New construction natural gas use, BAU	71,757 therms
New construction natural gas use, after Title 24	67,234 therms
Additional reduction in natural gas use	16,346 therms
GHG emissions reductions	87 $MTCO_2e$

COMMERCIAL

Metric	2030
Percent over Title 24 Energy Requirements	10%
New construction electricity use, BAU	770,459 kWh
New construction electricity use, after Title 24	539,321 kWh
Additional reduction in electricity use	14,022 kWh
New construction natural gas use, BAU	28,338 therms
New construction natural gas use, after Title 24	22,302 therms
Additional reduction in natural gas use	1,606 therms
GHG emissions reductions	10 MTCO2e

REDUCTIONS IN ENERGY USE FOR EVERY 1% OVER 2008 TITLE 24 ENERGY REQUIREMENTS, ZONE 5

Metric	Electricity	Natural Gas	Source
Commercial	0.26%	0.72%	CAPCOA Measure BE-1
Residential - Multifamily	0.09%	0.88%	CAPCOA Measure BE-1
Residential - Single	0.04%	0.91%	CAPCOA Measure BE-1
Residential - Townhome	0.05%	0.90%	CAPCOA Measure BE-1
Residential Average	0.06%	0.90%	Calculation

GREEN BUILDING REACH CODE (B), EE-C4

Action	Continue to adopt a green building ordinance for new and remodeled commercial and residential projects that requires green building methods and energy efficiency savings above the State building and energy codes. Marin County's green building ordinance that aligns with the 2022 California Building Standards code shall prohibit the installation of new natural gas end uses in all residential uses. The same prohibition should be applied to new nonresidential construction in the 2025 code cycle.
GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-733.2**
Methodology and Assumptions	We assume adoption of an ordinance in that bans natural gas use in new residential buildings beginning in 2023 and new non-residential buildings in 2026. Replacing residential space heating systems in Climate Forecast Zone 5 that use natural gas with systems that use heat pumps and electricity reduces emissions by an average of approximately 89% (derived from CRASS, Tables 2-9 and 2-26). We assume the same emissions reduction for electrifying non-residential space heating systems. An estimated 88% of new homes use natural gas for ranges and ovens and 58% use natural gas for dryers (CRASS, Table 2-22). We assume the ordinance reduces these numbers 100%. We assume all new homes use natural gas for primary space heating and water heating (CRASS, Table 2-25). We assume the ordinance reduces these numbers by 100%. Electricity used to power these systems is regulated under Title 24, which requires solar energy to supply energy requirements. We assume an average of 29 new housing units per year based on the County's Housing Element Progress Report for 2015-2019. CAPCOA Measure BE-1 used for estimating non-residential building electricity savings subject to Municipal Code Section 16-47.040.
Sources	2009 California Residential Appliance Saturation Study, Volume 2, Table 2-8 (PG&E for dryer and heat pump), Table 2-24 (PG&E for dryer), and Table 2-26 (Forecast Zone 5 for water heater and range). http://www.energy.ca.gov/2010publications/CEC-200-2010-004/CEC-200-2010-004-V2.PDF California Energy Commission, California Commercial End-Use Survey (March 2006), https://ww2.energy.ca.gov/2006publications/CEC-400-2006-005/CEC-400-2006-005.PDF

	California Department of Housing and Community Development, "Annual Progress Report permit Summary - Table with 5th Cycle Summary Data, updated 07/17/2020". California Air Pollution Control Officers Association, "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures," August, 2010.

CALCULATION

RESIDENTIAL

Metric	2030
New housing units, 2023-2030	357 units
Estimated natural gas use for space heating, per housing unit	306 therms
Estimated natural gas use for water heating, per housing unit	163 therms
Natural gas reduced beyond Title 24 requirements for heating systems	95,676 therms
Estimated annual natural gas use for cooktop and range	28 therms
Estimated natural gas use for clothes dryer	22 therms
Total natural gas reduced for appliances	13,352 therms
Estimated electricity use for cooktop and range	71 kWh
Estimated electricity use for clothes dryer	648k Wh
Total electricity used for electrified appliances	163,991 kWh
GHG emissions reductions	569.5 $MTCO_2e$

COMMERCIAL

Metric	2030
Natural gas reduced beyond Title 24 requirements	30,780 therms
GHG emissions reductions	163.7 $MTCO_2e$

PUBLIC LIGHTING, EE-M1

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**0**
Target	Complete conversion of remaining street, park, and other outdoor lights to LED by 2030.
Methodology and Assumptions	The County had converted 86% of its streetlights by 2020. The action assumes the County will convert the remaining 293 conventional streetlights to LED by 2030. We assume the streetlights use an average of 60 kWh per month per streetlight. LED reduces electricity consumption by approximately 50%. However, since the County was purchasing 100% renewable energy in 2018 for all of its facilities, there are no additional GHG reductions for this action.
Sources	Marin General Services Authority PG&E Rate Schedule LS-2

CALCULATION

Metric	2030
Estimated electricity use for conventional streetlights, 2018	210,960 kWh
Electricity savings	102,316 kWh
GHG emissions reduction	0.0 $MTCO_2e$

Energy Efficiency Audit and Retrofits in County Buildings, EE-M2

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-20**
Targets	Reduce electricity and natural gas use 10% through energy efficiency retrofits of existing systems and equipment.
Methodology and Assumptions	There are no GHG reduction savings for reduced electricity use because the County was purchasing 100% renewable electricity in 2018.
Sources	County of Marin Sustainability Team

Calculation

Metric	2030
Electricity consumption for buildings and facilities, excluding public lighting	13,682,056 kWh
Electricity consumption in unincorporated areas	935,720 kWh
Natural gas consumption for buildings and facilities	379,454 therms
Natural gas consumption in unincorporated areas	37,119 therms
Reduction in energy consumption	10%
Reduction in electricity consumption	93,572 kWh
Reduction in natural gas consumption	3,712 therms
Emissions reductions	20 $MTCO_2e$

Energy Conservation in County Buildings, EE-M3

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-10**
Targets	Reduce energy use in municipal buildings by 5%.
Methodology and Assumptions	Energy management software is proven to reduce energy consumption by 10% through identifying inefficiencies within operations. A 5% reduction in energy use for miscellaneous behavioral changes by staff and mechanical operations, and upgrading to Energy Star equipment were assumed. There are no GHG reduction savings for reduced electricity use because the County was purchasing 100% renewable electricity in 2018.
Sources	Marin County Sustainability Team

Calculation

Metric	2030
Electricity consumption in municipal buildings and facilities, 2018	13,649,989 kWh
Electricity consumption buildings in unincorporated areas	926,879 kWh
Natural gas consumption in municipal buildings and facilities, 2018	379,454 therms
Natural gas consumption in unincorporated areas	37,110 therms
Percent reduction in energy use	5%
Reduction in electricity consumption	46,344 kWh
Reduction in natural gas consumption	1,856 therms
GHG emissions reductions	10 MTCO2e

Renewable Energy Generation and Storage, RE-C1

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-5,370**
Targets	Solar energy installations continue to grow by an average of 4,748 KW DC each year through 2030.
Methodology and Assumptions	According to Project Sunroof, 86% of buildings in Marin County have roofs that are solar viable. By 2019, approximately 51.8 MW of solar capacity had been installed in the unincorporated areas across more than 7,500 solar electric arrays. Between January 1, 2018 and January 28, 2020 permits were issued for a total of 9,892.63 kW DC, which annualizes to 4,748 kW DC. We assume new distributed solar capacity will be added at the same rate as 2018-2019 through 2030, or 4,748 KW DC each year.
Sources	Project Sunroof, https://www.google.com/get/sunroof/data-explorer/place/ChIJ2cX8c6yXhYARECyyKE9Ek1Q/, accessed July 23, 2020. County of Marin Sustainability Team

Calculation

Metric	2030
Solar capacity added 2018-2019	9,496 KW DC
Average solar added annually	4,748 KW DC
Additional solar 2020-2030	52,228 KW DC
kWh generated by 1 KW solar energy system	1,450 kWh
Additional electricity produced by distributed PV	75,730,600 kWh
GHG emissions reductions	5,370 $MTCO_2e$

GHG-Free Electricity, RE-C2

GHG Emissions Reductions in 2030 ($MTCO_2e$/yr)	**-7,078**
Targets	MCE electricity is 100% GHG-free by 2030.
Methodology and Assumptions	The MCE 2019 Resource Integration Plan states that MCE electricity is projected to be 94% GHG-free in 2020 and 100% GHG-free by 2022. MCE supplied 70.5% of the total electricity load in the unincorporated area in 2018.
Sources	MCE 2019 Integrated Resource Plan (November 2018). https://www.mcecleanenergy.org/wp-content/uploads/2019/01/MCE-2019-Integrated-Resource-Plan_11-8-2018_V_12-21-18.pdf

Calculation

Metric	2030
Electricity use, BAU	330,458,814 kWh
Electricity saved through State actions	1,674,265 kWh
Less electricity saved through local energy efficiency and renewable energy actions	120,364,099 kWh
Net electricity use	208,420,450 kWh
Projected MCE electricity use (70.5% of total)	147,021,716 kWh
Electricity emissions w/MCE BAU	7,078 $MTCO_2e$
Electricity emissions w/MCE	0 $MTCO_2e$
GHG emission reductions	7,078 $MTCO_2e$

Building and Appliance Electrification (A), RE-C3

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-238**
Targets	47 cooktops, 71 water heaters, and 141 heating systems are replaced with electric versions by 2025 through a Building Decarbonization incentive program.
Methodology and Assumptions	Potential number of appliance replacements is based on the Electrify Marin program, provides cash rebates for natural gas appliance swap-outs. The program forecasted the following number of replacements during the pilot program period: stoves and cooktops, 20; water heaters, 30; and furnaces and heating systems, 60. We assume 25.3% of the replacements will take place in unincorporated area homes based on the unincorporated area's share of countywide households. We assume the program can grow at an annual rate of 50% with continued rebates and program implementation through 2025, at which time an ordinance requiring replacement with high efficiency electric appliances takes effect.
Sources	2009 California Residential Appliance Saturation Study, Volume 2, Table 2-8 (PG&E for dryer), Table 2-9 (Forecast Zone 5 for heat pump), Table 2-24 (PG&E for dryer), and Table 2-26 (Forecast Zone 5 for primary heat, water heater, and range). http://www.energy.ca.gov/2010publications/CEC-200-2010-004/CEC-200-2010-004-V2.PDF County of Marin, Marin County Building Decarbonization Pilot Program for BAAQMD Climate Protection Grant Application, May 8, 2018.

