Energy

Solutions for expanding renewable energy use and access, and helping local governments and businesses reach their renewable energy goals

Community Microgrids

Localized microgrids improve the energy independence and offer other benefits

Impact

Having relatively small, centralized microgrids that supply renewable, preferably carbon-free, electricity to a one or more buildings or a particular area of a city decreases dependence on utilities and increases energy resiliency.

Description

Localized microgrids supported by renewable energy from various sources improve the energy independence of communities, reduce overall costs and reduce carbon emissions.

Where It's Been Implemented

A project map from Clean Energy Group (see References section below), shows the location of approximately 20 microgrid solar-plus-storage projects that have been completed in California. According to the map, as of late 2020, at least 15 more were underway, and still more were in the planning stages. Among microgrids installed in California are these three completed projects:

- Borrego Springs Microgrid in the Southern California desert town of Borrego Springs consists of a 700 kilowatt-hour (kwh) solar panel system and 700kwh battery storage, enough to power 70 homes.
- Blue Lake Rancheria Community Microgrid, in Blue Lake, Calif., has a 500kwh solar panel system and 900kwh battery storage that are used to power community buildings.
- The Fire Stations Microgrid Project in Fremont, Calif., provides backup power and resiliency for three fire stations.

Peninsula Clean Energy (PCE), San Mateo County's public, locally controlled provider of renewable electricity, is currently working on a project to establish three to five locations that can serve as community emergency hubs. They will operate on microgrids equipped with solar and battery energy. Making facilities such as emergency hubs and government facilities energy independent is only the start. A long-term goal may be to make all communities energy independent.

Cities in the southern part of San Mateo County, using a state grant, developed a Peninsula Advanced Energy Community (PAEC) policy paper in 2019 that outlines strategies to integrate emergency microgrids, EV charging infrastructure, zero net energy buildings and solar energy storage.

New York has a grant program called NY Prize that helps communities in the state explore the feasibility of creating microgrids. It has funded feasibility studies in more than 80 locations throughout the state. The principal goal of NY Prize is to identify technical and business models for microgrids that can be replicated throughout the state. The prize competition is now in Stage 2. Eleven communities received funding to develop a comprehensive engineering, financial and commercial assessment associated with installing and operating a community microgrid at their proposed sites in New York State. As of August 2020, construction was expected to begin soon.

Description

Microgrids support community energy needs with better economics, reliability and resilience, while reducing carbon emissions. 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 explains in CalMatters.org: "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."

Key Drivers

In San Mateo County, Pacific Gas and Electric's (PG&E's) public safety power shutoffs are among the principal drivers for the timeliness of microgrid development. The utility's annual rates for electricity are increasing, and its reliability is declining. Due to safety errors during dangerous wildfire conditions, PG&E implemented a policy to shut off all power to the grid to prevent further disasters. Many people find this policy unacceptable, especially for buildings that need power such as government facilities, hospitals and important research institutes. While these facilities may have backup generators, community microgrids offer long-term solutions for energy resilience.

Key Factors for Success

Microgrids greatly increase energy resiliency in areas of the state that are prone to shutoffs due to wildfires or other causes. Properly integrated into the electrical system, they can act as distributed energy storage systems, reducing the need for more electricity

generation plants, which often use natural gas or some other fossil fuel. Microgrids are particularly effective in those disadvantaged communities of color which are underserved by investor-owned utilities. In those communities there is an added benefit of cleaner air.

Key Obstacles

The PAEC policy paper referenced above found these obstacles to microgrids:

- The preference of building owners to make decisions based on (lowest) initial costs instead of life cycle costs
- Budgeting conflicts between capital costs and operating costs
- Split incentives between the building owner and tenants
- Limited financing options
- The question of who should fund and who should own advanced energy community components

Cost is one of the main obstacles for implementing new community microgrids throughout San Mateo County. The region is already electrified and connected to PG&E's larger grid, so a new microgrid may seem unnecessary. However, support for investment is likely to increase as dependence on PG&E becomes more difficult. A second equally difficult obstacle is the lack of widespread understanding of the definition, advantages and disadvantages of microgrids. PCE's project is expected to help resolve some of these problems.

Timeline to Implementation

Building an operational community microgrid is not a simple process. It begins with a feasibility assessment, then system design, cost estimation and financial planning are needed to drive the project. After procurement of energy and materials and once construction is complete, utility interconnection takes place. Finally, the microgrid needs to be optimized.

Return on Investment

Each microgrid project is unique. Detailed financial calculations are necessary in the planning process. A detailed project plan and preliminary design are required in order to develop costs and feasibility studies.

