



Sustainable San Mateo County

Economy. Equity. Environment.

October 2020

Key Indicator 2020

Renewable Energy and Energy Efficiency

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Introduction

Conventional fossil-fuel energy sources such as coal and natural gas are huge contributors to climate change. Non-renewable electricity and power generation use large amounts of scarce energy and water resources and pollute both the air and water, greatly harming our health and environment. On the other hand, renewable energy generated from sources including sun, wind and tides provides substantial benefits for mitigating climate change and restoring our health and environment. Last year, Sustainable San Mateo County's annual Key Indicator report explored climate change with a focus on actions and responses by key agencies and businesses located in San Mateo County (SMC).

In 2020, the annual Key Indicator focuses on renewable energy and energy efficiency measures in San Mateo County as they apply to buildings, water use and waste management, land use and transportation, financing and community outreach efforts. The county's roadmap to decarbonization includes leveraging passive design and smart building technologies to optimize energy use in existing buildings while promoting policy and high efficiency design approaches for zero net carbon in new constructions. The roadmap further incorporates rapidly shifting to 100% greenhouse gas-free electricity, electrifying transportation and buildings, increasing countywide electric vehicle (EV) infrastructure, and fostering innovative local energy sources and carbon offset projects.

The greenhouse gas (GHG) reduction targets and pathways set by cities in their Climate Action Plans (CAPs) are a huge driver to achieve the overall county targets. Modernizing the grid to build energy resilience, prioritizing social equity while expanding clean energy access, and developing innovative financing models for advanced energy community solutions are also integral parts of SMC's roadmap to decarbonization and clean-energy transition.

Please note: All rebates, incentives, financing options mentioned throughout the report are correct as of October 2020.

Improving Building Efficiency

California is focused on reducing GHG sources and emissions from all of its industries to address climate change. Buildings are a major GHG contributor because of the energy they use to keep interiors at a comfortable temperature, the production and transportation energy embodied in their building materials, and the off-gassing of materials and building waste that are sent to the dump. This section focuses on switching energy sources in buildings from “dirty” to “clean” supplies and on highlighting buildings that are constructed or retrofitted to use less energy. Zero Energy or near-Zero Energy Buildings limit the amount of energy (and thus carbon) needed from the energy grid and from natural resources. Sustainable construction methods and on-site renewable energy can go a long way toward creating buildings that are truly energy efficient, if not self-sufficient.

California’s [Long Term Energy Efficient Strategic Plan](#) calls for all new residential construction to be zero net energy (ZNE) in 2020 and for all new commercial buildings to be ZNE by 2030. San Mateo County currently has nine zero energy Buildings verified or close to being verified, according to the New Buildings Institute’s online [database](#) (as of 08/21/2020). To increase the number of San Mateo County’s ZNE buildings, new construction should look to passive or high-performance building techniques coupled with on-site renewable energy. [Renewables](#) for buildings consist of energy sourced from easily replenishable resources, such as sunlight, wind, rain and geothermal heat.

Zero Energy Buildings

Buildings that strive to be energy self-sufficient and produce all their own power on-site are known as [Zero Energy Buildings](#). In contrast to Zero Carbon Buildings (which are primarily concerned with emissions from operational energy use or embodied carbon in building materials), Zero Energy Buildings operate using only on-site renewable energy sources. Projects that receive this certification must go through a year-long process to show actual rather than modeled performance and must operate as claimed to harness energy from the sun, wind or earth. The New Buildings Institute has a comprehensive state-by-state [listing of Zero Energy Buildings](#).

Energy-Efficient Building Construction

According to the U.S. Environmental Protection Agency (EPA), energy-efficient buildings, commonly known as “[green buildings](#),” go beyond the traditional architectural practice of creating structures concerned with form, function, durability and comfort. They add components that are environmentally responsible and energy/water/material resource efficient throughout a building’s life cycle. Also known as sustainable or high-performance buildings, these buildings incorporate climate-specific systems. In their simplest and earliest form, buildings that respond to the natural climate are referred to as [vernacular architecture](#). Although all vernacular buildings vary from region to region, they all take their cues from the local climate and respond to it with often ingenious biomimetic solutions to heat, cool or insulate the structure.

Biomimetic architecture is a more contemporary take on the same idea that looks to nature for its solutions. It is part of a larger movement known as [biomimicry](#), which is the examination of nature, its models, systems, and processes for the purpose of gaining inspiration in order to solve human-made problems.

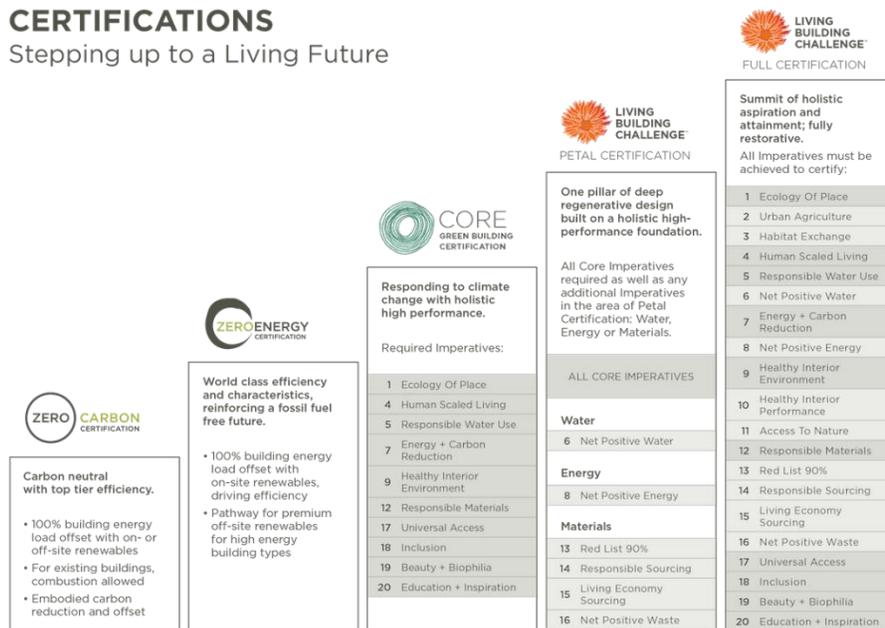
[Passive solar design](#) is one of the best known energy-efficient building systems from the 1970s, using [Trombe walls](#) for thermal mass, south-facing living spaces and shading of window glazing.

Another low-tech but nonetheless very energy-efficient technique is using vegetation to shade a building's south- or west-facing facades. [Studies](#) have shown that deciduous trees can lower the temperature of building surfaces by 20 to 45 degrees Fahrenheit, thus drastically lessening the cooling demand from air-conditioning (AC) units. This effect is significant since AC accounts for 10% of all global electricity consumption today.[1] The heat island effect of parking lots is well documented, and the benefit of using vegetation to cool the urban environment has been widely proven as well. [2]

One of the best methods to get energy efficient is to create a tight building envelope and use high-performance windows. A high-performance construction version of this idea is called [Passive House design](#), which allows the interior to maintain a stable temperature without having to resort to heating or cooling. A residential example, [Project Green Home](#) in Palo Alto combines Passive House design with Zero Energy certification.

CERTIFICATIONS

Stepping up to a Living Future



Program Certification Matrix: from fewest (left) to most (right) energy-efficiency features

Credit: [International Living Future Institute](#)

Renewable Energy Sources

In contrast to passive solar design, which takes advantage of the natural energy from the sun directly, [active solar design](#) captures the sun's energy and stores it for later use through mechanical or electrical means. Active solar design refers to photovoltaics (solar panels or PVs) and/or thermal hot water (storing the sun's energy in water). The current 2019 California Building code requires all new three-story-or-less residential construction to be powered by solar arrays, covering roughly 60% of the home's predicted energy use. According to Google's [Project Sunroof](#), approximately 91% of all buildings in San Mateo County are solar viable.

Wind energy is another renewable option. Research on buildings using a Built-Environment Wind Turbine (BEWT) reveals a commercial minefield of failed businesses and results. According to Paul Gipe, author of *Wind Energy for the Rest of Us*, [3] installation of BEWTs can involve a lot of [greenwashing](#), since many of the turbines don't work as advertised or are located in such a way that they don't generate the desired energy. Wind is attractive, though, because it could help to smooth out the "[duck curve](#)" (energy spike seen between 4 and 9 p.m.) by providing energy not tied to solar panels' diurnal swings. California's current capacity for energy generated by wind turbines is 5.9 megawatts (MW), with a potential for [303 MW](#), according to Energy.gov's Wind Exchange. Energy.gov also produces the [Small Wind Guidebook](#), which indicates that wind turbines work on sites that are larger than one acre, have been approved by local zoning and have reliable wind resources. Campus sites within San Mateo County such as institutional, recreational and commercial sites that clock wind at 6.5 meters a second at 80 meters high could benefit from this renewable energy source. Also, using a wind turbine certified by the [Small Wind Certification Council](#) is recommended.

An example of a residential project using both wind and solar in San Francisco's Mission District can be found [here](#). An example of a BEWT that didn't work is the San Francisco Public Utility building. It featured a [façade of wind turbines](#) that were integrated into the design of the building but, disappointingly, [broke down after one year](#).

Solar and wind offer intermittent renewable energy, while geothermal energy remains available when the sun sets or the wind dies down. Geothermal energy is on the rise for large-scale plants and Power Purchase Agreements (PPAs) with local Community Choice Energy (CCE) programs such as Peninsula Clean Energy (PCE) in San Mateo County. Geothermal energy uses pipes drilled down into the earth to capture the earth's natural heat and generate electricity. A [study](#) done in 2013 for the San Mateo County Jail compared a traditional central utility plant (CUP) with a geothermal utility plant. The report found that while the yearly operation savings were better for geothermal energy, the installation costs were much higher, possibly due to siting considerations, and overall the payback was too delayed, resulting in the geothermal option being abandoned. [4] Improving insulation in a home may also be more cost effective than installing a geothermal system. Installation of a geothermal system needs to be considered on a case-by-case basis and is heavily based upon individual circumstances like siting.

Building Codes, Enforcement and Reach Codes

[California's Building Standards Code](#), consisting of 12 individual codes, is collectively known as [Title 24](#) and includes some of the nation's strictest energy-efficiency and general requirements for new or retrofitted construction involving both residential and nonresidential buildings. All parts of Title 24 are enforced by local building officials and are intended to promote safety and build energy efficiency in new and existing buildings. The California Energy Code (Part 6 of Title 24) sets the energy baseline or "standard" beyond which local governments may adopt reach codes to push energy efficiency further. The California Green Building Code, or "CALGreen" (Part 11 of Title 24), sets a baseline of mandatory measures for energy efficient and sustainable project practices, with more aggressive voluntary tiers that local jurisdictions can choose to adopt. Both Part 6 and Part 11 contain specific requirements for resource conservation, and both parts address energy and resource efficiency as means to curb climate change. The state updates Title 24 every three years. The latest update was done in 2019.