Calculation

Metric	2030
Estimated annual natural gas use for stove/cooktop	28 therms
Estimated annual natural gas use for water heater	163 therms
Estimated annual natural gas use for space heating and cooling	306 therms
Estimated annual electricity use for induction stove/cooktop	71 kWh
Estimated annual electricity use for heat pump water heater	1,382 kWh
Estimated annual electricity use for heat pump space heating	1,213 kWh
% share of county-wide replacements	25.3%
Number of units stoves and cooktops replaced	38 units
Number of units water heaters replaced	58 units
Number of furnaces and heating systems replaced	115 units
Natural gas savings	45,744 therms
Electricity consumption	232,874 kWh
GHG emissions reduction	238 $MTCO_2e$

Building and Appliance Electrification (B), RE-C3

Action	Consider adopting an ordinance in 2024, effective January 1, 2025, that requires homeowners to replace natural gas appliances, such as hot water heaters, stoves, cooktops, and clothes dryers, with high-efficiency electric appliances at time of replacement where feasible. Evaluate the financial impact on households at different income levels and consider offering rebates or subsidies, in partnership with electricity providers if available, for disproportionately impacted households.
Targets	24% of residential water heaters, 19% of residential cooktops, and 12% of residential dryers are replaced with high efficiency electric appliances.
GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-7,186.4**
Methodology and Assumptions	We assume the ordinance applies to water heaters, stoves, cooktops, and clothes dryers in January 2025. We assume the high end of average life expectancies for these appliances. We further assume one-third of potential water heater replacements will be deemed infeasible due to interior location of the water heater.
Sources	2009 California Residential Appliance Saturation Study, Volume 2, Table 2-8 (PG&E for dryer), Table 2-24 (PG&E for dryer), and Table 2-26 (Forecast Zone 5 for water heater and range). http://www.energy.ca.gov/2010publications/CEC-200-2010-004/CEC-200-2010-004-V2.PDF California Department of Finance, E-5 Population and Housing Estimates for 20122-2020 with 2010 Census Benchmark

Calculation

Metric	2030
Number of housing units in unincorporated areas in 2020	29,786 units
Estimated annual natural gas use for stove or cooktop	28 therms
Estimated annual electricity use for induction stove or cooktop	71 kWh
% stoves and cooktops replaced	19%
Estimated annual natural gas use for water heater	163 therms
Estimated annual electricity use for heat pump water heater	1,382 kWh
% water heaters replaced	24%
Estimated natural gas use for clothes dryer	22 therms
Estimated electricity use for clothes dryer	648 kWh
% clothes dryers replaced	12%
Natural gas use eliminated	1,412,693 therms
Additional electricity use	13,265,796 kWh
GHG emissions reductions	7,186.4 $MTCO_2e$

Solar Energy and Storage Systems for County Buildings, RE-M1

GHG Emissions Reductions in 2030 ($MTCO_2e$/yr)	**0**
Targets	Install an additional 100 kW of solar PV by 2030.
Methodology and Assumptions	The County has already installed 100 kW of solar PV across six installations. We assume there are opportunities to install another 100kW of solar PV by 2030. There are no GHG reduction savings because the County was purchasing 100% renewable electricity in 2018.
Sources	County of Marin Sustainability Team

Calculation

Metric	2030
Solar capacity added	100 kW
Projected electricity generated by additional solar PV systems	145,000 kWh
GHG emissions reduction	0.0 $MTCO_2e$

Municipal 100% Renewable Electricity, RE-M2

GHG Emissions Reductions in 2030 ($MTCO_2e$/yr)	**0**
Targets	Continue to purchase Deep Green electricity for all municipal operations.
Methodology and Assumptions	Calculation assumes electricity consumption is reduced through all other measures first. There are no GHG reduction savings because the County was purchasing 100% renewable electricity in 2018.
Sources	

Calculation

Metric	2030
Government operations electricity use in 2018	14,080,277 kWh
Electricity emissions reduced through other measures	156,870 kWh
GHG-free electricity purchased	13,923,407 kWh
Reduction in GHG emissions	0 $MTCO_2e$

All-Electric Municipal Buildings, RE-M3

GHG Emissions Reductions in 2030 ($MTCO_2e$/yr)	**-22**
Targets	Electrify 5% of the space and water heating systems of County buildings by 2030.
Methodology and Assumptions	We assume the County will have feasible opportunities to replace space and water systems in existing buildings with equipment that uses electricity instead of natural gas. There are no emissions associated with electricity use because we assume the County will continue to purchase 100% renewable electricity.
Sources	County of Marin Sustainability Team

Calculation

Metric	2030
Natural gas usage for existing buildings	4,118 therms
GHG emissions reduction	21.9 $MTCO_2e$

COMMERCIAL ORGANIC WASTE, WR-C1

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-1,730**
Targets	Outreach to covered businesses. 30% are compliant.
Methodology and Assumptions	Passed in 2014, AB 1826 requires businesses to recycle their organic waste, depending on the amount of waste they generate per week. Organic waste means food waste, green waste, landscape and pruning waste, nonhazardous wood waste, and food-soiled paper waste that is mixed in with food waste. The law phases in mandatory recycling of commercial organics over time. In 2017, businesses that generate 4 cubic yards of organic waste per week must arrange for organic waste recycling services and divert all organic waste they produce. In 2019, the law extends to businesses that generate 4 cubic yards or more of commercial solid waste. The State law is intended to reduce statewide disposal of organic waste by 50% by 2020. If that target is not met, the law will be extended to cover businesses that generate 2 cubic yards or more of commercial solid waste. The County can assist Zero Waste Marin (a.k.a., the Marin Hazardous and Solid Waste Joint Powers Authority) and its waste haulers by conducting outreach, maintaining a registry of all businesses (including self-haulers) to track compliance with AB 1826, and hiring additional staff dedicated to these efforts. According to CalRecycle, 55% of franchised commercial waste is recoverable for compost and mulch and paper recycling. This measure makes the following assumptions: 43% of landfilled waste is generated by commercial uses (based on electricity consumption split in the community); 60% of commercial waste will be subject to AB 1826 by 2020; and 90% of commercial waste will be subject to AB 1826 by 2030. Based on current compliance rates, this measure assumes 30% of all businesses that meet the 2019 threshold will be compliant by 2020 and 30% of all business that meet the post-2020 threshold will be compliant by 2030.
Sources	Personal communication with Kim Schiebly, Marin Sanitary Service, Kim.Scheibly@marinsanitary.com CalRecycle, 2014 Disposal-Facility-Based Characterization of Solid Waste in California: Significant Tables and Figures, https://www2.calrecycle.ca.gov/WasteCharacterization/PubExtracts/2014/SigTableFig.pdf

CALCULATION

Metric	2030
Commercial waste as a percentage of total landfilled waste	43%
Commercial landfilled waste (excluding self-haul, sludge and municipal waste)	28,275 tons
Waste generated by covered businesses	25,447 tons
Recoverable organic waste generated by covered businesses (55%)	13,996 tons
Percent diverted from landfill	30%
Tons diverted from landfill	4,199 tons
GHG emissions reduction	1,730 $MTCO_2e$

Residential Organic Waste, WR-C2

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-2,806**
Targets	5% diversion of residential organic waste by 2020 and 50% by 2030.
Methodology and Assumptions	This measure continues and expands outreach activities already occurring by the waste haulers servicing the unincorporated areas, including mailings, websites, community events, tours, workshops, a marketing campaign by Zero Waste Marin, and community education by Resilient Neighborhoods. Under this measure, the County will utilize its website, communication tools, and social media to promote these activities and expand their reach, and encourage its franchised waste haulers to increase and expand their outreach through other channels such as on-bill and email response messaging. A 2014 Marin Sanitary Service (MSS) waste characterization study found that 38% of residential solid waste sent to the landfill was compostable organic waste (30% food scraps, 4% food-soiled paper, and 4% plant debris). MSS estimates that approximately 1% of food waste is currently collected and composted. Curbside collection of food waste has been available in the unincorporated areas. Based on MSS's experience, this measure assumes an additional 5% of residential organic waste will be diverted by 2020 due to education and outreach activities. Based on the current residential waste diversion rate of 72%, we assume 50% of residential organic waste can be diverted by 2030.
Sources	Personal communication with Kim Schiebly, Marin Sanitary Service, Kim.Scheibly@marinsanitary.com

Calculation

Metric	2030
Residential waste as a percent of total landfilled waste	57%
Residential landfilled waste (excluding self-haul, sludge and municipal waste)	36,775.1 tons
Compostable organic waste generated by residents	13,974.6 tons
Percent diverted from landfill	50%
Tons diverted from landfill	6,987 tons
GHG emissions reduction	2,806 $MTCO_2e$

Construction and Demolition Debris and Self-Haul Waste, WR-C3

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-261**
Targets	75% diversion of C&D waste currently landfilled by 2030.
Methodology and Assumptions	The County currently complies with the State's Green Building Code (CALGreen) by requiring development projects to direct all construction and demolition (C&D) materials to a certified facility that diverts at least 65% of nonhazardous C&D debris to recycle or salvage. However, recoverable material is still deposited in the landfill, primarily due to self-haul activity (clean-up and loads that are generated from projects not covered by CALGreen), and C&D loads that contain low percentages of recoverable material. The County can help to maximize the amount of recoverable material by providing outreach and education to waste generators, and by working with CalRecycle to require processing of all loads for recoverable materials at the landfill or processing facility. According to Zero Waste Marin, 3,351,87 tons of self-haul and debris box waste originating in the unincorporated areas were landfilled in 2016, which we use as a proxy. According to statewide solid waste characterizations studies, self-haul waste contains approximately 28% lumber, 3% paper, and 10% green waste, all of which could be diverted from the landfill. The measure assumes that 50% of this waste can be diverted by 2020 and 75% can be diverted by 2030, based on State mandates (SB 1383).
Sources	Personal communication with Garth Schultz, R3 Consulting Group, gschultz@r3cgi.com Personal communication with Judith Silver, Zero Waste Marin, jsilver@marincounty.org CalRecycle, "2014 Disposal-Facility-Based Characterization of Solid Waste in California: Significant Tables and Figures," October 6, 2015.