Resources

Peninsula Clean Energy website, January 2020 Resiliency Strategy, Energy Resilience plans. Contact: Kirsten Andrews-Schwind, kandrews-schwind@peninsulacleanenergy.com, or Carlos Moreno, cmoreno@peninsulacleanenergy.com

Resilient Power Project Map by Clean Energy Group of projects that operate independently from the grid

"Building a Microgrid: Understanding Your Microgrid Life Cycle and Design," Microgrid Knowledge, July 25, 2019

Peninsula Advanced Energy Community. Contact: Diane Bailey, Executive Director, Menlo Spark, diane@menlospark.org

NY Prize for Microgrid Installation. Contact Michael Razanousky, 866-697-3732, X3245

"Microgrids 101," NY Prize

"Five Things to Know About Microgrids," CalMatters.org, November 1, 2019

ECO100

Opting up to Peninsula Green Energy's ECO100 can lower a building's carbon footprint

The Impact

By opting up to ECO100, cities and individuals in San Mateo County can switch to 100 percent renewable energy. ECO100 sources half its electricity from solar and the other half from wind, making it 100 percent carbon free on an annual basis. Switching to ECO100 can have a large, immediate impact on city's ability to meet the carbon emission reduction goals of its Climate Action Plan.

Description

ECO100 is an initiative of Peninsula Clean Energy (PCE), which was launched collaboratively in 2016 by the County of San Mateo and all 20 of its cities via a joint powers agreement. PCE's goal is to provide electricity that is 100 percent greenhouse gas (GHG) free by 2021 and 100 percent renewable on a 24/7 basis by 2025. PCE is a Community Choice Aggregator (CCA) that purchases energy from clean sources. CCAs are an alternative to investor-owned utilities for electricity purchase.

Pacific Gas & Electric (PG&E) still provides transmission and distribution of electricity in San Mateo County. All PCE customers are automatically enrolled in ECOplus, which consists of 50 percent renewable energy that is also 90 percent carbon free. It is 5 percent less expensive than PG&E's rates. All customers have the option of opting up to ECO100, which makes their energy supply 100 percent renewable and carbon free.

ECO100 costs an additional one cent per kilowatt, which for the average household is an additional $4 to $5 per month more than ECOplus. Cities and businesses can set ECO100 as the default electricity plan for municipal operations and also opt up all of their residents, while still allowing them to opt out and get their electricity directly from PG&E.

Where It's Been Implemented

San Mateo County and 17 cities and government agencies within the county have opted up to ECO100 for their municipal operations. They are Atherton, Belmont, Brisbane, Burlingame, Colma, Foster City, Hillsborough, Menlo Park, Millbrae, Portola Valley, Redwood City, San Carlos, San Mateo and Woodside, as well as SamTrans, Caltrain and the San Mateo County Harbor District. The Town Council of Portola Valley voted to enroll all its residences and business automatically in ECO100.

Businesses such as Facebook's Menlo Park Corporate Headquarters and Visa's Foster City campus have also chosen to opt up to ECO100. Visa made this choice as a step toward reaching its 2019 goal of transitioning to 100 percent renewable electricity use across its global operations.

Key Drivers

Renewable energy is sourced from naturally replenishing resources. These provide an important sustainability solution because of their potential to replace the use of fossil fuels, which are a major source of carbon emissions. The opportunity to reduce carbon emissions is enormous because electricity contributes more than one-fourth of all U.S. emissions. By opting up to ECO100, residents, businesses and cities are sourcing their energy from 100 percent renewable electricity.

Key Factors for Success

While residential and commercial customers can choose to opt up to ECO100, this product is most effective at a corporate or city level. In particular, when a city chooses to automatically enroll all its residents in ECO100, it becomes the default energy option and greatly increases participation in ECO100. Doing so requires a City Council to approve a resolution to that effect.

Key Obstacles

Cost may an obstacle for implementation, since the additional cost is one cent per kilowatt hour used to opt up to ECO100. A city or company's budget constraints may make it difficult to make this transition.

Timeline to Implementation

Peninsula Clean Energy can be contacted at any time to opt up to ECO100. ECO100 is purchased on a month-to-month basis, and cancellations must be done five days prior to the date a customer's meter is read.