The California Energy Commission has ambitious goals for Zero Energy Building codes that include adopting zero energy for the residential and commercial sectors in 2020 and 2030, respectively. Local cities have also been pushing for even stronger and faster implementation of energy efficiency through additional code requirements generally known as "[reach codes](#)."

Currently only four entities in San Mateo County promote the installation of energy-efficient [photovoltaics](#) in their reach codes. [Menlo Park](#), for example, has established [reach codes](#) that require new nonresidential buildings and high-rise residential buildings to include on-site [solar panels](#). Advocacy groups such as the [Campaign for Fossil Free Buildings](#) and [Citizens' Climate Lobby](#) are asking city councils to adopt reach codes that hasten the achievement of carbon emission reduction goals by requiring all new buildings to be powered by all-electric energy sources.

There are two different ways to implement reach codes:

1. Whole Building or performance-based reach codes (also known as Brisbane's approach), under which minimum performance requirements are set for new construction projects, but individual measures and feature selection are left to the owner/designer/builder
2. Prescriptive-based reach codes, which require demonstrating compliance with minimum acceptable safety and performance standards

The City of Brisbane has implemented a building efficiency program designed to address energy and water use in buildings over 10,000 square feet. This program requires building owners to use the [Energy Star Portfolio Manager tool to "benchmark" their energy and water consumption on a yearly basis](#). The goal of the program is to track improvements in efficiency over time, work with building owners to increase efficiency and reduce overall energy demand, thus saving resources and money.

As cities ask their residents to take steps to improve energy efficiency, the cities themselves often follow suit. Palo Alto has installed solar panels on five city-owned sites, including the Baylands Interpretive Center and the Municipal Services Center. These buildings serve to reduce the city's overall energy use and, because of their high visibility, encourage residents to take action as well.

Half Moon Bay (Calif.) Library

A city-owned example of a new building striving to meet Zero Energy certification is the **Half Moon Bay Library**. This 22,000 square foot library and community center was completed in 2018 and has been awarded [Platinum certification in October 2019](#) under the LEED system (the Leadership in Energy and Environmental Design rating system of the U.S. Green Building Council). That means this building meets the highest international standards for energy savings, water efficiency, carbon emissions reduction, indoor environmental quality, and stewardship of resources with sensitivity to their impacts. The building incorporates many sustainable features, including solar panels on the roof, low-albedo cool roofs, natural ventilation, high-performance heating and cooling systems, a high-performance building envelope, passive solar shading, and thoughtful siting and design to reduce the need for energy. On-site low water use fixtures and drought-tolerant planting help to weave the sustainable elements through all parts of the site.



2019 [Half Moon Bay Library](#) Noll + Tam Architects LEED Platinum/ Net Zero Energy

Sacred Heart Schools Stevens Library, Atherton, Calif.

This library is part of an institutional campus and is the first school building in California to achieve the Zero Energy certification from the International Living Future Institute (ILFI). The 6,300 square foot library generates more energy than it consumes annually and was part of the Pacific Gas & Electric (PG&E) Zero Net Energy Pilot Project. The library also serves as a live educational tool to the school, educating K-12 students on the importance of environmental stewardship through its PV panels, solar tubes for daylighting, building shading systems, and a rainwater collection system on display as a 3,000 gallon tank used as a primary water source for a nearby eco-orchard.



2012 [Sacred Heart Schools Stevens Library](#) WRNS Architects LEED Platinum/ Zero Energy

Features: LEED Platinum. Designed to meet the Living Building Challenge Petals of Energy, Water, Habitat and Materials

Energy Efficiency in New Buildings

Energy-efficient construction is a component of the green building ordinance, which can also include requirements for water efficiency, green materials and waste reduction. Ensuring new buildings are operating with “clean” energy and are energy resilient requires using on-site renewables or being part of a [microgrid](#) that shares the burden of energy generation over several sites or an entire community. Microgrids are a good option for larger educational or corporate campuses.

The [Clean Coalition](#) has thought a great deal about how to improve energy efficiency in commercial and nonresidential installations using approaches such as [feed-in tariffs](#), [community microgrids](#) and Advanced Energy Communities (see [Richmond, Calif. here](#)). Often many strategies are required to work in concert in order to meet a building's energy demand. Significant energy reductions can be achieved through wall, ceiling and foundation insulation and by following "[Passive House](#)" or similar designs. New buildings are often able to achieve Zero Energy certification if their envelopes are designed to limit energy demand as much as possible.

A residential example of a Zero Energy construction is [Zero House](#), built by the Endeavour Centre with Ryerson University. It is a single home but the design is suitable to be built as part of a multi-unit complex too. The Zero House design meets all of the following goals: Zero Energy, Zero Carbon, Zero Toxins and Zero Construction Waste. It also captures greenhouse gases by using plant-based building materials to sequester carbon in the frame, insulation and finishes of the house, thus making the building itself a carbon sink.

Energy Retrofits in Existing Buildings

The number of homes powered solely by electricity [grew steadily from 2009 to 2015](#). More than 13,000 homes in San Mateo County are now powered by rooftop solar panels and send energy back to the grid, generating a rebate from PG&E if they are net positive (i.e., make more energy than they use over the course of a full year). Adding solar panels to residential buildings to make them more energy efficient has become commonplace, but it is often more economical to make other energy-efficient switches first. Ways to improve energy efficiency in either residential or commercial buildings include updating or retrofitting a building's envelope (by using higher insulation values in the roof, walls and floors); increasing the efficiency of existing heating, air-conditioning and hot water equipment; and upgrading the building's lighting (improving daylighting, lighting controls and LEDs).

The [Rocky Mountain Institute](#) has reported that in some instances, [retrofits can also save money](#) if they replace both gas and air-conditioning equipment. A report by Energy and Environmental Economics, Inc. (E3) looked closely at the implications of going all-electric in both new and existing residential homes in six climate zones in California and found the same result.[5] The E3 report posits that for electrification retrofits to succeed at scale, three things need to occur: contractors must understand best practices, international markets must be looked to for a wider range of high-efficiency electric technologies, and "retrofit ready" heat pump water heaters and heating, ventilation and air conditioning (HVAC) systems must be developed for more consumer choice at lower cost.

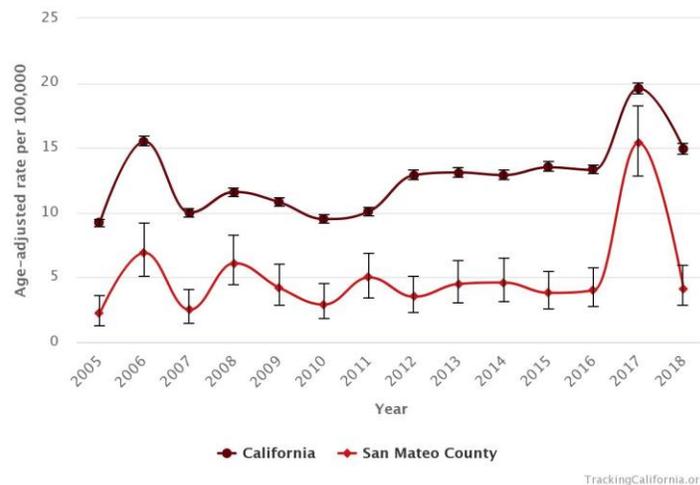
Existing tenants or renters that cannot switch out the heating and cooling equipment in their buildings can still improve their GHG emissions by sourcing "clean" energy from the grid through a Community Choice Aggregation (CCA) energy supplier such as [PCE](#) in San Mateo County. This grid-provided "clean" energy helps to lessen an existing building's operational GHG emissions. An option for buildings outside of CCA areas is to use [Renewable Energy Credits](#), which are similar to offsetting an airplane flight by contributing to a GHG-emission-lessening project.

San Mateo County Energy Watch offers [programs](#) to support homeowners in retrofitting their homes with more efficient appliances. A [toolkit](#) provides an easy way to evaluate and improve a home’s efficiency. Significant [rebates and financing](#) are available, and there are [programs](#) geared especially toward low-income residents. By assisting residents who want to make their homes more efficient, these programs work to reduce emissions throughout the county. Another option homeowners might consider to reduce their energy use and help boost resale value is BayREN’s [Green Labeling and Home Energy Score](#).

Homeowners who are considering going all-electric can check out [local rebates](#) for solar panels, energy-efficient electric equipment and free Induction Cooktop Loaner programs. Homeowners looking to dive into installing their own solar PV system should check out the [Solar Living Institute](#), home to the Solar Living Center in Hopland, Calif. A possible alternative to purchasing solar batteries could be using an EV vehicle as a battery backup during power outages with a [switch box offered by many vendors](#). Check out some of the informational guides [here](#) for helpful examples of heating, water and home appliances that will work in an all-electric building. Contractors can earn rebates on heat pump water heater installations and receive [training](#) from BayREN.

Energy Equity

[Extreme heat](#) events in San Mateo County are trending upward, a development that is particularly stressful for vulnerable and low-income populations. According to a recent report on energy equity, the energy sector impacts disadvantaged populations in four areas: energy access, energy affordability, environmental hazards and employment. [6]

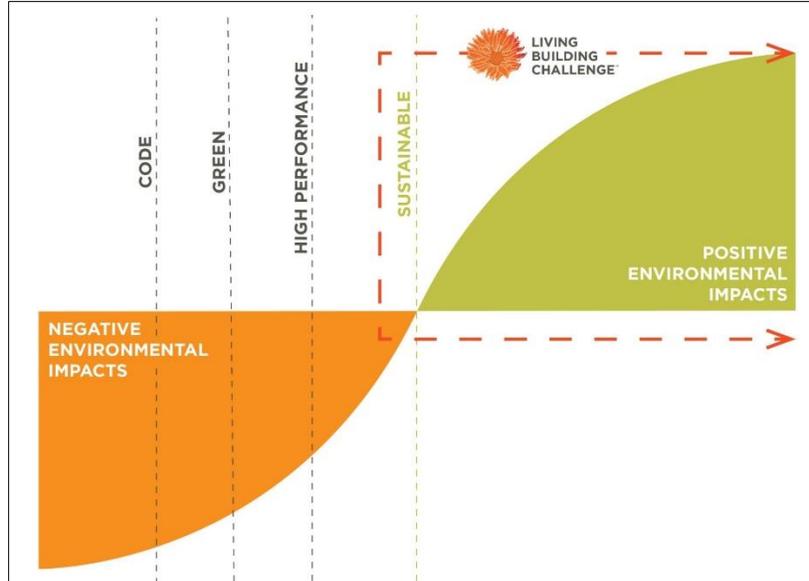


Emergency room visits due to heat, both sexes, all ages, all races/ethnicities, age-adjusted rate per 100,00, 2016. Credit: Trackingcalifornia.org