Calculation

Metric	2030
Self-haul landfilled waste	3,351.9 tons
Recoverable organic waste (26.4%)	884.9 tons
Percent organic material diverted from landfill	75%
Tons diverted from landfill	664 tons
GHG emissions reduction	261 $MTCO_2e$

Mandatory Waste Diversion, WR-C4

GHG Emissions Reductions in 2020 ($MTCO_2e/yr$)	**0**
GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-4,567**
Targets	Increase commercial AB1826 compliance rate to 50% and increase residential organic waste diversion rate to 80% by 2030.
Methodology and Assumptions	This measure assumes the County will adopt a mandatory waste diversion ordinance similar to the one adopted by the City of Palo Alto in January 2016 (Palo Alto Municipal Code Chapter 5.20). Palo Alto requires all residents, visitors, and businesses to place their discards in the appropriate container – recycle, compost, or garbage. There are four stopes to compliance: 1) subscribe to recycle, compost, and garbage service from the city's contract hauler; 2) set-up color-coded and labeled containers in convenient locations for patrons, employees, and residents; 3) train and educate tenants, residents, contractors and janitors about how to properly sort their waste and to ensure requirements are met; and 4) sort waste into proper containers. Requirements were phased in over two years. Drivers perform regular monitoring of contamination in the solid waste, recycle, and compost containers. The City's waste hauler's staff may also perform random site visits. Violators are subject to penalties. Residential compliance is based on the honor system. This measure assumes a similar ordinance would require all commercial accounts and multifamily buildings with 5 or more units to comply by 2020. We assume that a mandatory diversion ordinance could increase the AB 1826 compliance rate to 50% by 2030. Assuming that the ordinance is expanded to require residents to comply, we estimate an overall 80% compliance rate for residential compostable organic waste by 2030.
Sources	City of Palo Alto, http://www.cityofpaloalto.org/gov/depts/pwd/zerowaste/projects/ordinance.asp CalRecycle, "2014 Disposal-Facility-Based Characterization of Solid Waste in California: Significant Tables and Figures," October 6, 2015.

Calculation

Metric	2030
Additional commercial organic waste diverted	6,998.0 tons
Additional residential organic waste diverted	4,192.4 tons
GHG emissions reduction	4,567 $MTCO_2e$

Waste Processing Infrastructure and Franchise Agreements, WR-C5

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-3,231**
Targets	Increase diversion rate of recoverable organic waste to 95% by 2030.
Methodology and Assumptions	This measure assumes that new solid waste processing infrastructure is procured by 2030. Waste processing infrastructure could ultimately ensure that 95% of all recoverable organic waste collected by the franchised waste hauler is diverted from the landfill by 2030. For this measure, "recoverable waste" conservatively excludes carpet, textiles, composite paper and organics, and other wood waste that is not currently recyclable or compostable. As recycling technology and facilities evolve, the County will strive to divert this waste as well to meet SB 1383 targets. Although the County has franchise agreements with waste haulers servicing only about 20% of the unincorporated population, this measure assumes the County will work in concert with the community service districts to raise fees in order to cover the cost of specialized waste processing infrastructure.
Sources	Personal communication with Kim Schiebly, Marin Sanitary Service, Kim Scheibly, Kim.Scheibly@marinsanitary.com CalRecycle, 2014 Disposal-Facility-Based Characterization of Solid Waste in California: Significant Tables and Figures, https://www2.calrecycle.ca.gov/WasteCharacterization/PubExtracts/2014/SigTableFig.pdf

Calculation

Metric	2030
Landfilled waste, excluding self-haul and sludge	64,365tons
Tons diverted by other measures	22,376tons
Diversion target (95% for 2030)	30,573tons
Remaining tons to be diverted	8,197tons
Recoverable organic waste (50% of total)	32,182tons
GHG emissions reduction	3,231$MTCO_2e$

COMMUNITY WATER USE, WC-C1

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-15**
Targets	1% annual water consumption reduction.
Methodology and Assumptions	Water consumption in the unincorporated areas serviced by the Marin Municipal Water District (MMWD), the North Marin Water District (NMWD), and the Stinson Beach Water District, fell 20.7% between 2005 and 2018, or approximately 1.6% per year. We conservatively assume water consumption will continue to fall an average of 1% per year based on the following legislation and continued implementation of water conservation programs: -The County has adopted CALGreen Tier 1 for new residential buildings and additions over 1,200 sq. ft. and new non-residential buildings and additions over 3,000 sq. ft., which requires additional water conservation actions above the base code. -MMWD and NWMD's regulations meet or exceed State law that requires single family homes and commercial and multi-family buildings to replace all non-compliant plumbing fixtures when remodeling and upon resale (resale requirement for commercial and multi-family buildings will be in effect on January 1, 2019). -MMWD provides rebates for water-efficient toilets, clothes washers, hot water recirculation systems, turf replacement, pool covers, mulch, graywater systems, and rain barrels. -NMWD provides rebates for water efficiency landscape equipment (new drip irrigation system replacing a spray system or a rain shut off device), turf replacement with low water use plants, rainwater catchment systems, and high efficiency clothes washers and toilets. -MMWD provides residential and commercial building and landscape water audits and free-water saving devices (faucet aerators, showerheads, toilet leak test dye tablets, hose nozzles, etc.). -MMWD provides residential and commercial building and landscape water audits and free-water saving devices (faucet aerators, showerheads, toilet leak test dye tablets, hose nozzles, etc.). -NMWD provides a free Smart Home Survey that includes indoor and outdoor water efficiency checks. -MMWD has adopted a landscape water conservation ordinance which applies to all new construction and rehabilitated landscape projects requiring a building permit, plan check, or design review. Irrigation controllers are required under CALGreen. -New commercial and multi-family construction is required to meet CALGreen code. MMWD requires all plumbing installed, replaced, or moved on any new or existing service to have high efficiency fixtures and meet minimum requirements.

	-MMWD has adopted a Water Waste Ordinance and requires drinking water and linen washing upon request at restaurants and hotels. -MMWD requires applicants for new water service and applicants requesting an enlarged water service for substantial residential or commercial remodels to install a graywater recycling system to reuse the maximum practicable amount of graywater on site. -MMWD and NMWD conduct outreach and provides water conservation information to water users on its website and through newsletters. -MMWD provides virtual water-friendly garden tours on its website . GHG reduction calculations are based upon the following: -MMWD began purchasing 100% renewable electricity in 2017 and Sonoma County Water agency, which provides approximately 25% of water, began purchasing 100% renewable electricity in 2015. We assume the water agencies will continue this practice.
Sources	Personal communication with Carrie Pollard, Sonoma Marin Water Saving Partnership The Climate Registry for Sonoma County Water Agency emission factors Refining Estimates of Water-Related Energy Use in California, California Energy Commission, Dec. 2006

CALCULATION

Metric	2030
Water consumption, BAU	2,579 MG
Annual water consumption reduction	1%
Potential annual water savings	309 MG
GHG emissions reduction	15 $MTCO_2e$

Municipal Water Use, WC-M1

GHG Emissions Reductions in 2030 ($MTCO_2e$/yr)	**0**
Targets	20% reduction in electricity used for irrigation and pumping.
Methodology and Assumptions	We assume electricity used for irrigation and pumping systems will be reduced 20% due to water-efficient landscaping and efficiency upgrades. We assume the Town continues to purchase Deep Green electricity for all municipal operations.
Sources	Tiburon 2016 Greenhouse Gas Inventory

Calculation

Metric	2030
Electricity used for irrigation and pumps	0 kWh
Reduction in electricity use (20%)	0 kWh
GHG emissions reduction	0 $MTCO_2e$

CARBON FARMING, AG-C1

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-55,752**
Targets	Achieve 30% of potential GHG emissions sequestration from carbon farming by 2030.
Methodology and Assumptions	Based on the proven success of the Marin Carbon Project's foundational work on agricultural lands in Marin, this initiative would expand Carbon Farm Planning and implementation to reach a large scale of acreage and operations in Marin County. Sequestration estimated are based on the implementation of carbon farming practices across Marin's working lands, considering feasibility determined by mapping and extrapolation of existing carbon farm plans.
Sources	Research completed for the Climate Action Plan Update by RCD, UCCE Marin, MALT, and CCI.

CALCULATION

Carbon Sequestration Approach	Total Potential Acres	Annual Sequestration Factor (MTCO2e/acre)	Total Sequestration Potential by Practice 2030
Riparian restoration	5700	9.16	52,212
Compost on rangelands	60,217	1.49	89,723
Compost on croplands	407	1.18	480
Compost on vineyards	195	4.4	858
Hedgerow planting	267	1.49	398
Prescribed grazing	101,496	0.005	507
Range planting	28,271	0.502	14,192
Silvopasture	17,254	1.48	25,536
Windbreak/shelterbelt	852	1.48	1,261
Critical area planting	353	1.9	671
Total	215,012		185,839 $MTCO_2e$
Assumed target reductions by 2030 (30% of potential)			**55,752 $MTCO_2e$**

Manure Management, AG-C2

GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-26,191**
Target	Achieve 33% of potential GHG emissions reduction potential through mitigation and sequestration from manure management practices.
Methodology and Assumptions	Based on understanding of four specific practices, annual per cow emission reduction factors were established. It is assumed that these practices would apply to a certain number of cows, with each practice being assumed to apply to about a third of cows in the County. Woodchip production can be implemented in concert with other studied manure management practices and is estimated to be coupled for about one quarter of cows in the County. Of the estimated potential savings from mitigation and sequestration, this CAP sets a target of achieving 33% of this potential by 2030.
Sources	White paper completed for the County for the purposes of this CAP by CCI

Calculation

Metric	2030
Dairy cows in Marin	8,000 cows
Methane digester with energy recovery & field application of digestate, not including compost production	5.48 MgCO2e/cow/yr
Head of cattle impacted by above measure	2,985 cows
Dry scrape conversion with compost production & field application	7.97 MgCO2e/cow/yr
Head of cattle impacted by above measure	2,985 cows
Compost bedding pack barn with field application of compost	5.98 MgCO2e/cow/yr
Head of cattle impacted by above measure	2,985 cows
On-farm woodchip production for co-composting with manure to be combined with any of the above composting practices	9.53 MgCO2e/cow/yr
Head of cattle impacted by above measure	2,239 cows
GHG emissions reduction from Manure Management Practices	79,367 $MTCO_2e$
Assumed target reductions by 2030 (33% of potential)	**26,191 $MTCO_2e$**

URBAN FOREST AND FOOD PRODUCTION AND NATURAL LANDS MANAGEMENT, AG-C3

GHG Emissions Reductions in 2030 ($MTCO_2e$/yr)	**-106**
Target	Plant 300 net new trees each year between 2020 and 2030.
Methodology and Assumptions	Sequestration: CAPCOA Measure V-1. Assumed default annual sequestration rate of .0354 MTCO2 accumulation per tree per year and an active growing period of 20 years. Thereafter, the accumulation of carbon in biomass slows with age, and will be completely offset by losses from clipping, pruning, and occasional death.
Sources	California Air Pollution Control Officers Association, "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures," August 2010.