References and Resources

Peninsula Clean Energy's ECO100 program. Residential and commercial customers can opt up to EC100 by sending an email to info@peninsulacleanenergy.com or by calling 1-866-966-0110. For more information for city options, contact Kirsten Andrews-Schwind: kandrews-schwind@peninsulacleanenergy.com

Peninsula Clean Energy's commercial comparisons page

City of Foster City Information on ECO100

Reach Codes

These codes reduce fossil fuels in construction and offer health and safety advantages

The Impact

Reach codes reduce or eliminate fossil fuel use (primarily natural gas and propane) in buildings. They are usually mandated at the building permit stage, limiting gas heating, cooling, cooking and water heating equipment in new building construction. They can be made applicable to major remodels. Some reach codes also require electric vehicle (EV) charging infrastructure and photovoltaic (PV) panel and battery installation. A reach code ordinance reducing and preventing the introduction of new natural gas installations will contribute greatly to a city's goal of lowering carbon emissions, making that city's response to the climate crisis stronger. Reach codes which require EV infrastructure will encourage more people to purchase more electric vehicles.

Description

Reach codes are building codes for new construction that "reach" beyond minimum state building construction energy code requirements to reduce or limit fossil fuels.

Where It's Been Implemented

In San Mateo County, as of December 2020, eight cities and the County of San Mateo had approved codes that limit or partially ban the use of natural gas in new construction. In California, 41 cities and counties had adopted reach codes, and more than 50 others were considering them.

Background

Every three years, the California Energy Commission, working in conjunction with the

California Building Standards Commission, adopts an updated version of the Building Energy Efficiency Standards – Title 24, Section 6 of California law. The latest code was effective January 1, 2020. Title 24 is applicable to new construction legally entitled after the effective date. Cities can opt to "reach" beyond the basis minimum requirements of Title 24, with reach codes that encourage or require electrification of all new construction. Cities may also adopt reach codes through their powers to regulate public health and through the adoption of other codes, such as changes to the National Electric Code (NEC) or their zoning ordinances.

Key Drivers

All-electric buildings dramatically reduce carbon emissions, especially when they are coupled with renewable zero-carbon electricity sources such as solar and wind. These buildings are cleaner, safer and less expensive to build. In addition, electric appliances are more cost-effective over time due to their energy efficiency, and they are healthier because they don't emit toxic fumes. Improved safety also comes from fewer residential fires and less chance of pipeline fires. On average in the United States, a natural gas or oil pipeline catches fire every four days, results in an injury every five days, explodes every 11 days and leads to a fatality every 26 days, according to Fractracker.org.

Key Factors for Success

Reach codes are generally implemented by elected officials, staff and the public who understand the impacts of natural gas on the health and safety of their constituents. Natural gas used in American homes is actually methane, a colorless, odorless gas extracted from the ground, often by fracking, which involves the high-pressure injection of sand, water and cancer-causing chemicals into the ground. A recent study found that major cities are leaking methane twice as much as previously thought. Methane is 80 times deadlier than carbon dioxide. Burning natural gas in home heating and cooking creates dangerous exhaust biproducts that would be illegal if created outdoors. Natural gas leaks from appliances, transmission lines and other sources compound the impact.

Key Obstacles

There is often resistance to reach codes from elected officials, residential and commercial builders, and members of the public who are unfamiliar with electrification. When elected officials are made aware of the deadly impacts of natural gas, there is a greater possibility they will adopt strong Reach Codes.

Builders are not eager to switch from their tried and true subcontractors and suppliers, and they believe renters and buyers will be less willing to rent or buy all-electric homes. Members of the public are often reluctant to give up appliances such as gas stoves and fireplaces. In addition, the upfront cost of electric appliances can be greater than their gas equivalents.

Yet electric appliances are cost-effective over time due to their energy efficiency, and many people who swear they will never have an electric stove change their minds when their try one of the sleek new induction cooktops, which heat more quickly, turn off automatically

when a pan is removed and can handle all types of cooking. As the public becomes supportive of all-electric homes, builders follow suit.

Residential and commercial subcontractors for mechanical, electric and plumbing have skill sets in gas installation, but not so much in all-electric construction. Because subcontractors are not always knowledgeable about newer all-electric construction techniques, and because it is the subcontractor which assumes liability on construction projects, construction bids for all-electric construction can be unnecessarily higher than for gas installation. Some builders have found it useful to hire a consultant to work through this complicated process, with methodologies that are effective at resolving these problems.

Timeline for Implementation

Implementing reach codes is often time-consuming for staff and elected officials, due to the learning curve required. Meanwhile, each new version of Title 24 becomes stronger and stronger. In the 2022 Title 24 code revision, there is anticipation that natural gas could be eliminated in new residential construction. Cities that choose to act before then will benefit from having buildings already outfitted as all-electric. Over the next 25 years, there is expectation that natural gas will be phased out, as California reaches the "tipping point."

Return on Investment

All-electric buildings are much less expensive to construct if the work is done during the original construction.