The disturbing trend in extreme heat events points to the need for education, financial incentives and rebates (similar to the California Solar Initiative and California Proposition 39), and innovation. According to the [Building Decarbonization Coalition's recent study](#), a grant-only approach to enable low- and moderate-income (LMI) and renter households, who together represent more than 40 percent of California's population, to participate in building energy efficiency or renewable programs would dwarf any public expenditure in this area that the state has made to date. The study's findings suggest that a tariffed on-bill program based on the PAYS (pay as you save) system implemented by eight states over the last 18 years might be more effective. Essentially, the program would allow utility companies to pay for cost-effective energy improvements (such as solar panels) and then recover their costs over time from LMI or renter households through a dedicated charge on the utility bill that is less than the estimated savings from the improvements. [7]

Green Certifications and Rating Systems

Cities and municipalities often permit new and retrofit work using different types of energy rating systems and certifications. Many cities have been employing the [LEED](#) system, which has been in practice since 1998. However, the New Buildings Institute published a [report](#) in 2008 revealing that many LEED buildings were in fact performing worse than anticipated (modeled) and some were even performing below the standards set in the EPA's Energy Star program. Thus, using performance-based certification rather than a prescriptive approach will ensure that energy goals are met. There are many other rating systems available, such as the performance-based rating system [Living Building Challenge](#) (which focuses on self-sustaining buildings), [WELL](#) (which focuses on healthy buildings) and [PHIUS+](#) (a certification system by the Passive House Institute that promotes highly insulated, energy-efficient buildings). The ultimate energy goal is Net Positive Energy, in which buildings generate more power over the course of the year than needed and thus are considered restorative to the environment.



The Living Building Challenge is a philosophy, certification, and advocacy tool for projects to move beyond merely being less bad and to become truly regenerative.

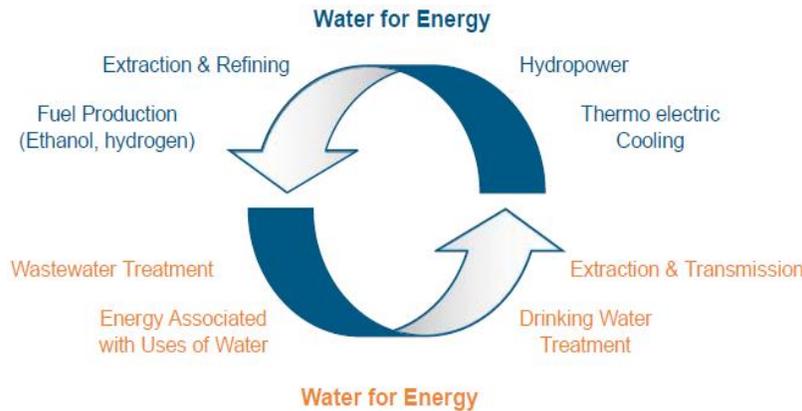
Credit: International Living Future Institute

If cities and municipalities decide to use a rating system, they should carefully consider what they wish to achieve and use the rating system in conjunction with California’s [CALGreen](#) code. The cost to certify projects is usually passed on to the developer or owner, which can prove to be prohibitive for some projects. Policy makers should consider how the rating system will be met by the public and whether it will be seen as a hurdle, a barrier or an incentive. The use of a rating system does allow, however, for a third-party check in the context of new commercial, institutional and public projects.

Water Use and Water Conservation

Water-Energy Nexus and Importance of Storage

Water use and energy use are inextricably related. The extraction, treatment, distribution and use of water, and the collection and treatment of wastewater, require a significant amount of energy. Conversely, hydroelectric and thermometric power generation require large amounts of water. Water can be used to store energy economically. For example, Hawaii has a fleet of 500 grid-enabled heat pump water heaters that store energy during the day when there is an excess of renewables on the grid.



The water-energy nexus. Click [here](#) for more information and image credit.

It is important, when addressing the significant issues facing San Mateo County regarding the sustainable use of both energy and water resources, to engage with diverse stakeholders such as customers, communities, suppliers, investors, employees, public interest groups and outside experts. [San Mateo County Energy and Water Strategy 2025](#) suggests three actions that have both energy and water benefits and therefore result in the highest impacts possible across all sectors:

1. Develop [water-to-energy projects](#) by identifying locations of existing or new large volume water movement with energy-generation capacity
2. Develop large water tanks, including grid-enabled heat pump water heaters, for energy storage
3. Deploy counterflow wastewater heat exchangers in multifamily or mixed-use buildings

Energy Efficiency in Water Management in Atherton, Calif.

The [City of Atherton's energy efficiency program](#) promotes activities which reduce buildings' energy use in the water-management context through the adoption of new, emerging technologies and simple in-house solutions. These activities include installing high-energy water heaters and air-conditioners, adding features such as insulation or duct sealing, and even following simple measures such as unplugging unused electronics or turning off lights when not at home. Energy audits for residents include an analysis of home energy usage and include suggestions on how to reduce home energy consumption.

Resources for Water Conservation

United States Environmental Protection Agency's WaterSense Program

[WaterSense](#) is a voluntary partnership program sponsored by the EPA. It is both a label for water-efficient products and a resource for helping people save water. The WaterSense label makes it simple to find water-efficient products, new homes and programs that meet the EPA's criteria for efficiency and performance. WaterSense-labeled products and services are certified to use at least 20 percent less water, save energy and perform as well as or better than regular models. WaterSense partners with manufacturers, retailers and distributors, home builders, irrigation professionals and utilities to bring the program to local communities.



San Mateo Resource Conservation District Technical Assistance

The [San Mateo Resource Conservation District \(SMRCD\)](#) is a trusted source of information for technical assistance and resource management facilitation on water conservation. With a competent staff of experienced conservation specialists, [SMRCD provides comprehensive, integrated technical services](#) addressing water issues to meet the needs of private and public land owners, land managers, public agencies, interest groups and others in San Mateo County. Free, confidential technical assistance helps landowners and land managers manage natural resources.



Bay Area Water Supply and Conservation Agency (BAWSCA) Rebates, Tips and Classes

The [Bay Area Water Supply and Conservation Agency \(BAWSCA\)](#) offers a variety of [rebates](#) and programs to help Bay Area water users become more water efficient inside their homes and outdoors. BAWSCA provides simple [tips](#) to reduce



indoor and outdoor water use, [classes](#) on water conservation and landscape education and a water-wise gardening guide that shows how to garden beautifully while saving water.

Leak Detection Pilot Study by WaterNow Alliance

San Mateo County participates with other local leaders in the [WaterNow Alliance](#) to achieve high-impact, widespread adoption of sustainable water solutions in local communities. Residents of Foster City and Burlingame are currently eligible to participate in a [leak detection study](#) and pilot leak detection devices in their homes. These devices are monitored for their effectiveness in detecting active leaks and enabling remote water shutoff, as well as for their impacts on water conservation behavior. The findings from the study will be helpful in forming countywide efforts on water conservation.



Green Business Program: The San Mateo County Office of Sustainability certifies and promotes small- to medium-sized businesses that operate in an environmentally responsible manner through the county’s Green Business Program. By offering technical assistance and resources, the county helps local businesses save money by teaching them how to conserve energy and water, minimize waste, prevent pollution and shrink their carbon footprints. The program, which is part of the California Green Business Network, is available in the following sectors: office/retail, restaurant/catering, hotel, cleaning services, auto repair, small manufacturing, printing and medical/dental practices. Click [here](#) to learn more and to participate in this program.

Water Agencies in San Mateo County

There are many water agencies in San Mateo County. Residents of most cities receive water from the city or a special district within the city. They can contact their City Hall for more information about water rebates. California Water Services Company provides water service to San Carlos, the city of San Mateo and South San Francisco. Its rebate programs can be found [here](#). Many water providers from cities or the California Water Services Department also offer rebates.

San Mateo County Check-It-Out Home Energy and Water Saving Toolkit

San Mateo County Energy Watch offers a [Check-It-Out Home Energy and Water Saving Toolkit](#) with free resources that community members can borrow from any public library in the county. It is designed to help residents perform a basic assessment of the efficiency of their home energy and water use and improve it where possible. This program also aims to help residents save money



on their utility bills and increase the comfort of their homes. The toolkit [user guide](#) includes information on how energy and water are used in homes and steps that can be taken to reduce use of both.

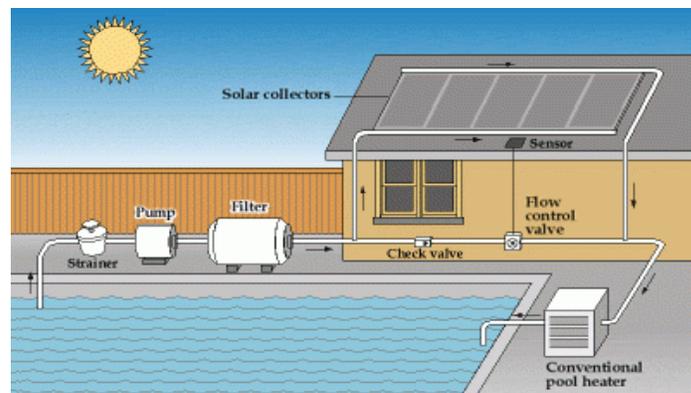
Brisbane and Pacifica Reduce Energy Requirements and Greenhouse Gases

Brisbane and Pacifica are two San Mateo County cities making notable improvements in reducing their energy requirements and GHG emissions. [Brisbane](#) uses a solar thermal cover for its community pool and a variable frequency drive for the circulating pump to reduce conventional energy use and global greenhouse gases. Solar thermal heating provides 10 to 20 percent of the energy needed to heat the pool, depending on weather.

[Pacifica](#) improved heating and lighting in its Council Chambers while reducing its utility costs. Rather than replacing a broken boiler system with a traditional central heating system, the city installed a ductless “mini-split” heat pump to save energy and make the building’s temperature more comfortable for occupants. This pump prevents 30 percent of the energy from being lost by pushing heated air through leaky and bulky ducts. Pacifica also improved lighting quality in the Council Chambers by replacing more than 100 outdated light bulbs with highly efficient LED lighting. It is expected that this action will reduce the building’s annual energy use by 22,000 kilowatt hours, saving the city 10 percent on the building’s electricity costs each year and trimming the city’s carbon footprint by almost 16 metric tons of carbon dioxide a year – the equivalent of the pollution from more than three cars for one year.[1] These projects are small steps toward reaching each city’s goal of significantly reducing greenhouse gas emissions and their carbon footprints.