CALCULATION

Metric	2030
Annual sequestration rate per tree	0.0354 $MTCO_2$
Number of net new trees planted each year	300
Number of years	10
Number of trees planted over period in active growing stage in inventory year	3,000
GHG emissions reduction from sequestration	106 $MTCO_2e$

Light and Heavy Duty Fleet Regulations, State Action

Program Description	Current federal and State regulations and standards will reduce transportation emissions from the light and heavy duty fleet. These include: 1. Pavley Standards which increase fuel economy standards for light-duty vehicles for 2009-2016 model years. 2. Advanced Clean Cars Program which will reduce greenhouse gas and smog emissions for light-duty vehicles sold between 2017 and 2025. New automobiles will emit 34 percent fewer GHG emissions and 75 percent fewer smog-forming emissions. 3. ARB Tractor -Trailer Greenhouse Gas Regulations which accelerate the use of low rolling resistance tires and aerodynamic fairing to reduce GHG emissions in the heavy-duty truck fleet. 4. Heavy Duty GHG Emissions Standards (Phase One) which establish GHG and fuel efficiency standards for medium duty and heavy duty engines and vehicles for 2014-2018 model years.
GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-20,473**
Methodology and Assumptions	Transportation emissions estimated using EMFAC 2017. Emission factors have been adjusted to account for the SAFE Vehicle Rule Part One and the Final SAFE Rule. In order to be consistent with the methodology used in the Greenhouse Gas Inventory, results are adjusted to reflect the global warming potential of methane and nitrous oxide as reported in the IPCC Fifth Assessment Report.
Sources	California Air Resources Board, EMFAC2017 v.1.0.2. California Air Resources Board, EMFAC2014 Volume III - Technical Documentation, v1.0.7, May 12, 2015 California Air Resources Board, "EMFAC Off-Model Adjustment Factors for Carbon Dioxide (CO2) Emissions to Account for the SAFE Vehicle Rule Part One and the Final SAFE Rule," June 26, 2020, https://ww3.arb.ca.gov/msei/emfac_off_model_co2_adjustment_factors_06262020-final.pdf?utm_medium=email&utm_source=govdelivery

Calculation

Metric	2030
Passenger VMT BAU	303,994,722 VMT
Passenger VMT, net reductions from other measures	202,341,175 VMT
Commercial VMT BAU	13,125,127 VMT
Emissions, BAU	85,067 $MTCO_2e$
Emissions with regulations	64,594 $MTCO_2e$
Reduction in emissions	20,473 $MTCO_2e$

Renewable Portfolio Standard, State Action

Program Description	Established in 2002 in Senate Bill 1078, the Renewable Portfolio Standard program requires electricity providers to increase the portion of energy that comes from eligible renewable sources, including solar, wind, small hydroelectric, geothermal, biomass and biowaste, to 20 percent by 2010 and to 33 percent by 2020. Senate Bill 350, passed in September of 2015, increases the renewable requirement to 50 percent by the end of 2030. Senate Bill 100, passed in September 2018, accelerated the RPS standard to 60 percent by 2030 and zero-carbon by 2045.
GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-1,476**
Methodology and Assumptions	This State Action assumes PG&E and Direct Access entities will meet the Renewable Portfolio Standard requirements and that these entities will carry the same share of the community's electricity load as in 2016. GHG reductions related to MCE's GHG reduction policies are quantified separately as a local action. California Public Utilities Code Section 454.52 requires each load-serving entity to procure at least 50 percent eligible renewable energy resources by 2030 and to meet the economywide reductions of 40% below 1990 levels by 2030. For 2030, the CPUC has set electric sector GHG reductions at a level that represents a 50% reduction from 2015 levels. We therefore apply a 50% reduction to PG&E and DA 2015 CO_2 emission factors to forecast 2030 emission factors. CH_4 and N_2O factors are kept constant at 2018 levels.
Sources	GHG Calculator, version 3c_Oct2010. https://ethree.com/public_projects/cpuc2.php PG&E, "Greenhouse Gas Emission Factors: Guidance for PG&E Customers," November 2015, https://www.pge.com/includes/docs/pdfs/shared/environment/calculator/pge_ghg_emission_factor_info_sheet.pdf California Public Utilities Commission "CPUC Adopts Groundbreaking Path to Reduce Greenhouse Gases in Electric Sector," Press Release Docket #: R.16-02-007, Feb. 8, 2018.

Calculation

Metric	2030
Electricity use, BAU	330,458,814 kWh
Electricity saved through other State actions	1,674,265 kWh
Electricity saved through local actions	120,364,099 kWh
Net electricity use (PG&E)	46,955,539 kWh
Net electricity use (DA)	14,443,195 kWh
Electricity emissions, BAU	7,702 $MTCO_2e$
Electricity emissions w/RPS	6,226 $MTCO_2e$
GHG emission reductions	1,476 $MTCO_2e$

Title 24 Energy Efficiency Standards, State Action

Program Description	The California Energy Commission (CEC) promotes energy efficiency and conservation by setting the State's building efficiency standards. Title 24 of the California Code of Regulations consists of regulations that cover the structural, electrical, mechanical, and plumbing system of every building constructed or altered after 1978. The building energy efficiency standards are updated on an approximate three-year cycle, and each cycle imposes increasingly higher demands on energy efficiency and conservation. The California Energy Commission's 2007 Integrated Policy Report established the goal that new building standards achieve "net zero energy" levels by 2020 for residences and by 2030 for commercial buildings.
GHG Emissions Reductions in 2030 ($MTCO_2e/yr$)	**-936**
Methodology	Estimated residential energy use assumes homes use natural gas for primary space heating and water heating. We assume all new homes install central air conditioning and outdoor lighting. Only end uses covered by Title 24 are included in the analysis. We assume 51 new units are built each year, based on the County's Annual Housing Element Report covering 2015-2019. Estimated energy reductions for the 2016 and 2019 building codes based on information provided by the California Energy Commission. CAPCOA Measure BE-1 used for estimating building energy savings. We assume all residential electricity use subject to Title 24 is offset by mandatory solar installation beginning with the 2019 building code.
Sources	California Energy Commission, 2016 Energy Standards Overview (June 15, 2016), https://www.lgc.org/wordpress/wp-content/uploads/2016/02/2016-Energy-Standards-Overview-California-Energy-Commission.pdf California Energy Commission, https://ww2.energy.ca.gov/title24/2019standards/documents/2018_Title_24_2019_Building_Standards_FAQ.pdf California Energy Commission, California Commercial End-Use Survey (March 2006), https://ww2.energy.ca.gov/2006publications/CEC-400-2006-005/CEC-400-2006-005.PDF 2009 California Residential Appliance Saturation Study (CRASS), Volume 2. http://www.energy.ca.gov/2010publications/CEC-200-2010-004/CEC-200-2010-004-V2.PDF California Air Pollution Control Officers Association, "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures," August, 2010. California Department of Housing and Community Development, "Annual Progress Report permit Summary - Table with 5th Cycle Summary Data, updated 07/17/2020"

Calculation

Reductions from Title 24 Upgrades

Metric	Energy Savings, 2016 Reductions from 2013 Standards (assumed for development after 2018)	Electricity, Energy Savings for 2019 Code (assumed for development 2020-2022)	Natural Gas, Energy Savings for 2019 Code (assumed for development 2020-2022)	Electricity Savings, Projected average reduction 2023-2030 from 2018 baseline	Natural Gas Savings, Projected average reduction 2023-2030 from 2018 baseline
Residential New Construction	28.00%	100%	7%	100%	50%
Non-residential New Construction	5.00%	30%	30%	50%	50%

Projected Residential Development with Title 24 Energy Reductions

Metric	2018-2019	2020-2022	2023-2030	TOTAL through 2030	GHG Reductions through 2030
New Residential (units)	102	153	408	663	
Electricity Use BAU , subject to Title 24	4,080	145,503	388,008	537,591	
Electricity Use Savings	64	145,503	388,008	533,575	32
Natural Gas Use BAU, subject to Title 24	47,838	71,757	191,352	310,947	
Natural Gas Use Savings	12,061	4,523	95,676	112,261	597

PROJECTED NON-RESIDENTIAL DEVELOPMENT WITH TITLE 24 ENERGY REDUCTIONS

Metric	2018-2019	2020-2022	2023-2030	TOTAL through 2030	GHG Reductions through 2030
Electricity Use BAU, Subject to Title 24	213,674	770,459	1,797,738	2,781,871	
Electricity Use Savings	10,684	231,138	898,869	1,140,691	97
Natural Gas Use BAU, subject to Title 24	7,859	28,338	66,121	102,318	
Natural Gas Use Savings	279	6,036	33,061	39,376	209

APPENDIX C: CLIMATE ACTION PLANNING PROCESS

Marin community members were invited to contribute ideas and concerns throughout the CAP development process. The project team hosted a public workshop in February 2020 at the Marin Center Exhibit Hall with approximately 40 attendees. The workshop began with a half-hour presentation that reviewed state legislation and statewide reduction targets, the County's efforts to date to address climate change, the unincorporated area's GHG emissions inventory, and opportunities to further reduce emissions. Participants then worked in small groups, each one dedicated to a single topic area, to learn more about the challenges and opportunities with subject matter experts and brainstorm ideas to reduce emissions. The six topic areas were:

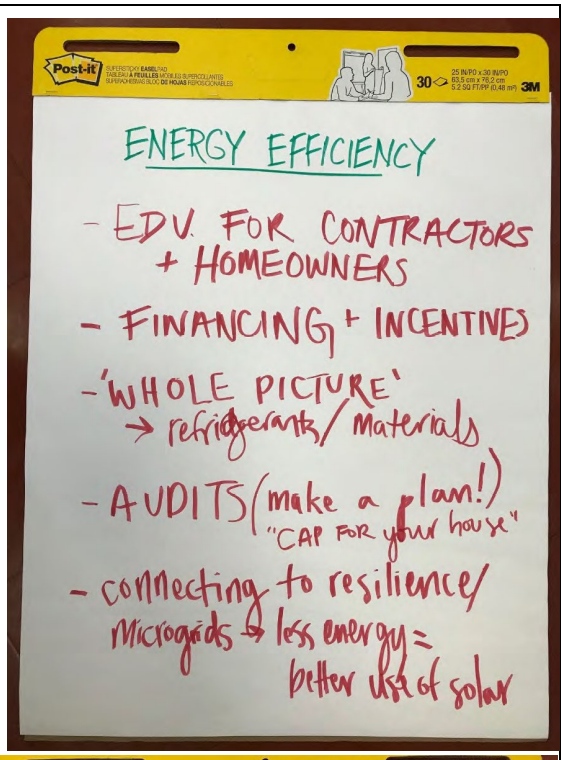
- Renewable Energy
- Energy Efficiency
- Low Carbon Transportation
- Waste Reduction and Recycling
- Low Carbon Water and Conservation
- Agriculture and Sequestration

Participants recorded their ideas and shared them with the larger group at the end of the workshop.

In addition to the workshop, the County posted an online survey to gather feedback on potential CAP measures and the community's willingness to take personal steps to reducing their emissions. The survey provided a link to the workshop presentation and background information on each of the six topic areas. Respondents were then asked to about their commitment to take personal actions to take reduce their GHG emissions and their priorities for Government action. The County received 26 responses to the survey.