Reference and Resources

Peninsula Clean Energy Model Ordinances

"Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health in California," University of California at Los Angeles, Department of Occupational and Environmental Health, April 2020

"Ten Truths About Natural Gas," Campaign for Fossil Free Buildings in Silicon Valley, 2019."California Nears Tipping Point on All Electric Regulations for New Buildings," GreenTechMedia, July 29, 2020

"E3 Quantifies the Consumer and Emissions Impacts of Electrifying California Homes," Energy + Environmental Economies, April 15, 2019

Redwood Energy Construction Guides: All-Electric Multifamily Guidelines, All-Electric Commercial Guidelines, All-Electric Single-Family Construction Guidelines. These guides include examples of all-electric construction as well as information on appliances and electric equipment.

Smart Glass for Commercial Buildings

Installing "dynamic glass" in large buildings saves energy

Impact

Windows are often the most inefficient part of a building envelope. Installing smart glass (also called dynamic or electrochromic glass) or special sheet coatings greatly improves energy efficiency. It has the potential to cut heating ventilation and air-conditioning (HVAC) costs by up to 30 percent and lighting costs by as much as 60 percent.

Description

Smart glass products typically consist of layers of glass panes in a sealed, Insulated Glass Unit (IGU) with a thin layer of metal oxides between two glass panes, or applied to one or more panes. Bursts of voltage can stimulate color changes in the glass, causing it to change its tint. Another method is to physically and chemically treat the glass during manufacturing so that it automatically transitions during the day from clear to tinted, translucent or even opaque glass without electricity. For retrofits of existing windows, some manufacturers provide sheet coverings that are either electrically charged or treated with chemicals.

Smart glass can be incredibly useful for reducing the heat gain from sun-exposed windows. The glass can prevent the interior of the building from warming, thus reducing energy costs for cooling. As the day goes on, the tint of electrically charged glass can be programmed to automatically change to allow in more light and heat. This regimen can be optimized for energy efficiency. "Drawdown," a comprehensive book of climate solutions, estimates that smart glass could result in 0.3 to 0.5 gigatons of emissions reductions between 2020 and 2050 in the U.S.

Where It's Been Implemented

Smart glass is found most often in Europe and Canada. Examples are also found in the United States at Bowie State University in Maryland (shown above) and yogurt-maker Chobani's office building in Twin Falls, Idaho. Other examples include the U.S. General Services Administration headquarters building in Washington, D.C., the McKinnon Center at the University of New Mexico and the Luminary Office Building in Dallas, Texas.

Key Drivers

Greenhouse gas (GHG) emissions are one of the most pressing topics in climate change discussions because energy use contributes more than a quarter of all U.S. emissions. Therefore, solutions that significantly reduce electricity usage, especially in large buildings, can have a great and lasting impact on GHG emissions. Additionally, reducing energy use will drastically reduce long-term costs. While smart glass is more expensive than traditional glass, the energy cost savings can, over time, more than make up for the initial expense.

Key Factors for Success

Local climate, weather, building location and builder acceptance are all important factors for the success and impact of this solution. Buildings with high sun exposure will benefit much more from smart glass applications, both in new construction and in retrofits. During summer and warmer times of years, the energy requirement for cooling interior air can be reduced through the utilization of smart glass. Programmable smart glass can reduce heating loads in the winter, too.

Key Obstacles

The principal obstacle is price. While prices vary, smart glass is roughly three times more expensive than traditional glass. However, energy savings will accumulate over time, and smart glass has the potential to pay for itself in five to seven years. Additionally, heat waves and hot summers are becoming increasingly common, causing rising energy bills, so smart glass may become more cost competitive.

Timeline to Implementation

The best time to install smart or dynamic glass is at the time of new construction, although retrofit films do show promise. While additional care must be taken by the builder when installing smart glass, the time it takes to install it is similar to ordinary glass. Smart glass is not in wide use in the United States, but as knowledge of the benefits of smart glass increases, widespread use will likely accelerate.

Background

Historically, windows have consisted of only one pane of clear glass, which is a very poor insulator, quickly causing heat or cooling loss. In order to retain heat in the winter and keep heat out in the summer, double-paned and even triple-paned windows saw widespread use beginning in the 1970s. Today, single-pane windows are almost never installed in new construction or retrofits. In the early 2000s, improvements in production saw low emissivity or "Low-E" (low emissivity) glass, a thin coating on the glass panes to keep heat in or out, depending on the season. Smart glass takes that technology one step further.

As awareness of the climate crisis increases, and as energy costs mount, there will be a push to install smart glass in new construction and take advantage of new technologies in window film retrofits.

References and Resources

Architect Magazine, October 11,2019. "How to Specify Smart Glass"
Helpful Descriptive Brochures from SageGlass.com
Chobani Headquarters Example
Bowie State University Example