Solar Swimming Pool Heaters

[Solar swimming pool heaters](#) are cost competitive with both gas and heat pump pool heaters and can significantly reduce swimming pool heating costs and annual operating costs while reducing GHG emissions. With a solar swimming pool heating solution, pool water is pumped through a filter and then through a solar collector, where it is heated and then returned to the pool. This system requires little maintenance and roof space and has a long lifespan. However, solar swimming pool heaters are less efficient in the evening and on overcast days than a traditional pool heating system, require more up-front cost and can take a bit longer to initially heat a pool. *For image credit, click [here](#).*



Water-Efficient Landscaping Ordinances

Water poses one of the most difficult-to-achieve building and landscaping efficiencies. Local codes and state guidelines regulate the safe disposal of gray water and sewage from buildings. Houses or buildings that strive to safely recycle, treat and reuse water on-site often face regulatory challenges that go beyond simple building permits. With water shortages in some states becoming the norm, changes to these regulations may be a step toward allowing buildings to become more water efficient. Other building efficiencies that face regulatory challenges include on-site wind generation and solar panels on constricted sites that could otherwise be used for reforestation or retaining/increasing tree canopies.

According to the [California Department of Water Resources](#), about half of all urban water use is for landscape irrigation in California, and large water savings can be gained by efficient landscape design, installation and maintenance. The State of California publishes and maintains the [Model Water Efficient Landscape Ordinance \(MWELO\)](#) for use by local governments. MWELO's purpose is to promote the values and benefits of landscaping practices that integrate conservation and efficient use of water. The model ordinance establishes a structure for planning, designing, installing, maintaining and managing water-efficient landscapes in new construction and rehabilitated projects. Multiple municipalities in San Mateo County, including [Menlo Park](#), [San Mateo](#), [Millbrae](#) and [Brisbane](#), have adopted water-efficient landscaping ordinances based on this model.

Water Reuse

Landscape Design Assistance Programs. These programs support water conservation in landscaping by supporting water customers' transition from turf lawns to water-efficient landscaping. Many cities offer turf conversion rebates that are often underutilized, especially considering their financial benefit to customers. Supplementary design assistance programs increase participation in these programs and make attractive, user-friendly and sustainable lawns more accessible. Many San Mateo County water districts already participate in the Bay Area Water Supply and Conservation Agency's (BAWSCA's) [Lawn Be Gone](#) program, which offers a rebate of \$1 to \$4 per square foot of turf removed from lawns.

Satellite Treatment Facility. Satellite plants are an ideal solution for businesses looking to improve water resilience when they are far away from treatment plants and centralized recycled water pipelines. By treating water closer to its source and next to its destination, satellite plants and their pipelines also form smaller, more energy-efficient circuits. In 2020 the Sharon Heights Golf and Country Club in [Menlo Park](#) completed construction of a satellite treatment facility. This plant will replace up to 400,000 gallons of freshwater a day with recycled water that would otherwise be treated and released into San Francisco Bay.

Rain Barrel Rebate. [Rain barrels](#) capture roof runoff to be saved and used for irrigation or other non-potable purposes. Rainwater reuse is a simple, cost-effective way for water customers to engage in water sustainability. Just 1,000 square feet of roof surface can capture 625 gallons of water per inch of rainfall. Depending on the size of a rain barrel and how often it is utilized, a San Mateo County household could save more than 11,000 gallons per year. Harvesting rainwater using a rain barrel not only saves money and water for irrigation, but also helps prevent stormwater pollution from urban runoff and moderates flooding. Click [here](#) to learn more about the Flows to Bay rain barrel rebate program and image credit.



Gray Water and Purple Pipes.

[Gray water](#) is gently used water from bathroom sinks, showers, tubs and washing machines, i.e., all streams except for the wastewater from toilets. It can be used for landscaping, crop irrigation and other non-potable purposes. Local ordinances could encourage or mandate use of this reclaimed water for public landscaping and irrigation. The San Francisco Public Utilities Commission has a thorough [Graywater Design Manual](#) for homeowners and professionals who want to install residential graywater systems for subsurface outdoor irrigation. Additionally, new construction and significant remodels could be required to install an option for “[purple pipes](#)” that carry reclaimed water from bathrooms and laundry rooms to landscaped areas. Image [credit](#).

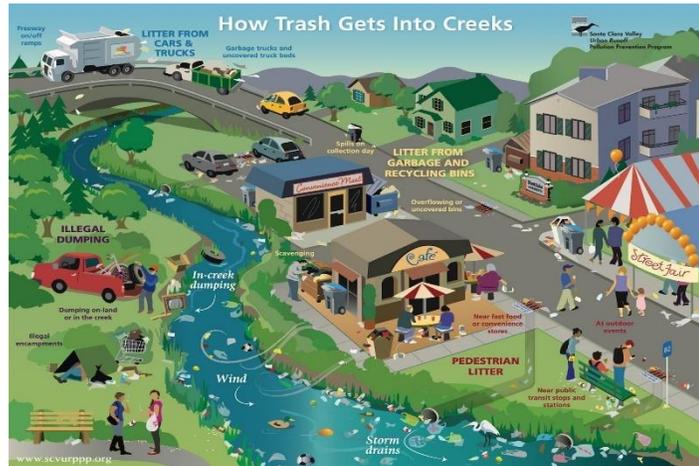


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[Ecology Action](#) has proposed an ordinance requiring residential property owners doing major construction to build dual-drainage plumbing and dual water supply-graywater systems into their home construction and remodeling projects. [Greywater Action](#) is a collaborative of educators who teach residents and tradespeople about affordable and simple household water systems that dramatically reduce water use and foster sustainable cultures of water. Its [teaching tools](#) include interactive models of composting toilets and graywater systems, design and installation workshops, and presentations.

Stormwater Pollution

As rain, stormwater and irrigation runoff flow across impervious surfaces like rooftops, paved roads and even oversaturated lawns, they pick up and carry pollutants such as litter, animal waste, sediment, pesticides, motor oil and other urban chemicals. This untreated stormwater runoff and other sources of "outdoor drainage" create [stormwater pollution](#) that typically flows into street drains, then into San Mateo County streams and creeks, and ultimately into San Francisco Bay and the Pacific Ocean, making these waterways unsafe for recreational contact and fishing and for creatures that live in them. San Mateo County cities are required by law to prevent contamination of stormwater by utilizing clean work practices, inspecting businesses and construction activities, and educating the public. The [San Mateo Countywide Water Pollution Prevention Program \(SMCWPPP\)](#) is a comprehensive countywide effort to prevent stormwater pollution. *For image credit, click [here](#).*



City of San Mateo's [Green Infrastructure Plan](#)

Rather than accelerating irreversible damage to ecosystems caused by urbanization, the City of San Mateo has adopted a [Green Infrastructure \(GI\) Plan](#). This plan is designed to guide the expansion of GI initiatives that focus on using natural solutions to capture, filter and convey stormwater runoff instead of building more impermeable structures. These solutions include rain gardens, bioswales and subsurface infiltration systems. Concrete buildings and roadways as well as other impermeable construction prevent water from soaking into the ground and contaminate water with oil, metals and other toxins as it travels across these surfaces before entering the bay. GI projects have several advantages: cleaner water and air, reduced flooding, better water supply, safer travel, climate resilience and a more pleasant environment.

[Rainwater harvesting](#) is the collection of runoff from a structure or other impervious surface "at the source" in order to store it for later use. Traditionally, this involves harvesting rain from a roof. Gutters channel the water into downspouts and then into storage vessels. Rainwater collection conserves clean water for animals or landscape plants, reduces stormwater runoff from homes and businesses, and protects local creeks, San Francisco Bay and the Pacific Ocean by reducing urban runoff that transports litter, motor oil, copper and other pollutants into storm drains. BAWSCA and participating member agencies are partnering with SMCWPPP to offer [rebates](#) for the purchase and installation of qualifying rain barrels.

Transportation and Clean Energy

COVID-19's Impact on the Transportation and Energy Consumption Sector

Many state and regional economies had to shut down beginning in February and March of 2020 to prevent the spread of COVID-19. According to the Institute for Regional Studies in Silicon Valley, annual GHG emissions in Silicon Valley could decline by an estimated 8 to 21 percent year-over-year, based on measured declines in vehicle miles traveled in March and April. Similarly, global GHG emissions are expected to decrease by 4 to 8 percent this year due to the pandemic. One major factor making the regional estimate higher is Silicon Valley's relatively clean electricity and a greater dependence of total emissions on the transportation sector.[1] Other notable impacts on the transportation sector include:

- SamTrans (San Mateo County's bus system) saw a drop in ridership of 65 to 70 percent on most routes, resulting in reduced services to 31 routes due to low demand.[2]
- California transit agencies are expected to lose \$2 billion in fare revenue and operational expenses, leading to trickle-down effects economically as transit agencies furlough employees and defer payments to contractors. However, transit agencies are expected to receive about \$4 billion in stimulus funding.[3]

Work from Home/Telecommuting

As the global pandemic continues, telecommuting has become an increasingly attractive option for companies. Due to a combination of benefits (decreased transportation emissions, rent savings and increased workforce productivity), the San Mateo County Board of Supervisors voted on June 30 to encourage all employers in the county to offer employees the option to work from home and telecommute when feasible.[4] Technology companies in the Bay Area (e.g., Google, Twitter, Facebook) were among the first to embrace a fully remote workforce, and other businesses have been following suit. In addition, San Mateo County has offered \$1 million in grants to small businesses adversely impacted by COVID-19.[5]

County's and Cities' Response to COVID-19

On April 27, 2020, the Redwood City Council authorized a temporary pilot program to encourage reduced driving on a few streets while the shelter-in-place order (due to COVID-19) was in effect. The intent of the [Slow Streets program](#) is to allow residents to more safely walk, roll and bike with members of their households on



City of Redwood City Announces Slow Streets Pilot Program to Enable Walking and Biking

already low-traffic streets and to promote physical distancing of at least 6 feet by creating new low-traffic, low-speed streets. In total, there are approximately 5.5 miles of temporary soft closure (3 percent of total streets in the city). To view a printable map, click [here](#). Other cities that have closed streets to traffic to allow for safe walking, biking and dining include San Mateo, Foster City and Burlingame. *For image credit, click [here](#).*

California Clean Transportation Program

The Clean Transportation Program is a \$100 million fund that plays an important role in achieving California’s ambitious goals regarding mitigating climate change, improving air quality, reducing petroleum consumption and adopting zero-emission vehicles.[6] The fund is used to develop and deploy advanced transportation and fuel technologies and will run through January 2024.