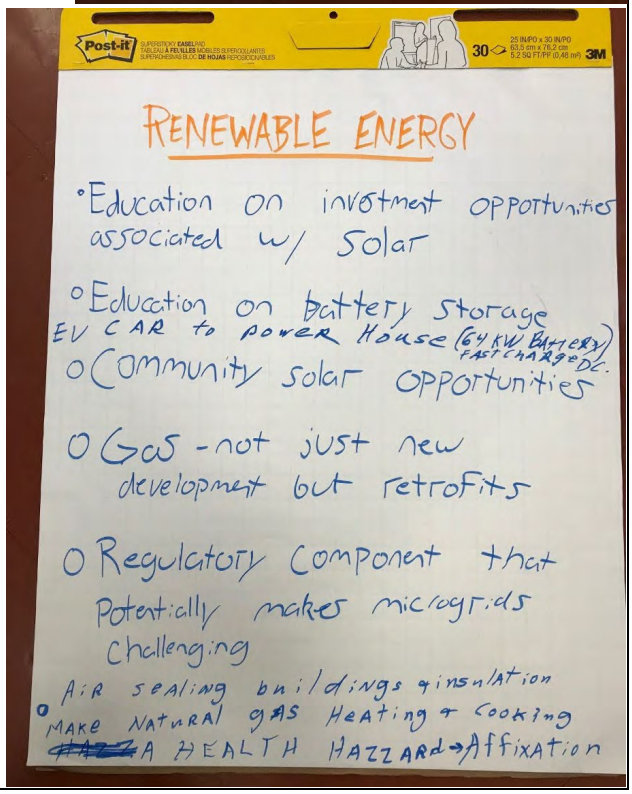
Energy Efficiency

- EDV for contractors & homeowners
- Financing & Incentives
- "Whole Picture"
- Refrigerants/materials
- Audits (make a plan!)
- "CAP for your house"
- Connecting to resilience/microgrids
- Less energy = better use of solar



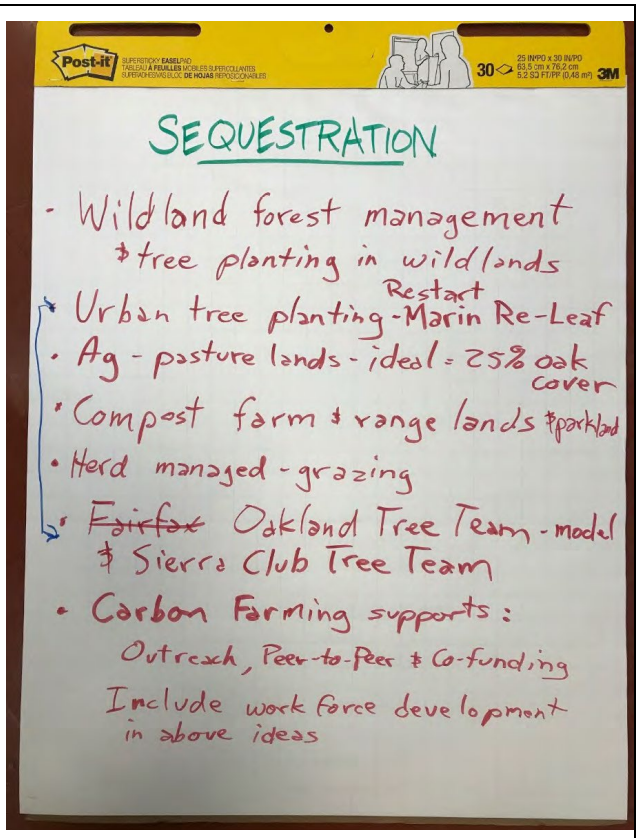
Renewable Energy

- Education on investment opportunities associate with solar
- Education on battery storage
- EV Car to power house (64 kW battery fast charge DC)
- Community solar opportunities
- Gas: Not just new development but retrofits
- Regulatory component that potentially makes microgrids challenging
- Air sealing buildings & insulation make natural gas heating & cooking a health hazard (asphyxiation)



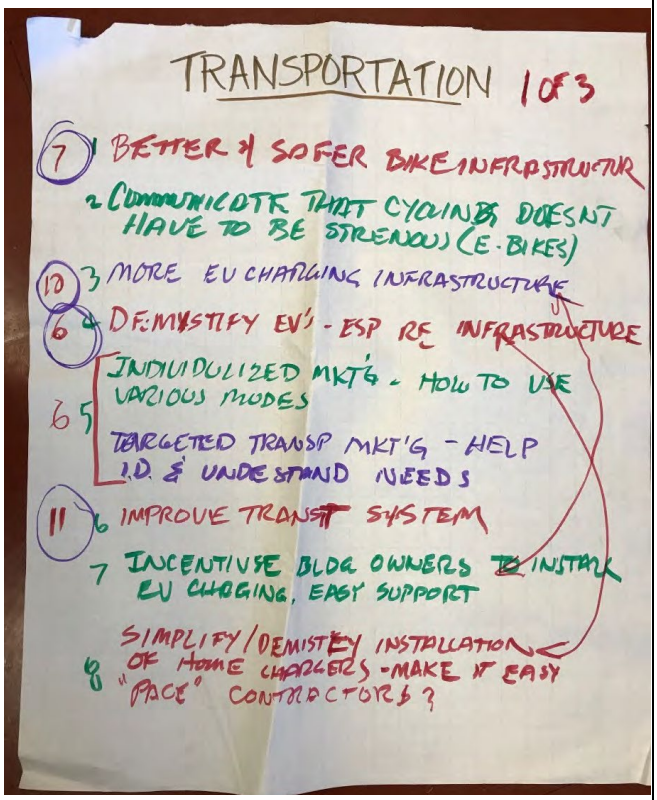
Agriculture & Sequestration

- Wildland forest management & tree planting in wildlands
- Urban tree planting
- Restart, Marin Re-Leaf, Oakland Tree Team model, Sierra Club Tree Team
- Ag: Pasturelands, ideal = 25% oak cover
- Compost farm, range lands & park land
- Herd managed grazing
- Carbon Farming supports:
- Outreach, peer-to-peer, & co-funding
- Include workforce development in above ideas

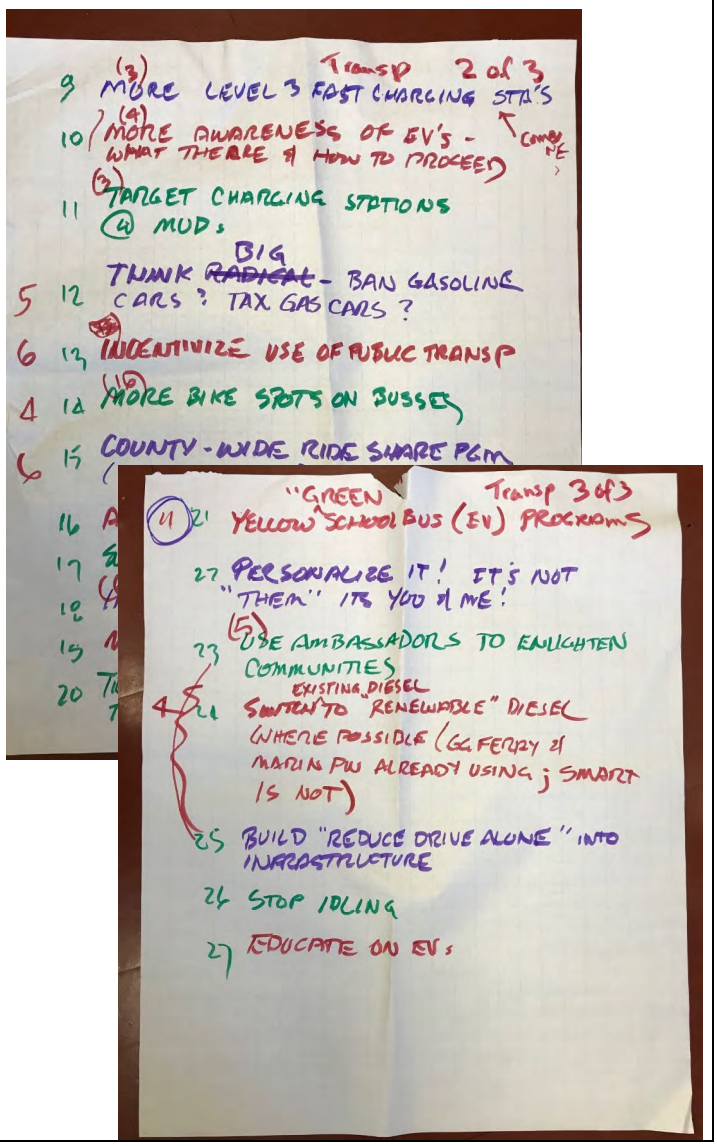


Low Carbon Transportation

- Better & safer bike infrastructure
- Communicate that cycling doesn't have to be strenuous (e-bikes)
- More EV charging infrastructure: Incentivize building owners to install EV charging, easy support
- Demystify EVs, especially regarding infrastructure: Simplify installation of home chargers, make it easy
- "PACE" contractors?
- Individualized marketing: How to use various modes
- Targeted transportation marketing: help identify & understand needs
- Improve transit system
- More level 3 fast charging stations
- More awareness of EVs (what they are and how to proceed)

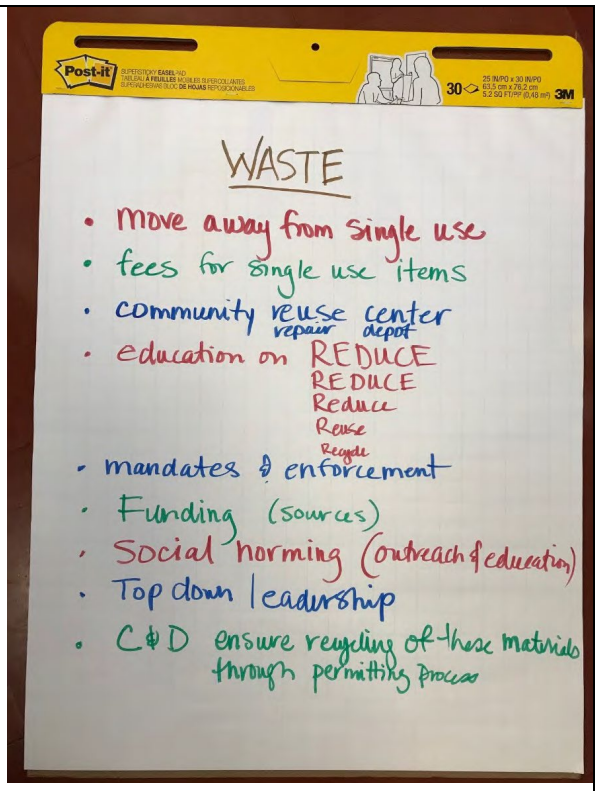


- Target charging stations at multiple unit dwellings (MUDs)
- Think big: Ban gasoline cars? Tax gas cars?
- Incentivize use of public transportation
- More bike spots on busses
- County-wide ride share program (emphasize EVs)
- Allow e-bikes on ferry & transit
- Supportive legislation
- Increase frequency on trunk lines
- Make transit cool
- Tie low carbon transportation to other things people love
- "Green" yellow school bus (EV) programs
- Personalize it! It's not "them", it's you and me!
- Use ambassadors to enlighten communities
- Switch existing diesel to "renewable" diesel where possible (Golden Gate Ferry & Marin Public Works already using; SMART is not)
- Build "reduce drive alone" into infrastructure
- Stop idling
- Educate on EV