Spare The Air

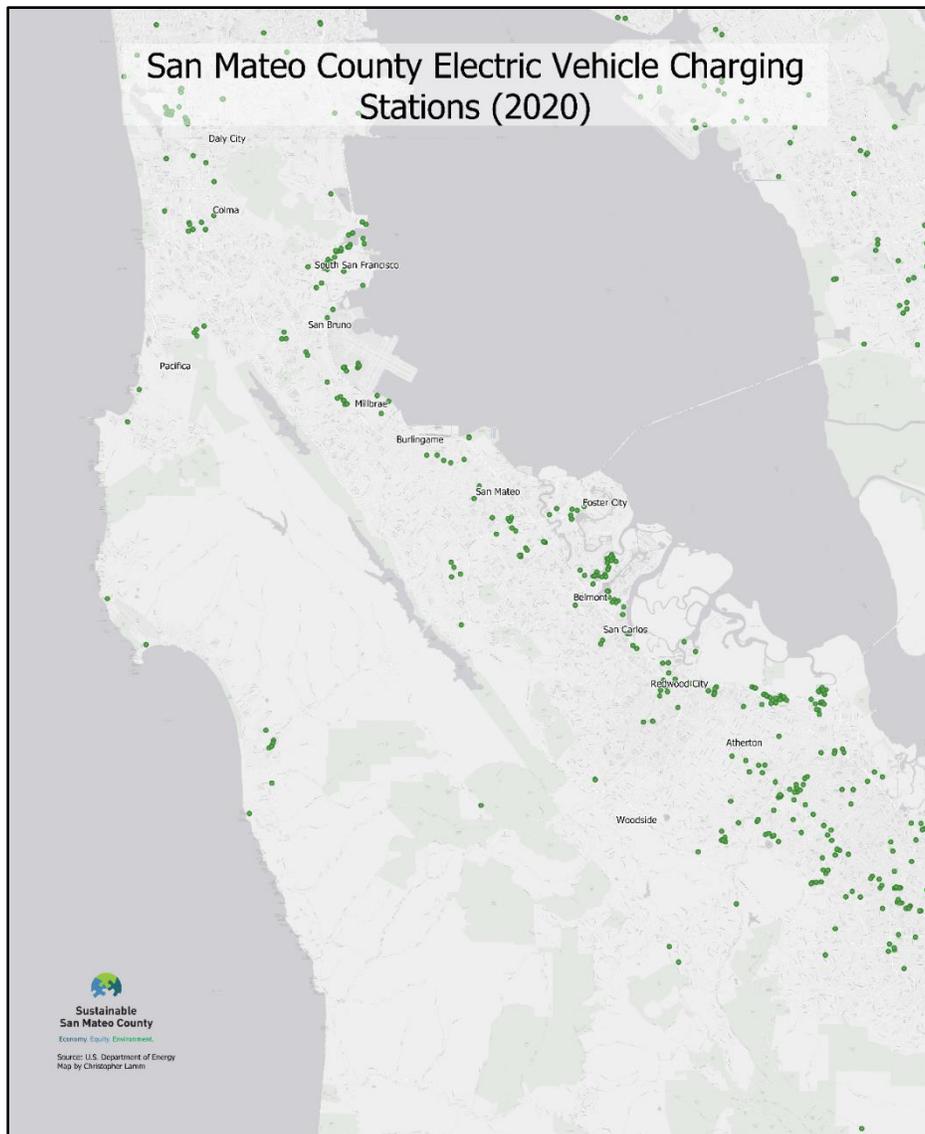
Spare the Air focuses on educating and helping residents choose actions that will improve air quality and make the Bay Area a healthier, more enjoyable place to live. The organization’s [commute tips](#) offer suggestions on how to help improve air quality in the Bay Area. Spare the Air also provides a list of tips and incentives that are offered for various forms of transportation in the Bay Area. Click [here](#) to know more.

Clean Bus Company

Proterra, based in Burlingame, is a leader in the design and manufacture of zero-emission electric transit vehicles, and it also offers electric vehicle technology solutions for heavy-duty applications. As major cities are converting to 100% electric fleets, Proterra vehicles have become one of the most popular electric buses on the road in North America. Proterra has sold more than 950 electric buses to 100 communities across 43 U.S. states and Canadian provinces.[7]



SamTrans is rolling out a fleet of electric buses. Credit: San Mateo County Transit District



Current EV charging infrastructure in San Mateo County (as of Sept. 2020)

Social Equity in Transportation

The [Transportation Equity Allied Movement Coalition \(TEAMC\)](#) is a coalition of about 30 organizations working to advance transportation solutions that promote social equity, public health and safety, and environmental protection in San Mateo County. People from low-income communities are at a disadvantage when it comes to accessing clean forms of transportation. TEAMC brings together diverse voices to advance community-supported transportation solutions that provide greater access to opportunity. In 2018 TEAMC launched a massive campaign to ensure that SamTrans would prioritize community needs in its next expenditure plan. That plan will guide how \$80 million in tax revenues are spent every year, helping to shape the future of transportation in the county.

Car-Share Programs in San Mateo County

San Mateo County offers a variety of ride-sharing programs for residents and commuters. These include carpool discounts through [Scoop](#), San Mateo's ride-share app, which lets people book carpool rides based on where they are going and presently has 40,000 subscribers.[8] The county offers another carpool incentive through [Commute.org](#) (San Mateo County's agency for transportation demand management), under which a person who carpools for 10 trips receives a \$25 gift card. Carpools logged in San Mateo County as part of that program more than quadrupled from 6,400 in September 2018 to well over 27,000 in April 2019.[9]

Guaranteed Ride Home Program

Commute.org's [Guaranteed Ride Home Program](#) (GRH) reimburses people who commute to a workplace in San Mateo County or students who commute to a participating college in San Mateo County for the cost of their ride home in the event they have an emergency. Commuters can use any form of transportation to get home, such as public transit, a ride-hailing app like Uber or Lyft, car sharing or a taxi, and they will be reimbursed up to \$60 per trip (excluding gratuities) up to four times a year. Commuters using public transit for their GRH ride will receive a \$5 e-Card bonus from Commute.org.



Redwood City's Safe Pedestrian Routes to Schools Plan

This program works to increase students' and families' knowledge about pedestrian and bicycle safety, provide volunteer training and promote options for physical activity. It also fosters collaboration with professional partners to further identify and address physical barriers to safety.[10] [Redwood City 2020](#) is inviting schools to host educational programs during and after the school day, and it is contracting with vendors to provide hands-on programming such as bicycle rodeos and school-based workshops for students and families. [Redwood City Parks and Recreation](#) is continuing its successful SPOKES program, which teaches students about bicycle safety and basic bicycle maintenance and repair.

Mobility and Access for Pedestrians, Cyclists, and Public Transit Users

Complete Streets

In California, all cities and counties are required to include [Complete Streets](#) as a part of their circulation plan. Complete Streets are designed and constructed to serve all users of streets, roads, and highways, regardless of their age or ability, or whether they are driving, walking, bicycling, or taking transit. To learn more, click [here](#).

Hybrid/electric cars and charging infrastructure in SMC, discount on electric vehicles

[Peninsula Clean Energy \(PCE\) offers various incentives for electric vehicle purchases in San Mateo County.](#) These range from rebates for low-income households looking to purchase used electric cars (up to \$10,000 in value) to providing \$24 million in funding for EV charger installations in workplaces, multi-unit dwellings, colleges, public parking garages/lots and other public locations. Click [here](#) for details. In September 2020 California Governor Newsom signed an executive order that bans the sale of new gas-powered passenger cars in California starting in 2035.

Highway 101's lane for cleaner cars

Due to large amounts of traffic congestion and fuel-efficiency considerations, drivers of certain plug-in hybrid, alternative fuel and clean-air vehicles (with a white or green decal issued by the Department of Motor Vehicles) can freely use [High Occupancy Vehicle](#) lanes without having to meet the requirement of two or more passengers. The U.S. 101 Express Lanes Project, scheduled for completion in 2022, will convert the fast lane into a toll lane that will allow buses and carpools with three or more passengers to travel free of charge, and charge vehicles with two passengers less than those with one passenger. The auxiliary (outside) lanes will be changed to through-lanes.[11]

Renewable Energy Financing

San Mateo County is committed to providing financial incentives and rebates to residents who are looking to purchase renewable energy systems and other energy-efficiency upgrades. Available in San Mateo County are programs such as [Property Assessed Clean Energy](#) (PACE), a financing mechanism that allows homeowners to install energy efficiency, water efficiency or clean energy projects with no upfront costs; [SunShares](#), an annual, limited-time program that offers discounts on residential solar and EVs; and [Bay Area Renewable Energy](#) (BayREN), which offers energy use reduction improvements through partner contractors. A home energy adviser can help residents of detached single-family homes and buildings with up to four attached units to receive cash rebates for installing energy-efficient measures.

Property Assessed Clean Energy (PACE)

The [property assessed clean energy](#) (PACE) model is an innovative mechanism for financing energy efficiency and renewable energy improvements on private property. PACE programs exist for both commercial (C-PACE) and residential (R-PACE) properties. The unique characteristic of PACE assessments is that the assessment is attached to the property rather than to an individual. Click [here](#) to learn more. It is important to note that PACE funding may require using a contractor from a pre-approved list of providers. Not all solar and energy contractors are on that list. Choosing PACE financing is an individual decision based on comparing financing costs and payments provided through PACE to rates and costs from other financial institutions. PACE financing can fund solar installation, water conservation, energy efficiency and more. Property owners receive 100% financing of improvement costs, and projects can be cash-flow positive from day one.

PACE Study: A [2018 study by Berkeley Lab](#) found that between 2010 and 2015, residential Property Assessed Clean Energy (R-PACE) programs increased deployment of residential solar photovoltaic (PV) systems in California by about 7% to 12% in cities that adopt these programs. R-PACE is a financing mechanism that uses a voluntary property tax assessment, paid off over time, to facilitate energy improvements and, in some jurisdictions, water and resilience measures. While previous studies have demonstrated that early, regional R-PACE programs increased solar PV deployment, this new analysis is the first to demonstrate these impacts from the large, statewide R-PACE programs dominating the California market today, which use private capital to fund the upfront costs of the improvements. Read the complete study [here](#).

Solar and Energy-Efficiency Financing Programs in San Mateo County

San Mateo County's Office of Sustainability offers a range of tools, assistance programs and resources to help its residents and businesses to use energy wisely and reduce emissions. These offers can range from the PACE program (mentioned earlier) to measures which can include retrofitting light fixtures, installing insulation and replacing single-pane

windows. Visit the [county's Office of Sustainability Energy Efficiency website](#) for more information and financing options.