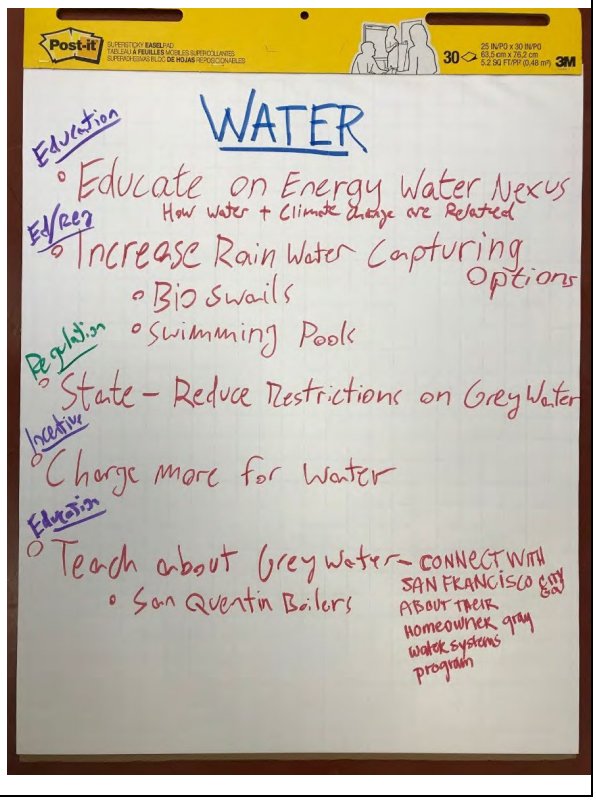
Waste Reduction, Reuse, and Recycling

- Move away from single use
- Fees for single use items
- Community reuse center
- Repair depot
- Education on:
    - Reduce
    - Reduce
    - Reduce
    - Reuse
    - Recycle
- Mandates & enforcement
- Funding (sources)
- Social norming (outreach & education)
- Top-down leadership
- Construction & demolition ensure recycling of these materials through permitting process



Low Carbon Water & Conservation

- (Education) Educate on energy water nexus
- How water & climate change are related
- (Education/Regulation) Increase rainwater capturing options
    - Bioswales
    - Swimming pools
- (Regulation) State: Reduce restrictions on greywater
- (Incentive) Charge more for water
- (Education) Teach about greywater
- Connect with San Francisco city government about their homeowner greywater systems program
- San Quentin boilers



LOW CARBON TRANSPORTATION

Which of these actions would you take?

	Definitely wouldn't	Probably wouldn't	Probably would	Definitely would	Already doing this, but want to do more	Already doing this
Walk, bike or take public transportation when shopping or running errands for a majority of trips	20%	24%	24%	4%	20%	8%
Walk, bike, carpool or take public transportation to work and/or school most of the time	28%	28%	8%	16%	16%	4%
Drive an electric vehicle	12%	4%	16%	40%	0%	28%
Install an electric vehicle charger at my home or business	16%	8%	24%	16%	8%	28%
Use electric landscape equipment rather than gasoline-powered equipment (such as leaf blowers or lawn mowers)	8%	4%	12%	36%	12%	28%

What are your priorities for the 2030 Climate Action Plan?

	Not a priority	Low priority	Moderate priority	High priority	Urgent priority
Install more pedestrian pathways and sidewalks	8%	16%	36%	28%	12%
Install more bike lanes and bike paths	0%	8%	28%	36%	28%
Require businesses to provide employees with incentives to walk, bike, carpool, take public transportation, or drive an EV to work	0%	8%	36%	40%	16%
Work with regional transit agencies to improve and/or expand bus and train service	0%	16%	20%	28%	36%
Purchase more electric vehicles for the County fleet	16%	0%	24%	36%	24%

	Not a priority	Low priority	Moderate priority	High priority	Urgent priority
Install more EV chargers at County-owned parking lots	4%	13%	38%	17%	29%
Increase requirements for new and substantially remodeled multi-family and commercial properties to install EV chargers	0%	20%	24%	32%	24%
Require new and remodeled gas stations to provide EV fast chargers and/or hydrogen fueling stations.	12%	12%	20%	36%	20%
Ban gas-powered leaf blowers and landscape equipment	0%	24%	20%	12%	44%
Replace gas-powered landscape equipment used for County facilities and parks with electric alternatives	0%	12%	32%	16%	40%

RENEWABLE ENERGY AND ELECTRIFICATION

Which of these actions would you take?

	Definitely wouldn't	Probably wouldn't	Probably would	Definitely would	Already doing this, but want to do more	Already doing this
Install solar panels at home	6%	11%	50%	33%	0%	0%
Install battery storage for solar panels	5%	18%	27%	50%	0%	0%
Replace gas stove with an induction stove	29%	19%	38%	14%	0%	0%
Replace gas clothes dryer with an electric version	14%	14%	36%	36%	0%	0%
Replace gas hot water heater with an electric heat pump water heater	18%	9%	36%	36%	0%	0%

	Definitely wouldn't	Probably wouldn't	Probably would	Definitely would	Already doing this, but want to do more	Already doing this
Replace a gas home heating system with an electric one, like a mini split or central air source heat pump	17%	22%	35%	26%	0%	0%
Opt up to 100% renewable electricity through your electricity provider (such as MCE Deep Green or PG&E Local Sol)	22%	11%	0%	67%	0%	0%

What are your priorities for the 2030 Climate Action Plan?

	Not a priority	Low priority	Moderate priority	High priority	Urgent priority
Install solar energy and battery storage systems at County facilities	0%	0%	12%	48%	40%
Require solar carports in parking lots	0%	17%	25%	33%	25%
Require all new residential buildings to be all-electric (no natural gas or propane).	16%	8%	20%	24%	32%
Require all new commercial buildings to be all-electric (no natural gas or propane).	8%	0%	28%	32%	32%
Continue to provide rebates for replacing gas appliances and heating systems with efficient electric alternatives	8%	16%	12%	36%	28%
Require homeowners to install electric appliances at time of appliance replacement	20%	8%	32%	12%	28%
Replace gas appliance and heating systems in County buildings with electric alternatives	8%	28%	24%	20%	20%
Explore opportunities for local pumped hydro energy storage	20%	20%	28%	20%	12%

	Not a priority	Low priority	Moderate priority	High priority	Urgent priority
Continue to purchase MCE Deep Green 100% renewable electricity for all County facilities	12%	0%	0%	44%	44%

ENERGY EFFICIENCY

Which of these actions would you take?

	Definitely wouldn't	Probably wouldn't	Probably would	Definitely would	Already doing this, but want to do more	Already doing this
Make home energy efficiency upgrades such as improved insulation, duct sealing, and new windows	0%	7%	21%	36%	36%	0%
Purchase energy efficient (e.g. Energy Star rated) appliances	0%	0%	0%	21%	79%	0%
Switch to LED light bulbs	0%	0%	13%	13%	75%	0%
Unplug appliances and electronics when not in use	14%	23%	18%	0%	45%	0%
Install smart thermostats	36%	21%	21%	21%	0%	0%

What are your priorities for the 2030 Climate Action Plan?

	Not a priority	Low priority	Moderate priority	High priority	Urgent priority
Continue to retrofit County facilities to make them more energy efficient	0%	0%	28%	48%	24%
Provide additional incentives for energy efficiency projects	0%	4%	28%	36%	32%
Continue to require new homes to be more energy efficient than required by State law	8%	0%	17%	54%	21%

	Not a priority	Low priority	Moderate priority	High priority	Urgent priority
Continue to require new commercial buildings to be more energy-efficient than required by State law	0%	4%	21%	42%	33%
Require increases in energy efficiency at time of building remodel	8%	8%	16%	44%	24%
Require energy audits at time of sale	16%	16%	20%	36%	12%
Require energy audits and energy efficiency retrofits at time of sale	20%	20%	20%	20%	20%

WASTE REDUCTION

Which of these actions would you take?

	Definitely wouldn't	Probably wouldn't	Probably would	Definitely would	Already doing this, but want to do more	Already doing this
Buy less stuff.	8%	4%	4%	0%	52%	32%
Limit online shopping to items that are not locally available	13%	4%	25%	8%	38%	13%
Shop at reuse facilities like thrift and hardware reuse stores	0%	12%	32%	4%	32%	20%
Prevent food waste by buying only what my family and I will eat	0%	0%	4%	0%	42%	54%
Donate used items before throwing them in the trash	0%	4%	4%	0%	28%	64%
Compost food waste	0%	0%	8%	4%	25%	63%
Refuse single-use plastics and bring my own reusable bags and food/drink containers	0%	0%	0%	20%	40%	40%

What are your priorities for the 2030 Climate Action Plan?

	Not a priority	Low priority	Moderate priority	High priority	Urgent priority
Ban single-use food service items and encourage reusable alternatives	8%	0%	21%	46%	25%
Require residents to compost food waste at home or in the green can	8%	16%	20%	24%	32%
Encourage state laws that require businesses to take back packaging	4%	16%	28%	28%	24%
Develop local lending libraries to support shared ownership of tools and other low-use goods.	0%	12%	40%	32%	16%
Require historic buildings to be deconstructed and reused rather than demolished and landfilled	4%	12%	28%	24%	32%
Adopt building code amendments that set standards for the lifecycle/embodied emissions of building materials (building on existing low carbon concrete standards)	8%	13%	25%	33%	21%
Reduce waste at County facilities, such as by updating green purchasing policies and improving waste sorting.	0%	0%	29%	46%	25%
Install more recycling and composting cans in public places	0%	17%	13%	46%	25%
Educate the public on how to properly sort compostable and recyclable items	8%	8%	16%	40%	28%

WATER CONSERVATION

Which of these actions would you take?