Energy Resilience

Sustainable systems must maintain their function even in the event of disruptions to be considered truly sustainable. As the energy landscape undergoes a transformation from fossil fuels to cleaner energy and navigates the impacts of climate change – including increased wildfires and heat waves that lead to sudden demand surge – it is imperative to build energy resilience on both the supply and demand sides.

Resilient grids hedge against the negative effects of increasingly intense weather events and support continuous, critical electricity service. Supply-side energy resilience is achievable, in part, by modernizing existing grids and designing resilient, new grids able to quickly resume their system functions after a disturbance. However, the stability of the electricity supply may impact energy pricing and continuous power availability.

Energy resilience on the demand side must ensure that at-risk populations, including those belonging to lower-income and/or medically vulnerable communities, can afford clean and reliable energy supply and the needed storage options during emergencies. Additionally, the insurance costs relating to damages from wildfires and sea level rise (coastal flooding) place an additional financial burden on San Mateo residents who are vulnerable to these hazards. Solutions that provide affordable options for all communities will ensure equitable demand-side energy resilience.

Choices for medically vulnerable populations dependent on power-operated equipment

PG&E's [Medical Baseline program](#) is an assistance program for residential customers with special energy needs due to medical conditions. Enrollment in this program provides a lower rate on energy bills and extra notifications in advance of Public Safety Power Shutoff (PSPS) events. In addition, Peninsula Clean Energy's Power-On Peninsula program, which targets approximately 4,300 known Medical Baseline customers,[1] helps



people access clean backup power and other resources during power outages. Learn more [here](#). *Image: Continuous Positive Airway Pressure (CPAP) machine.*

The California Public Utility Commission's (CPUC's) [Self-Generation Incentive Program](#) (SGIP) offers rebates for installing energy storage technology at both residential and nonresidential facilities and covers the full cost of battery and operations. These storage technologies include battery storage systems that can function during a power outage. In

preparation for the wildfire season, the CPUC has authorized funding of more than \$1 billion through 2024 for SGIP. This funding prioritizes communities in high fire-threat areas, communities that have experienced two or more utility PSPS events, and low-income and medically vulnerable customers. The funds are also available for “critical facilities” that support community resilience in the event of a PSPS or wildfire.[2] To learn more about PCE’s energy resilience strategy, click [here](#).

Energy resilience through battery storage

Local Bay Area energy agencies are joining forces to stabilize California’s grid by providing residents and businesses with economical and emissions-free battery backup systems. East Bay Community Energy, Peninsula Clean Energy, Silicon Valley Power and Silicon Valley Clean Energy are issuing a joint solicitation for the installation of more than 30 megawatts of battery storage for their customers. The program will provide resilient solar power combined with battery storage to approximately 6,000 homes and hundreds of businesses in Alameda, San Mateo and Santa Clara counties, including those hit by recent PG&E power shutoffs. This innovative program also enables the use of local resources to fulfill the state’s “resource adequacy” requirements. Resource adequacy refers to energy-generating capacity that local agencies and utilities are contractually obligated to provide in order to ensure the safe and reliable operation of California’s electrical grid in real time.



Learn more about Peninsula Clean Energy’s 2020 Resilience Strategy [here](#).

Renewable Energy Procurement and Green Workforce Development

Peninsula Clean Energy hopes to build and sustain healthy communities by ensuring that every PCE-owned renewable energy development project will utilize local businesses, union labor and foster apprenticeship programs through multi-trade agreements and/or through multiple agreements for work.[3] In addition, PCE will proactively seek services from local and green-certified businesses and/or businesses that are taking steps to protect the environment. More information on these goals and how they will be accomplished can be found [here](#).

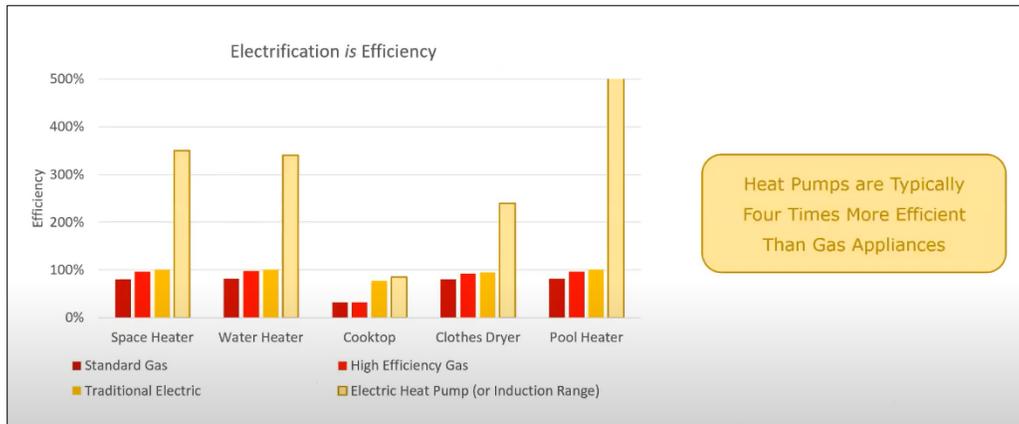
California Renewables Portfolio Standard

California's [Renewables Portfolio Standard](#) (RPS) is one of the state's key programs for advancing renewable energy. It mandates that 33% of electricity sold by the state's investor-owned utilities be generated from renewable resources by 2020. The program sets continuously escalating renewable energy procurement requirements for the state's load-serving entities.

Senate Bill ([SB-100](#)) revised the state's [RPS](#) program. It requires that 60% of electricity retail sales be served by renewable resources by 2030 and that all of the state's electricity come from carbon-free resources by 2045.

Municipal Green Building

BayREN provides free engineering technical assistance and funding to help local governments, businesses and homeowners save energy and money while reducing their carbon footprint. It also offers incentives to homeowners for switching to energy-efficient electric heating appliances, including heat pump water heaters. Additional incentives are available to multifamily property owners switching from gas-fueled space heating and cooking appliances to cleaner, highly efficient electric alternatives. Click [here](#) to find out more about the BayREN programs and its eligibility requirements.



Credit: [BayREN Regional Forum - No Missed Opportunities: Decarbonization of Public Buildings](#), Sept. 16, 2020

The [Municipal Zero Net Energy/Zero Net Carbon Assistance](#) program helps municipalities retrofit or construct buildings to meet zero net energy (ZNE) or zero net carbon (ZNC) goals by providing engineering analysis and recommendations for projects. A building meeting zero net energy standards is one where the amount of energy produced by on-site or adjacent renewable energy resources (e.g., solar panels) is equal to the amount of electrical and natural gas energy consumed by the building annually. A building achieves zero net energy when, over the course of 12 consecutive months, the building consumes an amount of energy less than or equal to the renewable energy generated on site. Click [here](#) to read more about zero net energy and get assistance.

Energy and Land use

Many renewable energy technologies, such as wind and solar farms, require enormous amounts of land if deployed at scale, putting them in competition with other land uses, including agriculture. Critical factors in siting mega-solar plants are access to sunlight, solar irradiation, available land, market demand, local expertise, land prices and sufficient transmission infrastructure. Factors that slow down siting for large mega-solar plants include insurance, ownership, permitting, California Environmental Quality Act (CEQA) compliance and zoning problems.

The [San Mateo County Energy and Water Strategy 2025](#) provides a detailed strategy of the county's vision to transition to cleaner energy and water use. It focuses on optimizing energy use through deploying smart design and technologies in existing buildings. It also focuses on pilot projects using new energy-storage and microgrid technologies, load balancing in real time, decarbonizing both the supply and demand, expanding electric vehicle infrastructure, better leveraging data, and addressing financing and funding issues. The strategy aims to enhance indoor and outdoor water conservation through policy, education and best practices. It also prioritizes development and use of water data and expanded use of on-site recycled water, along with utility-supplied recycled water.

Potential actions for implementing this energy and water strategy include installing solar electric panels, wind turbines and solar hot water systems; developing cogeneration and alternative fuel at city facilities; and investing in clean energy systems by providing rebates and by reducing or eliminating permit fees altogether. Several cities in San Mateo County have installed or plan to install solar electric systems in government facilities.

One example of at-scale solar PV application in San Mateo County is the 200-megawatt utility-scale Wright Solar Facility in Los Banos (in California's Central Valley), which broke ground in October 2018. Peninsula Clean Energy began providing more solar power to San Mateo County from the Wright Solar Project in January 2020, when it went online. It is, as of to date, the largest renewable energy installation ever built for a Community Choice Aggregation agency, consisting of 650,000 4-by-2-foot solar panels.[1] PCE has an exclusive 25-year power purchase agreement (PPA) with Wright Solar Park LLC to buy all of the facility's electricity to power more than 100,000 San Mateo County homes. *Image credit - [here](#).*



Community Microgrids and Mobile Microgrids

Another example of using solar PV to advance energy solutions for communities in San Mateo County is the Hoover Solar Emergency Microgrid (SEM). Microgrids support community energy needs with better economics, reliability and resilience while reducing carbon emissions. A microgrid is a local energy grid which can get disconnected from the traditional grid and operates autonomously. The U.S. [Department of Energy](#) describes a microgrid as "a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island mode."

Julie Cart of CalMatters explains, "A microgrid can be as simple as a single home operating on its own solar power, or a complex series of connections between a power source and distribution lines to end users. It can run a business, a neighborhood or even a city. It can be any size and may be fueled by renewable energy stored in batteries, or by generators run on a conventional fuel such as diesel."

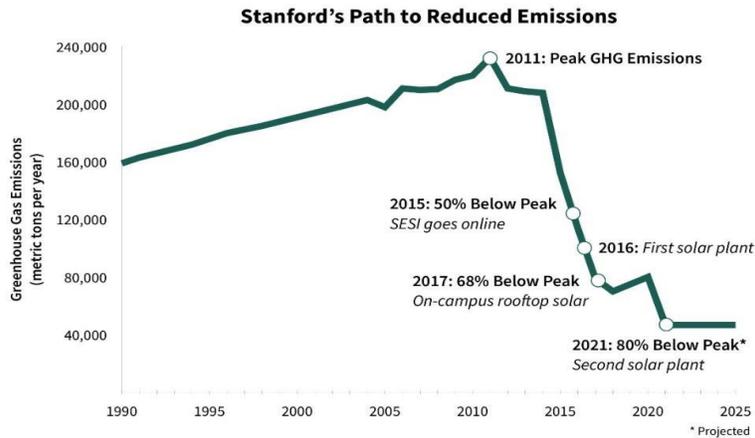
Microgrids are subsets of power systems, designed to operate both in parallel with the main grid and independently of it, in an island or independent mode, as needed. During outages, a microgrid can be decoupled from the main grid and run in a standalone, islanded mode, ensuring continuous power supply within the microgrid. Microgrids can provide combined heat and power (CHP), using the waste heat from making electricity to heat buildings that are connected to them. As they have local generation, they reduce peak demand on the overall grid and are relatively economical due to absence of delivery tariffs paid to maintain the larger grid.

The major benefits of an SEM are cost savings on a customer's utility bill from energy usage reduction, load shifting and demand charge reduction, as well as the ability to act as a valuable community resource in case of a natural disaster. These benefits are all on top of building overall energy resilience. The two key challenges hindering SEM uptake are inadequate feed-in tariffs [2] and the lack of integrated design tools that combine demand charge reduction with off-grid response. To learn more about SEM utilizing residential and working spaces, click [here](#).

An example of a well-functioning community microgrid in San Mateo County is the Stanford Redwood City microgrid. It leverages the resources of a top-tier research university and showcases how distributed energy resources (DER) can be configured to provide energy cost savings and resilience for campuses and buildings nationwide. The Stanford campus in Redwood City is a smaller-scale version of the [Stanford Energy System Innovations \(SESI\)](#) at Stanford's main campus in Palo Alto. SESI has grid-sourced electricity and has an efficient electric heat recovery system. Stanford University's goal is to become 80% carbon-free by 2025.

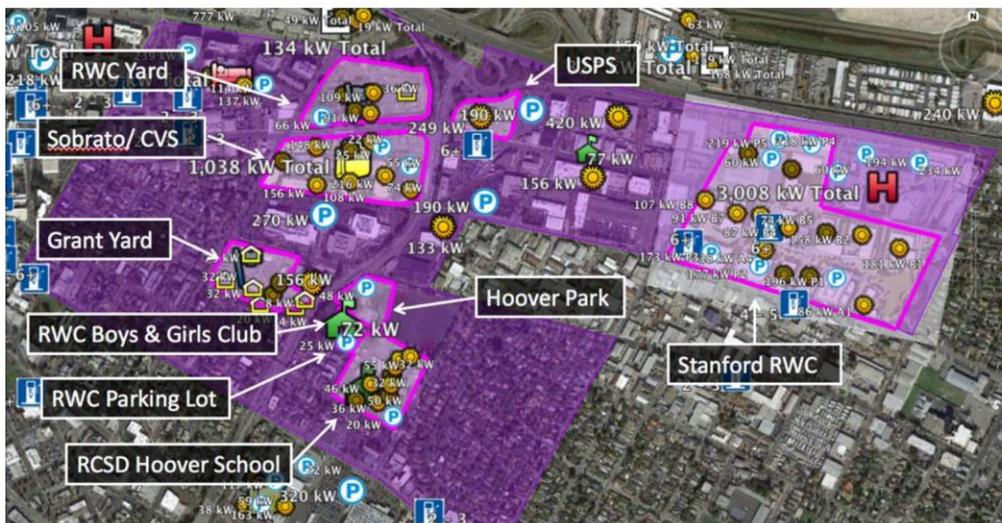
Stanford Redwood City is a new, two-phase real estate development of more than a dozen buildings located in the disadvantaged Stambaugh-Heller neighborhood within the city.

This community microgrid is for a large campus with multiple buildings and meters as well as highly customized energy solutions for central heating and hot water, while the ownership model is representative of a nonprofit site owner/project beneficiary. To read more about Stanford's journey toward clean energy transition, go [here](#). To learn more about Stanford's SESI project, click [here](#).



Credit: Stanford University – Click [here](#)

The Hoover School, located in Redwood City, operates year-round to serve 700 students with approximately 100 staff employees. A full-service cafeteria, after-school programs and summer camps make Hoover an important community resource. Hoover School's SEM design criteria have already incorporated energy-efficiency retrofits that allow for a properly sized solar PV system to be designed and installed without risk that the system may be oversized. The school also enjoys a Red Cross emergency shelter designation. The goal of this SEM is to provide power continuity in case of short-term (minutes-long) to long-term (days-long) outages.



Overview of Redwood City's SEM sites. Credit: Peninsula Advanced Energy Community

Burlingame Solar Carport: In November 2019 Burlingame became the home of one of the largest dual-axis solar carports in the country, with each of the six trackers supporting up to 100 solar panels. The tracker captures light earlier in the morning and later in the evening than does a fixed tilt array, which enables it to yield 45% to 60% more energy than a fixed-tilt solar array using the same number of solar panels, at a cost of about 50% less.[3] The dual-axis design also outperforms single-axis trackers, with a 20% energy boost. The Mechatron [4] array used in this solar carport provides a levelized cost of energy (LCOE) at 7 cents per kilowatt-hour (kWh), compared with an estimated LCOE of 24 cents for a fixed-tilt design, and it will deliver a return on investment in less than four years. There are plans to add several EV charging stations, each of which can recharge up to nine vehicles. This tracking solar carport system charges electric vehicles and provides 90% of the power needed at Kahala Tower, an office building near the San Francisco International Airport.



Dual-Axis Solar Carport, Burlingame. Credit: [Solar Power World Online](#)

Waste to Energy and Waste Management

One important aspect of sustainability involves the life cycle of materials and energy extracted, consumed, transformed and disposed of in the functioning of urban societies. Modern-day waste management should look at waste as a valuable resource, rather than simply bury or burn it. One promising technique is waste-to-energy (WTE) conversion, which offers an efficient means of managing waste commensurate to the needs of large population urban centers, while providing a source of alternative and renewable energy. San Mateo County's sole landfill, Ox Mountain, is expected to reach capacity in only 14 years (by 2034). To achieve optimal waste energy management, it is key to link the [circular economy](#) framework (under which a restorative and regenerative economy takes a systematic approach to economic development designed to benefit businesses, society and the environment) to the [waste-to-energy nexus](#) framework (under which one utilizes reuse, reduction, recycling, recovery and reclamation techniques to address waste management, energy demand, and environmental concerns).



Credit: [here](#)

SMC has many innovative waste management pilot programs in place, including the Organics to Energy (O2E) Pilot Program and Stanford University's Pilot Water Treatment Plants.

Organics-to-Energy Pilot Program in San Mateo County

Even though most of San Mateo County's residents understand the value of composting organic material either at home or placing it in the green bin for curbside pickup, participation rates are very low. Some organic waste even ends up as trash, creating an unnecessarily large volume of waste, which is becoming increasingly harder to handle.

The South Bay Waste Management Authority (SBWMA), branded as RethinkWaste and the Recology Center in San Carlos, is responsible for collecting, transporting and disposing of waste from homes and businesses. The cities where it operates in San Mateo County are Atherton, Belmont, Burlingame, East Palo Alto, Foster City, Hillsborough, Menlo Park, Redwood City, San Carlos and San Mateo.

SBWMA has initiated a pilot [Organics-to-Energy \(O2E\)](#) project to separate organic waste from trash. This initiative was undertaken even before California required that such steps be taken; the state now requires all jurisdictions to significantly reduce organics going to landfill where it produces and off-gasses methane, one of the worst greenhouse gases. The agency has purchased a \$5 million extrusion press to remove organic material, convert it to a liquid slurry and transport it by trucks to wastewater treatment plants. At the plants, it will be dumped into anaerobic digesters for conversion to methane and then converted into energy. When completed, the project is projected to divert up to 200 tons of organic waste per day from landfills. The methane will be used to generate electricity and power engines at the wastewater plants, which, while still a combustion process and therefore a greenhouse gas contributor, will reprocess methane into clean energy.

Stanford University’s Pilot Anaerobic Water Treatment Plant

Funded by a \$2 million California Energy Commission grant, Stanford University researchers collaborated with Silicon Valley Clean Water engineers to build and operate a small anaerobic water treatment plant in Redwood Shores. This pilot project is expected to operate through March 2021. It is cost-effective, with a potential savings of \$2 million a year (compared to a traditional aerobic plant), and takes less physical space than an industrial-scale anaerobic plant (a 40% smaller footprint). It can digest pharmaceutical drugs and powerful household and industrial herbicides out of the waste stream, meaning that treated water could be used for “higher value” uses, including groundwater replenishment or in drip irrigation. In the long term, it could also be used for drinking.



*The anaerobic wastewater treatment plant in Redwood Shores represents a fundamental shift in water treatment technology.
Credit: Stanford.edu*

Composting

San Mateo County's Office of Sustainability created a website to educate residents about [how to compost](#). This is an effective communication tool that simplifies conveying recycling, composting and waste guidelines to residents. RethinkWaste's [interactive website](#) helps residents test their waste-management knowledge.

As part of its waste-energy management efforts, residents of 12 cities in the county receive CartSMART, a weekly [curbside collection service](#) for recycling, composting and trash once a week. The service is part of a 10-year contract (began in 2011) between Recology and RethinkWaste, also known as the South Bayside Waste Management Authority. The county's Office of Sustainability also runs a [community garden partnerships program](#) that partners with local community organizations and businesses to build vibrant community gardens and promote sustainable composting techniques.

Composting helps keep organic waste from ending up at Ox Mountain, San Mateo County's sole landfill, which is near capacity. One such partnership is [Compost Hub](#), a community compost network. Residents are able to bring their food scraps to the weekly farmers market located in East Palo Alto in exchange for vouchers to use at the farmers market. Additionally, residents receive free access to education workshops and free airtight bins that they can place under their sinks. [Image credit](#).



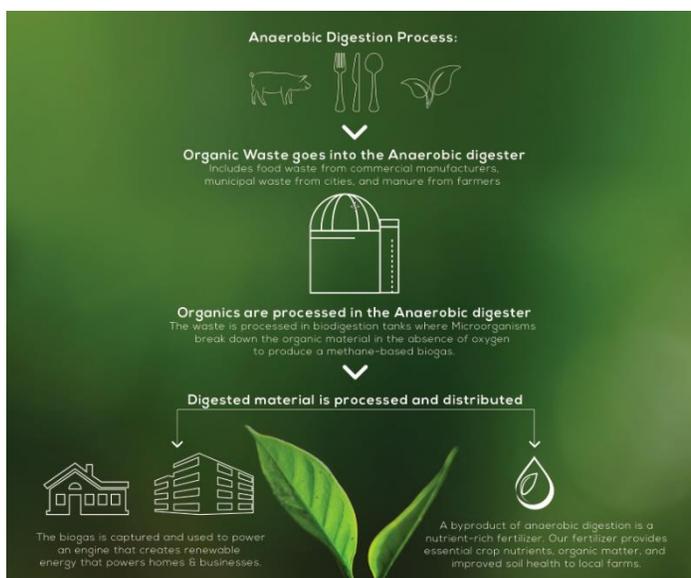
The [Recology](#) team works with businesses and community partners to implement new recycling programs or improve existing programs. The team help partners apply best management practices for recycling and composting items that are eligible, to keep them out of the landfill. A prime example is the Promontory Point apartment complex, located in Foster City. It is a multifamily dwelling with 90 units, totaling three separate buildings. The Recology team found that 30% of residents' organic waste was being placed in landfill carts. It recommended implementing and increasing organics services and decreasing garbage service by providing more green composting bins and decreasing the number of black trash bins. [Image Source](#).