	Definitely wouldn't	Probably wouldn't	Probably would	Definitely would	Already doing this, but want to do more	Already doing this
Install low-flow toilets, shower heads and faucets	0%	33%	50%	0%	17%	0%
Install water-efficient appliances such as clothes washers and dishwashers	0%	0%	9%	36%	55%	0%
Practice water-efficient behavior, such as taking shorter showers and turning off faucets when washing	0%	4%	12%	4%	32%	48%
Replace lawn with drought tolerant and low water use plants	0%	0%	44%	11%	44%	0%
Capture and utilize rainwater	4%	28%	20%	28%	16%	4%
Install a greywater system	8%	33%	25%	33%	0%	0%

What are your priorities for the 2030 Climate Action Plan?

	Not a priority	Low priority	Moderate priority	High priority	Urgent priority
Provide more incentives for water-efficient appliances, fixtures and landscapes for residents and businesses	0%	12%	32%	48%	8%

	Not a priority	Low priority	Moderate priority	High priority	Urgent priority
Provide incentives for and remove barriers to residential greywater and rainwater storage systems	4%	0%	32%	40%	24%
Require purple pipe (recycled water) in all new developments	0%	0%	28%	40%	32%
Replace lawn landscapes at County facilities and parks with drought tolerant and low water use plants, where appropriate	12%	4%	48%	16%	20%
Install water-efficient toilets and faucets at County facilities beyond state requirements	8%	16%	16%	44%	16%
Install water-efficient landscaping at County facilities beyond state requirements	8%	16%	20%	36%	20%

CARBON SEQUESTRATION

Which of these actions would you take?

	Definitely wouldn't	Probably wouldn't	Probably would	Definitely would	Already doing this, but want to do more	Already doing this
Plant trees in your yard	5%	10%	29%	19%	38%	0%
Complete home hardening activities as recommended by Fire Safe Marin to protect my home and existing vegetation from wildfires	0%	5%	37%	26%	32%	0%
Use compost in my garden	0%	8%	32%	12%	20%	28%
Engage in community reforestation projects	4%	16%	36%	28%	16%	0%

	Definitely wouldn't	Probably wouldn't	Probably would	Definitely would	Already doing this, but want to do more	Already doing this
Pay an additional fee (1% of total bill, for example) when dining out at participating restaurants to support carbon farm projects in Marin County	16%	16%	24%	44%	0%	0%
Purchase local food and shop at farmers markers for most of my groceries	0%	8%	20%	0%	40%	32%

What are your priorities for the 2030 Climate Action Plan?

	Not a priority	Low priority	Moderate priority	High priority	Urgent priority
Apply compost to County-owned landscapes to support carbon sequestration	0%	16%	24%	36%	24%
Develop a plan to plant more trees on County-owned properties	4%	8%	46%	29%	13%
Work to develop carbon sequestration labeling for local producers who develop and implement carbon farm plans	4%	12%	32%	32%	20%
Incentivize farmers and ranchers in Marin County to practice carbon farming	4%	0%	28%	32%	36%
Incentivize farmers and ranchers in Marin County to manage manure in ways that reduce methane emissions	4%	12%	8%	44%	32%

APPENDIX D: GHG EMISSIONS INVENTORY

COMMUNITY GHG EMISSIONS SUMMARY TABLES

Jurisdiction: Unincorporated Marin
Population: 69,237 in 2018 (CA Department of Finance)
Number of Households: 26,393 in 2018 (CA Department of Finance)

Inventory Year: 2018
Date Prepared: August 17, 2020
Reporting Framework: Communitywide Activities

1.0 BUILT ENVIRONMENT

ID	Emissions Type	Source or Activity	Included, Required Activities	Included, Optional Activities	Excluded (IE, NA, NO or NE)	Notes	Emissions ($MTCO_2e$)
1.1	Use of fuel in residential and commercial stationary combustion equipment	Both	●				91,280
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	21,753
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

ID	Emissions Type	Source or Activity	Included, Required Activities	Included, Optional Activities	Excluded (IE, NA, NO or NE)	Notes	Emissions ($MTCO_2e$)
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	●				99,953
2.3	On-road freight and service vehicles operating within the community boundary	Source			IE	Obtained data for preferred activity-based method instead	

ID	Emissions Type	Source or Activity	Included, Required Activities	Included, Optional Activities	Excluded (IE, NA, NO or NE)	Notes	Emissions ($MTCO_2e$)
2.4	On-road freight and service vehicles associated with community land uses	Activity	●				15,270
2.5	On-road transit vehicles associated with community land uses	Activity		●			2,196
2.6	Transit rail vehicles operating with the community boundary	Source		●			348
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		●			4,471
2.13	Use of air travel by the community	Activity			NE		

3.0 Solid Waste

ID	Emissions Type	Source or Activity	Included, Required Activities	Included, Optional Activities	Excluded (IE, NA, NO or NE)	Notes	Emissions ($MTCO_2e$)
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	19,536

4.0 Water and Wastewater

ID	Emissions Type	Source or Activity	Included, Required Activities	Included, Optional Activities	Excluded (IE, NA, NO or NE)	Notes	Emissions ($MTCO_2e$)
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	●				118
4.3	Use of energy associated with generation of wastewater by the community	Activity	●				137
4.4	Process emissions from operation of wastewater treatment facilities located in the community	Source					

ID	Emissions Type	Source or Activity	Included, Required Activities	Included, Optional Activities	Excluded (IE, NA, NO or NE)	Notes	Emissions ($MTCO_2e$)
4.5	Process emissions associated with generation of wastewater by the community	Activity	●				876
4.6	Use of septic systems in the community	Source	●				919

5.0 Agriculture

ID	Emissions Type	Source or Activity	Included, Required Activities	Included, Optional Activities	Excluded (IE, NA, NO or NE)	Notes	Emissions ($MTCO_2e$)
5.1	Domesticated animal production	Source		●			68,896
5.2	Manure decomposition and treatment	Source		●			53,068
5.3	Fertilizer application			●		Line item added to the table.	407

6.0 Upstream Impacts of Communitywide Activities

ID	Emissions Type	Source or Activity	Included, Required Activities	Included, Optional Activities	Excluded (IE, NA, NO or NE)	Notes	Emissions ($MTCO_2e$)
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		●			1,090
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.) 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

1.0 Built Environment

Sector/ID	Emissions Source	Source and/or Activity Data	Emission Factor and Methodology
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.	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.
1.4 Electricity Use	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

Sector/ID	Emissions Source	Source and/or Activity Data	Emission Factor and Methodology
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, http://capvmt.us-west-2.elasticbeanstalk.com/data).	CO_2 for on-road passenger vehicles quantified in the EMFAC2017 model. Passenger vehicle emissions calculated according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.1.A.
2.2 On-Road Passenger Vehicle Operation	On-Road Mobile Combustion (CH_4 & N_2O)	Estimated vehicle miles traveled associated with origin and destination land uses (Metropolitan Transportation Commission, http://capvmt.us-west-2.elasticbeanstalk.com/data).	CH_4 and N_2O for on-road passenger vehicles quantified in the EMFAC2017 model and adjusted for IPCC AR5 100-year values. 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 2040 and the 2017 Regional Transportation Plan).	CO_2 for on-road commercial vehicles quantified in the EMFAC2017 model. Emissions allocated utilizing LEHD data according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.2.A.
2.4 On-Road Freight and Service Truck	On-Road Mobile Combustion (CH_4 & N_2O)	Estimated commercial vehicle miles traveled within the boundary (Metropolitan Transportation Commission utilizing Plan Bay Area 2040 and the 2017 Regional Transportation Plan).	CH_4 and N_2O for on-road commercial vehicles quantified in the EMFAC2017 model and adjusted for IPCC AR5 100-year values. Emissions allocated utilizing LEHD data according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.2.A.

Sector/ID	Emissions Source	Source and/or Activity Data	Emission Factor and Methodology
Freight Operation			
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.
2.5 On-Road Transit Operation	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.
2.6 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 2007 for Lawn and Garden and from OFFROAD2017 for Construction equipment. All categories are allocated by share of countywide households.	CO_2 emissions calculated according U.S. Community Protocol v. 1.1, Appendix D, Method TR.8. Emission factors provided in Table TR.1.6.
2.12 Off-Road Vehicles and Equipment	Off-Road Mobile Combustion (CH_4 & N_2O)	Estimated fuel use from OFFROAD 2007 for Lawn and Garden and from OFFROAD2017 for 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

Sector/ID	Emissions Source	Source and/or Activity Data	Emission Factor and Methodology
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 and 2014) 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

Sector/ID	Emissions Source	Source and/or Activity Data	Emission Factor and Methodology
4.2 Water Supply & Conveyance, Treatment and Distribution	Electricity Use (CO_2)	Water consumption data provided by Marin Municipal Water District (MMWD), North Marin Water District, and Stinson Beach Water District. Electricity consumption data provided by MMWD. Sonoma County Water Agency (SCWA) delivery amount provided by SCWA. 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.
4.2 Water Supply & Conveyance, Treatment and Distribution	Electricity Use (CH_4 & N_2O)	Water consumption data provided by Marin Municipal Water District (MMWD) North Marin Water District, and Stinson Beach Water District. Electricity consumption data provided by MMWD. 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 known percent of methane in digester gas provided by Central Marin Sanitation Agency (2016 data used as a proxy), Sausalito-Marin City Sanitation Agency (2012), and Sewerage Agency of Southern Marin (2017). Known amount of digester gas produced per day (2016) and known percent of methane in digester gas (2017) provided by Las Gallinas Valley Sanitary District. 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.a.
4.5 Treatment of Wastewater	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 Central Marin Sanitation Agency (2016 data used as a proxy), Sausalito-Marin City Sanitation Agency (2012), and Sewerage Agency of Southern Marin (2017). Known amount of digester gas produced per day (2016) and known percent of methane in digester gas (2017) provided by Las Gallinas Valley Sanitary District. 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.
4.5 Treatment of Wastewater	Process Emissions from Wastewater Treatment Plant without	Estimated population served by wastewater treatment plant provided by Central Marin Sanitation Agency and Sewerage Agency of Southern Marin.	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.8.

Sector/ID	Emissions Source	Source and/or Activity Data	Emission Factor and Methodology
	Nitrification or Denitrification		
4.5 Treatment of Wastewater	Process Emissions from Wastewater Treatment Plant with Nitrification or Denitrification	Estimated population served by wastewater treatment plant provided by Las Gallinas Valley Sanitary District (2010 data). Sausalito-Marin City Sanitation Agency, and Novato Sanitary District.	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.7.
4.5 Treatment of Wastewater	Fugitive Emissions from Effluent Discharge (N_2O)	Estimated population served by wastewater treatment plant provided by Central Marin Sanitation Agency and Novato Sanitary District; assumed significant industrial or commercial input. Estimated population served by wastewater treatment plant provided by Sausalito-Marin City Sanitation Agency; assumed no significant industrial or commercial input.	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.12(alt).
4.5 Treatment of Wastewater	Fugitive Emissions from Effluent Discharge (N_2O)	Estimated population served by wastewater treatment plant provided by Las Gallinas Valley Sanitary District. Assumed no significant industrial or commercial input.	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.12.
4.6 Septic Systems	Fugitive Emissions from Septic Systems (CH_4)	Estimated number of septic systems within jurisdictional boundary based on information from Marin County Department of Environmental Health Services. Population estimated using average household population estimate from Department of Finance Report E-5 Population and Housing Estimates for Cities, Counties, and the State, January 1, 2011-2019. 2010 data used as a proxy for 2005-2018.	Emissions calculated according to U.S. Community Protocol v. 1.1 Method WW.11(alt).