COVID-19's Impact on Waste Management

On March 18, 2020, San Mateo County issued health orders, shelter-in-place ordinances and social distancing protocols designed to mitigate the COVID-19 pandemic. Although the full impact of these new policies has not been fully studied yet, below are a few observable, immediate impacts on waste management:

- The RethinkWaste facility continues to receive waste during COVID-19. Residential waste generation continues, but commercial and development waste generation has drastically declined.
- Residential customers increased recycling during the shelter-in-place period, and RethinkWaste was able to upgrade its machinery and technology during this time.
- The O2E Program has been delayed as the needed volume to run the program is not met by residential food waste only and depends heavily on local merchants' food waste volumes.[1]
- Reusable bags for grocery shopping were banned temporarily, leading to an increase of plastic bag usage. Personal Protective Equipment (PPE) such as gloves, masks, and wipes must be thrown away for health and safety reasons; these items cannot be recycled as they may contaminate the recycling stream and threaten the health and safety of workers at recycling facilities. As PPE is recommended for all individuals who need to work or go outside of their home, the amount of PPE being thrown away and headed to landfills is high.

An emerging topic in waste-to-energy management is anaerobic food waste digestion. Anaerobic digestion occurs naturally, in the absence of oxygen, as bacteria break down organic materials and produce biogas, which can then be used as an energy source. Some research indicates that optimal waste management systems pair an anaerobic food waste system with a composting system.[2][3] The EPA suggests that shifting to a solely anaerobic food-waste system is most effective and cites major benefits from such a system to the economy and to climate change mitigation efforts. Click [here](#) to learn more about anaerobic digestion and see a comparison with composting.



Credit: [Renergy](#)

Community Education and Outreach Efforts on Renewable Energy and Energy Efficiency

San Mateo County Office of Education's Environmental Literacy and Sustainability Initiative

The [San Mateo County Office of Education \(SMCOE\)](#) launched its Environmental Literacy and Sustainability Initiative at the start of the 2017-18 school year. The initiative's vision is for the school communities and leaders to prioritize sustainability integration and environmental literacy for all students. The initiative supports a broad variety of complementary programs and efforts, including:

- [Collective Impact - Campus as a Laboratory for Learning Program](#): This program utilizes the Collective Impact Approach to bring together school districts and their broader community to “green” one aspect of their school’s facilities and operations, while utilizing these efforts in curriculum and instruction as a “living laboratory” for learning. See a full description of this project [here](#).
- [Community-Based Environmental Literacy Partners Network](#): SMCOE regularly convenes the Community-Based Environmental Literacy Partners network to foster collaboration among organizations that offer environmental literacy programs. The goal of this network is to foster capacity and consistency building by aligning programs and further integrating them into districts and schools.
- [Environmental Literacy Initiative Community of Practice](#): With this project, SMCOE convenes a network of educators on a quarterly basis to focus on the knowledge, skills and values needed to move environmental literacy forward across all school communities. Its focus is to build capacity through comprehensive professional development, knowledge sharing, and joint campaigning to secure funding for environmental sustainability efforts.
- [Environmental Youth Leadership Network and Summits](#): The Environmental Youth Leaders Network brings together students in grades 7 through 12 who are eager to make an environmental sustainability impact in their communities. The network convenes three times a year for summits held during the fall, winter and spring.



[One Planet Schools Challenge](#): This recognition and awards program fosters a culture of sustainability in school communities across the county by providing a structure and roadmap for achieving the vision of sustainability integration. It identifies champions who are leading meaningful change and recognizes them for their positive impact toward creating a sustainable future.

[Schools for a Sustainable Future Summit](#): This annual one-day summit creates a space for networking, problem solving and exchanging innovative solutions that are driving environmental and social transformation in school communities.

[San Mateo Environmental Teacher Fellowships](#): This program offers paid teacher fellowships that build teacher capacity for designing and delivering hands-on, student-centered, solutions-oriented, and problem- and project-based learning experiences that integrate real-world environmental and social issues.

Online Community Outreach

[Freecycle.org](#) is a grassroots nonprofit movement of people who are giving (and getting) items for free in their own communities. Its main goal is to keep reusable items out of the landfills. This resource can be accessed by San Mateo County residents [here](#).



[Neighborland](#) is a public engagement platform for government agencies, developers and civic organizations. In the Bay Area, Neighborland has worked with the City and County of San Francisco and the cities of Oakland and San Jose to engage communities in planning, urban development and resilience building.

The [Buy Nothing Project](#) is an international movement of Facebook groups that give and share items among members. It has more than 1.2 million participants in at least 25 countries, led by at least 6,000 volunteers. Before buying anything, members are encouraged to ask the group if anyone has what they need. Groups in California are listed [here](#).

The [San Mateo County Green Challenge](#) educates and encourages individuals and households to contribute to energy efficiency by turning their efforts into a game. The game includes 10 sustainability-related categories followed by action items, of varying difficulty levels, that participants can complete in order to earn points. For example, under the energy-efficiency category, participants can take any or all of the 22 actions and earn

points. These actions range from drying clothes on the line to completing a home energy checkup to upgrading ovens/stoves. The platform also includes a moderated discussion forum and tips and tricks for the participants, making them aware of the impact of each of the actions. This gamified approach shows how each person can reduce impact, save money, improve community and help create a safer, healthier future.

[Nextdoor](#) is a neighborhood hub and social networking service that encourages the exchange of helpful information, goods and services. Information from the [San Mateo County Manager's Office](#) and [Peninsula Clean Energy Authority](#), as well as other local and city-specific renewable energy information, is available on Nextdoor.

[California Materials Exchanges \(CalMAX\)](#) CalRecycle's materials exchange portal helps connect businesses, organizations, manufacturers, schools, and individuals with the most effective online resources for exchanging materials.

[Resource Area for Teaching \(RAFT\)](#) is a way for businesses to donate surplus materials to schools. Raft has impressively diverted 300 tons of material from landfill annually and over 1 million cubic feet of upcycled materials to date.

Bay Area Regional Energy Network (BayREN)

BayREN implements energy savings programs throughout the nine Bay Area counties. It serves homeowners, renters, multifamily property owners, workers and businesses.

For [residents](#), BayREN Home+ offers cash rebates for home improvements while providing support services and a list of certified contractors. Single family homeowners can receive incentives for installing highly efficient electric space heating, water heating, clothes air-drying and induction cooking ranges individually or in combination with other building improvements. Through the Home Energy Score tool, BayREN assesses a home's envelope and major energy systems in a standardized way and then provides homeowners with customized suggestions for improving the home's energy efficiency. Energy-saving projects that are self-completed by residents or completed by contractors outside BayREN's approved list are not eligible for reimbursement.

BayREN offers cash rebates and no-cost energy consulting for multifamily properties undertaking energy and water upgrades. The program assists in planning energy-saving improvements designed to save 15% or more of a building's energy and water usage and provides \$750 per unit in rebates to help pay for the upgrade. Improvements can include heating and cooling systems, water heating systems, gas-to-electric conversions, lighting and appliances, building sealing and insulation, and electrification measures.

Participating Contractors and Assessors: BayREN is enrolling contractors for all its programs. Only enrolled contractors may perform work eligible for reimbursement. BayREN contractors or assessors get support for leads development, training and access to other regional workforce resources. You can learn more about this topic [here](#).

BayREN’s new innovative program provides small or medium businesses with upgrades for energy-efficient lighting, HVAC and refrigeration equipment at no “out-of-pocket” cost. Small or medium businesses must meet one or more of the following criteria: facility size of less than 50,000 square feet, energy use of less than 500,000 kWh/year or less than 250,000 therms/year, at least 12 months of prior-energy-usage history and location in one of the nine BayREN counties including San Mateo County. BayREN has partnered with the Mission Asset Fund (MAF) to provide small and medium businesses with 0% interest microloans of up to \$2,500 to help cover the cost of energy-efficiency improvements.

Other Programs for Schools and Places of Worship

Peninsula Clean Energy has awarded grants of up to \$75,000 each for innovative local pilot projects that reduce greenhouse gas emissions and deliver benefits to the communities of San Mateo County. [California Interfaith Power and Light](#) is one of the local pilot [awardees](#). Funding will enable California Interfaith Power and Light to recruit relevant professionals and develop plans to equip three to five faith institutions in San Mateo County to act as community emergency hubs. These hubs will have access to clean energy backup power through solar panels and battery storage. They will be open to all residents in the community in the event of an emergency, such as a major earthquake.

Partnership with the Hillsborough Unified School District

The Town of Hillsborough established a partnership with the Hillsborough Unified School District to complete Climate Action Outreach and Competition programs. The partnership involves friendly competition between schools on achieving energy efficiency at home; each participating home completes easy energy and water efficiency actions. This school partnership also planned a campaign similar to the [Cool the Earth Program](#) underway in Redwood City. Cool the Earth is an award-winning climate change program that uses a student-driven model to inspire families to conserve. It is a parent/volunteer-run program that focuses on kindergarten through eighth-grade classes. Students are provided with action books outlining 20 no- or low-cost ways in which their family can reduce carbon emissions. Adults and kids pledge to take environment-friendly actions such as turning off electronic devices when not in use, biking/walking to school instead of riding, and making the next car purchase electric.

San Carlos School District: More than \$1 billion in state revenue is now accessible for schools throughout the state to implement energy-efficiency upgrades through California Proposition 39 (Prop 39). [San Mateo County Energy Watch](#) has supported 20 school districts in the county by providing energy audits and assistance with writing Energy Expenditure Plans (EEPs) needed to access these funds. Out of the 22 K-12 school districts in San Mateo County, 20 submitted EEPs and were approved for Prop 39 funding. In 2018 the [San Carlos School District](#) was awarded \$1.5 million to add solar electricity generation at six sites; upgrade interior and exterior lighting to LED; install smart, programmable thermostats; upgrade to high-efficiency heating and cooling systems; and implement an energy management system.

Peninsula Interfaith Climate Action, a nonprofit group made up of several congregations, provides information and comprehensive resources on energy efficiency and renewable-energy options such as solar installations. It works with local congregations to save water and reduce greenhouse gases. Congregations have installed solar panels and EV charging stations and are exploring alternatives to natural gas for heating systems. Click [here](#) to visit the organization's resource page.

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