6.0 Upstream Impacts of Community-wide Activities

Sector/ID	Emissions Source	Source and/or Activity Data	Emission Factor and Methodology
6.1 Emissions from Electric Power Transmission and Distribution	Electricity Use (CO_2, CH_4 & N_2O)	Western Region T&D losses estimated in U.S. EPA's eGrid reports.	Emissions calculated according to U.S. Community Protocol v. 1.1 Method B.4.1.

Activity Data and Emissions by Sector

Emissions are quantified by multiplying 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.

The County's GHG emissions 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 CO2e, to provide an apple-to-apples comparison among the various emissions. Greenhouse gas emissions are reported in the County's GHG inventory as metric tons of carbon dioxide equivalents, or MTCO2e.

Built Environment: Electricity

Year	Electricity Use (kWh)	Transmission & Distribution Losses (kWh)	Total Emissions from Electricity ($MTCO_2e$)
2005	347,404,934	16,814,399	81,316
2006	342,894,188	16,596,079	74,822
2007	346,280,111	16,759,957	105,080
2008	364,647,946	17,648,961	111,578
2009	369,337,779	30,322,632	104,750
2010	342,252,743	23,410,088	71,263
2011	335,631,399	22,957,188	64,367
2012	317,267,498	18,274,608	63,786
2013	331,106,340	19,071,725	61,408
2014	310,512,614	14,873,554	53,518
2015	308,940,496	14,798,250	51,221
2016	306,836,954	12,979,203	41,631
2017	308,787,771	13,061,723	19,660
2018	306,739,336	14,723,488	22,843
Change from 2005	**-40,665,598**	**-2,090,911**	**-58,474**
% Change from 2005	**-12%**	**-12%**	**-72%**

Built Environment: Natural Gas

Year	Natural Gas Use (therms)	Residential Propane Use (gallons)	Total Emissions from Natural Gas and Propane ($MTCO_2e$)
2005	19,915,187	657,962	109,636
2006	19,738,400	657,962	108,696
2007	19,502,543	657,962	107,441
2008	19,215,064	627,269	105,739
2009	19,215,474	627,269	105,741
2010	19,500,375	627,269	107,256
2011	19,789,307	612,948	108,712
2012	18,557,495	679,184	102,534
2013	18,720,218	746,494	103,780
2014	15,227,871	698,876	84,937
2015	15,447,221	494,805	84,951
2016	16,363,359	513,199	89,928
2017	16,762,809	517,929	92,079
2018	16,640,231	491,914	91,280
Change from 2005	**-3,274,956**	**-166,047**	**-18,356**
% Change from 2005	**-16%**	**-25%**	**-17%**

Transportation

Year	Passenger Vehicle Miles Traveled (VMT)	Commercial Vehicle Miles Traveled (VMT)	Bus Miles Traveled (VMT)	SMART Diesel (gallons)	Total Emissions from Vehicles ($MTCO_2e$)
2005	286,018,408	14,913,204	1,001,639	0	139,691
2006	282,926,489	16,274,053	1,080,559	0	142,504
2007	280,612,900	18,002,248	1,219,137	0	144,114
2008	277,915,052	17,553,446	1,316,505	0	140,721
2009	272,179,763	17,882,389	1,407,453	0	139,458
2010	265,160,462	14,572,204	1,295,584	0	129,370
2011	269,110,790	13,905,917	1,435,282	0	129,161
2012	274,987,474	13,728,242	1,468,343	0	130,097
2013	277,807,267	14,777,161	1,525,407	0	129,957
2014	280,649,599	14,218,088	1,601,461	0	128,039
2015	284,272,417	13,748,334	1,707,721	0	126,599
2016	284,793,215	13,550,665	1,723,060	0	122,449
2017	287,941,761	13,475,828	1,724,912	11,810	120,182
2018	288,941,452	13,297,860	1,754,911	34,119	117,767
Change from 2005	**2,923,044**	**-1,615,344**	**753,271**	**34,119**	**-21,924**
% Change from 2005	**1%**	**-11%**	**75%**	**n/a**	**-16%**

Waste

Year	Landfilled Waste (tons)	ADC (tons)	Total Waste Disposed	Total Emissions from Waste Disposal ($MTCO_2e$)
2005	64,573	14,382	78,955	22,779
2006	65,809	17,824	83,633	22,447
2007	61,505	13,812	75,317	20,061
2008	56,542	7,348	63,890	16,677
2009	48,224	5,530	53,754	14,364
2010	48,112	5,062	53,174	14,027
2011	46,751	5,267	52,018	13,748
2012	48,014	5,583	53,597	14,115
2013	48,625	6,151	54,776	14,173
2014	46,741	7,733	54,474	14,360
2015	49,687	6,819	56,506	14,901
2016	58,731	6,985	65,716	17,444
2017	61,029	7,236	68,266	18,250
2018	65,987	10,817	76,804	19,536
Change from 2005	**1,414**	**-3,565**	**-2,151**	**-3,243**
% Change from 2005	**2%**	**-25%**	**-3%**	**-14%**

Water

Year	Water Consumption (MG)	Total Emissions from Water Use ($MTCO_2e$)
2005	3,154	2,798
2006	3,198	2,541
2007	3,161	2,903
2008	3,218	2,811
2009	2,959	2,850
2010	2,766	1,553
2011	2,789	1,124
2012	2,914	1,178
2013	3,095	1,356
2014	2,680	1,199
2015	2,526	969
2016	2,328	676
2017	2,433	221
2018	2,501	118
Change from 2005	**-653**	**-2,680**
% Change from 2005	**-21%**	**-96%**

Off-Road

Year	Construction Equipment Emissions ($MTCO_2e$)	Lawn & Garden Equipment Emissions ($MTCO_2e$)	Agricultural Equipment Emissions ($MTCO_2e$)	Total Emissions from Off-Road Vehicles and Equipment ($MTCO_2e$)
2005	2,698	2,646	600	5,944
2006	2,687	2,846	598	6,131
2007	2,683	3,953	597	7,232
2008	2,693	2,819	595	6,107
2009	2,706	2,148	594	5,447
2010	2,729	1,846	593	5,169
2011	2,755	1,793	591	5,139
2012	2,771	1,725	589	5,085
2013	2,778	1,637	587	5,001
2014	2,797	1,540	585	4,922
2015	2,817	1,430	583	4,830
2016	2,837	1,306	582	4,725
2017	2,858	1,169	581	4,608
2018	2,875	1,015	581	4,471
Change from 2005	**177**	**-1,630**	**-19**	**-1,473**
% Change from 2005	**7%**	**-62%**	**-3%**	**-25%**

Wastewater

Year	Wastewater Treatment Plant Emissions ($MTCO_2e$)	Septic System Emissions ($MTCO_2e$)	Total Emissions from Wastewater ($MTCO_2e$)
2005	1,782	893	2,676
2006	1,726	893	2,619
2007	2,057	891	2,948
2008	2,094	895	2,989
2009	1,913	887	2,800
2010	1,505	894	2,399
2011	1,532	898	2,430
2012	1,574	909	2,484
2013	1,566	913	2,479
2014	1,421	924	2,345
2015	1,385	928	2,313
2016	1,283	927	2,210
2017	1,060	923	1,983
2018	1,014	919	1,933
Change from 2005	**-769**	**26**	**-743**
% Change from 2005	**-43%**	**3%**	**-28%**

AGRICULTURE

Year	Manure Management Emissions ($MTCO_2e$)	Enteric Fermentation Emissions ($MTCO_2e$)	Fertilizer Application Emissions ($MTCO_2e$)	Total Emissions from Agriculture ($MTCO_2e$)
2005	57,476	70,945	424	128,845
2006	63,957	75,394	283	139,634
2007	60,536	71,711	294	132,541
2008	59,654	69,065	377	129,096
2009	54,542	64,471	515	119,528
2010	57,310	66,037	512	123,860
2011	55,787	61,875	485	118,147
2012	51,894	58,512	427	110,834
2013	59,185	69,525	422	129,132
2014	49,448	64,015	398	113,862
2015	50,014	64,404	405	114,823
2016	50,850	66,623	477	117,950
2017	50,621	67,609	434	118,665
2018	53,068	68,896	407	122,371
Change from 2005	**-4,407**	**-2,050**	**-17**	**-6,474**
% Change from 2005	**-8%**	**-3%**	**-4%**	**-5%**

APPENDIX E: QUALIFIED GHG REDUCTION STRATEGY

In 2010, the California State Office of Planning and Research adopted revised CEQA Guidelines that allow streamlining of project-level analysis of GHG emissions through compliance with a GHG reduction plan contained in a general plan, long range development plan, or separate climate action plan. Plans must meet the criteria set forth in section 15183.5 of the CEQA Guidelines, which include requirements for quantifying existing and projected GHGs; identifying a level of cumulative GHG emissions that would not be considered significant; specifying measures and standards that would ensure achievement of this level; and continued monitoring to track progress. This Climate Action Plan meets those criteria as follows:

- Quantify emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area (see Chapter 2).
- Establish a level, based on substantial evidence, below which the contribution of emissions from activities covered by the plan would not be cumulatively considerable. This CAP identifies three targets, consistent with State guidance, that are further addressed in Chapter 2.
    - Reduce emissions through mitigation measures to 40% below 1990 levels by 2030 (equivalent to statewide target).
    - Reduce emissions through mitigation and sequestration measures to 60% below 2005 levels by 2030 (Drawdown Marin target).
    - Reduce emissions through mitigation and sequestration measures to below zero by 2045 (Drawdown Marin and Executive Order B-55-18 target).
- Identify and analyze the emissions resulting from specific actions or categories of actions anticipated within the geographic area (see Chapter 2).
- Specify measures or a group of measures, including performance standards that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level (see Chapter 3 and Chapter 4).
- Establish a mechanism to monitor the plan's progress toward achieving the level and to require amendment if the plan is not achieving specific levels (see Chapter 5).
- Adopt the GHG Reduction Strategy in a public process following environmental review. The County is adopting this CAP as an Addendum to the Countywide Plan Environmental Impact Report (EIR).